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NEW TECHNOLOGIES IN SUPPLY CHAIN IN FOOD RETAIL SECTOR

Master's Thesis

NEVZAT ONUR DUYAL

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THE REPUBLIC OF TURKEY
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SOCIAL SCIENCES INSTITUTE
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ABSTRACT

NEW TECHNOLOGIES IN SUPPLY CHAIN IN FOOD RETAIL SECTOR

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Today, with the expansion of markets and their globalization, the only way for companies and organizations to survive is to increase their competitiveness and gain lasting competitive advantage. The competition among supply chains has replaced the competition between individual companies. Information technology and e-commerce have transformed supply chain processes. In the supply chain, information plays a crucial role in making decisions in organizations. Appropriate adoption of supply chain management information technology approach enables reliable management information systems to be developed, improving supply chain management efficiency and creating value in the organization. In this study, it's analysed the technologies that can help businesses, and especially food retailers, manage their supply chains. In the first chapter, the basic definitions of the supply chain and its characteristics are discussed. Then the characteristics of food retailers are described. In the second chapter, articles and history of technology impact in industries are reviewed. After reviewing the industrial revolutions and the impact of technology on these changes, new developments in the food retail supply chain are examined. Then, the supply chain management practices adopted by large companies are investigated. In Chapter Three, the supply chain technologies in food retailing sector are researched in detail. In this chapter, after an introduction to supply chain management in food retailers, the impact of technology in this field is

examined. Then each of the future technologies in this field and the applications of these technologies by major retailers are analyzed. In Chapter Four, the method and research design of the study is described. An in-depth interview was made with an expert working in food retail industry within the context of the research. In Chapter Five, the results of the in-depth interview are presented. The final part of the thesis is the conclusion chapter which takes form in line with the results of the interview The interview showed that the development of an inter-organizational information system has advantages such as cost reduction, productivity and market improvement for the supply chain of food retailers.

Keywords: Supply Chain Management, Food Retail, Supply Chain in Food Retailing Sector, Supply Chain Technologies

ÖZET

GIDA PERAKENDESİ SEKTÖRÜNDE TEDARİK ZİNCİRİNDEKİ YENİ GELİŞMELER

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Piyasaların genişlemesi ve küreselleşmesiyle birlikte, şirketler ve kuruluşların hayatta kalabilmelerinin tek yolu rekabet edebilirliklerini artırmak ve kalıcı rekabet avantajı elde etmektir. Şirketler arasındaki bireysel rekabetin yerini, tedarik zincirleri arasındaki rekabet almıştır. Bilgi teknolojisi ve e-ticaret, tedarik zinciri süreçlerini değiştirmiştir. Tedarik zincirinde bilgi,, kuruluşlarda karar vermede çok önemli bir rol oynamaktadır. Tedarik zinciri yönetimi, bilgi teknolojisi yaklaşımının uygun şekilde benimsenmesinin yanı sıra, tedarik zinciri yönetimi verimliliğini artırarak ve organizasyonda değer yaratarak güvenilir yönetim bilgi sistemlerinin geliştirilmesini sağlamaktadır. Bu çalışmada, işletmelere ve özellikle gıda perakendecilerinin tedarik zincirlerini yönetmelerine yardımcı olabilecek teknolojiler incelenmiştir. Birinci bölümde, tedarik zincirinin temel tanımları ve özellikleri açıklanmıştır. Devamında, gıda perakendecilerinin özellikleri detaylı olarak anlatılmıştır. İkinci bölümde, sektörlerdeki kaynaklar ve teknoloji etkisinin tarihçesi gözden geçirilmiştir. Endüstri devrimlerini ve teknolojinin bu değişimler üzerindeki etkisini inceledikten sonra, gıda perakendeciliği sektörü ile ilgili tedarik zincirindeki yeni gelişmelere bakılmıştır. İkinci bölümün sonunda, büyük şirketler tarafından benimsenen tedarik zinciri yönetimi uygulamaları konu edilmiştir. Üçüncü bölümde, gıda perakendeciliği sektöründe kullanılan tedarik zinciri teknolojileri detaylı bir şekilde araştırılmıştır. Bu bölümde, gıda perakendeciliği

sektöründe tedarik zinciri yönetimine giriş yapıldıktan sonra, teknolojinin bu alandaki etkisi incelenmiş olup, gelecekteki teknolojilerin her biri ve bu teknolojilerin büyük gıda perakendecileri tarafından uygulanış biçimi analiz edilmiştir. Dördüncü bölümde, çalışmanın yöntemi ve araştırma modeli açıklanmıştır. Araştırma kapsamında gıda perakendeciliği endüstrisinde çalışmakta olan bir uzmanla, derinlemesine bir mülakat gerçekleştirilmiştir ve beşinci bölümünde, bu mülakatın sonuçlarına yer verilmektedir. Tezin son bölümü ise, mülakattan elde edilenler doğrultusunda şekillenen, sonuç bölümüdür. Mülakat; örgütler arası bir bilgi sisteminin geliştirilmesinin, gıda perakendecilerinin tedarik zinciri için, maliyet azaltma, verimlilik ve pazar iyileştirme avantajlarına sahip olduğunu göstermiştir.

Anahtar Kelimeler: Tedarik Zinciri Yönetimi, Gıda Perakendeciliği, Gıda Perakendeciliği Sektöründe Tedarik Zinciri, Tedarik Zinciri Teknolojileri

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ABBREVIATIONS

SCM	**:** Supply Chain Management
IoT	**:** Internet Of Things
ICT	**:** Information and Communication Technology
IT	**:** Information Technology
COFR	**:** Collaborative Planning, Forecasting, and Replenishment
VMI	**:** Vendor Managed Inventory
FGP	**:** Factory Gate Pricing
AI	**:** Artificial Intelligence
DLT	**:** Distributed Ledger Technology
P2P	**:** Peer-To-Peer
RFID	**:** Radio Frequency Identification
EDI	**:** Electronic Data Interchange
GSCM	**:** Green Supply Chain Management

1. INTRODUCTION

Rapid advances and heavy competition in the marketplace have led organizations and companies to consider improving their supply chain performance. One of the critical supply chains is the food supply chain, which requires special attention due to their specific characteristics. The credibility of the food safety plan has been challenged in the last decade and has improved as the economy and standards of living grow; this has led consumers to pay more attention to food quality. A safe food product is the result of all the processes and activities carried out throughout the food chain (Arora et al., 2008). Product identification can allow manufacturers to achieve food safety. Product identification requires having a product identification system and retrieving reliable product information. In recent years, many governments have been trying to build food tracking systems to give consumers more information about production. This can not only help increase food reliance but also help to track problems and track the production process, track the food safety risks, and improve the supply chain processes (Francisco and Swanson, 2018).

A food chain tracking system supports and covers all processes and activities of manufacturing companies involved in the food supply chain. This process requires the management of raw material flow reports and the responsibility of all stakeholders involved in the process. The increasing development of information technology has transformed the face of the industry, and it can be used to enhance supply chain management (Tian, 2017).

This paper examines the impact of technology on enhancing the quality level of supply chain management in food retailers. It is also studied the importance and impacts of the fast and accurate flow of information, technology tools, and information systems for supply chain operation. The focus of our review in this article is the supply chain in the food retailers in Turkey.

Food health is a growing issue in all parts of the world and has positive benefits in accessing large markets, but manufacturers need to be aware of the health aspects and

quality of food. Tracking information includes the first stages of production and procurement of raw materials until the product reaches the consumer, which is recorded according to the capabilities of the companies. Tracking all food components, including timely and accurate information, enables us to take steps to reduce food risks and to achieve a rapid and effective response to accidents and increase the reliability of food products. The correct tracking system should include the ability to quickly access all the details of the changes in the food chain (Tian, 2017). The tracking system has become a standard system by integrating information across the food supply chain, ranging from primarily agricultural to consumer-wide, replacing the human mechanism and its potential errors.

Because of the global competition among businesses and companies, many organizations are looking for ways to gain a competitive advantage. One way to gain a competitive advantage is to focus on the supply chain and improve it. Information technology leads to improved performance of the company and partners in the supply chain by providing timely, accurate, and reliable information. The use of information technology tools affects the supply chain capabilities and, subsequently, the supply chain performance. For this reason, this thesis examines the impact of information technology on supply chain management in the food retail sector.

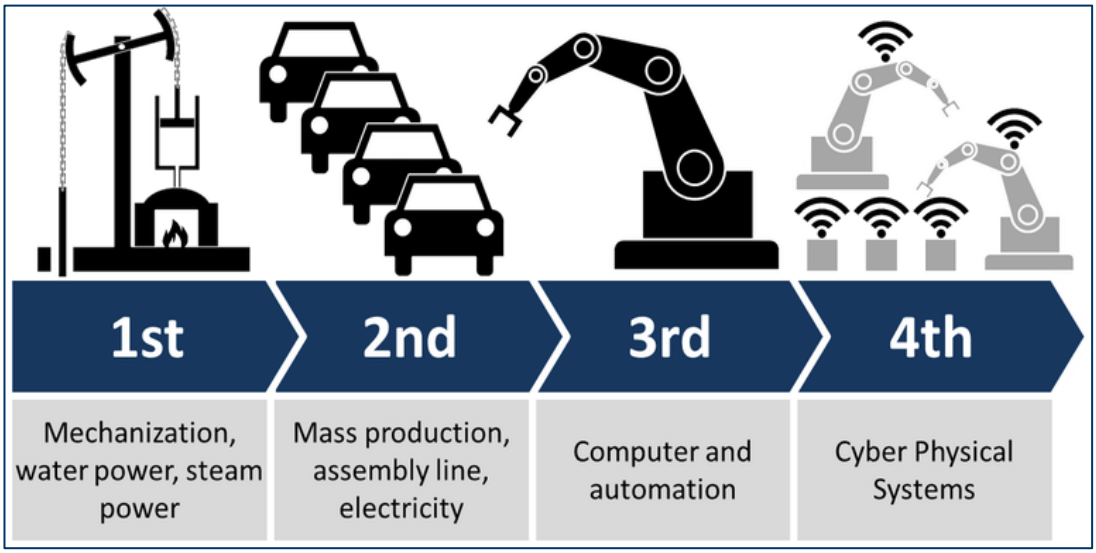
2. LITERATURE REVIEW

In this chapter, technological developments in the industry along with the industrial revolution, new inventions created from the 1700s until today are explained chronologically. Then, the types of these technological developments and their effects on the supply chain in food retailing sector are examined. Finally, new technologies that will be used in this sector in the future are discussed in detail.

2.1 THE EVOLUTION OF THE INDUSTRIAL AGES

The Industrial Revolution is a great change in the industry, agriculture, production, and transportation that began in the mid-18th century in England. These developments occurred during the industrialization of factories and industries, which means the use of machine power instead of the workforce. It, then, spread to other countries. Many believe in the four industrial revolutions that will be investigated in the following.

Table 1.1: The Different Phases Of The Industrial Revolution (Pfohl et al., 2015)



2.1.1 Industry 1.0

The first industrial revolution took place in the years 4-5, with the human ability to use two sources of energy, coal and steam. The breakthrough in steam engine engineering and manufacturing with the invention of cheaper ways to extract coal was one of the key technologies in shaping this revolution. With the advent of this revolution, cheap low-cost coal-fired steam engines had a significant impact on increasing the efficiency of factories across industries. Before the first industrial revolution, most goods were manufactured locally and by different people, but after the commercialization of coal-fired steam engines, large industries producing much more for customers were formed. This situation led the community from agricultural culture to large industrial cities at the time. Independent and individual employers no longer dominated the workforce, and they all began to work in the large factories run by the capitalists. Cities gradually became the economic centers of the whole country (Pfohl et al., 2015). This trend did not slow down until the Second Industrial Revolution.

2.1.2 Industry 2.0

The second industrial revolution was based on electricity and oil rather than coal, which was the primary source of energy up to that time. The beginning of this industrial revolution began with the production of steel in the 1980s, which led to the massive production of iron and steel for other industries.

Due to advances, the production volume of iron, steel, and machine parts has increased, and many tools have been manufactured to standard dimensions, such as standard metal screws and strips. In some advanced countries, a new complex rail infrastructure was built, and with the development of the steam turbine engine, water arteries evolved. During this period, a completely new and evolving transportation system was introduced to carry mass-produced goods. Market also changed during this period due to increased production and transportation speed and lower production costs. After the Second Industrial Revolution, countries interacted better than ever, and the first steps towards globalization were made (Moavenzadeh, 2015). These developments continued until the second half of the 20th century when society saw a new fundamental development: The Digital Revolution.

2.1.3 Industry 3.0

Since the late 1980s, the Third Industrial Revolution, or Digital Revolution, has taken root in society and has transformed analog electronics into digital. The two significant developments of this revolution are digital processing and communication technology. Rapid processing of computers, along with interconnected devices via the Internet and satellite, has created a digital structure in which information is exchanged rapidly across the world and all devices (Pfohl et al., 2015).

Like the productive innovations of the First and Second Industrial Revolution that led to the construction of industrial cities with manufactured goods, the electronic innovations of the Third and Fourth Industrial Revolution also led to the creation of intelligent applications that utilized the production data (Moavenzadeh, 2015).

2.1.4 Industry 4.0

The Fourth Industrial Revolution, the revolution in communications, relates to Internet technology and technology that has transformed the world, and we are still in the age of the Fourth Industrial and Communication Revolution.

This age is characterized by the advent of new technologies in several areas of robotics, artificial intelligence, blockchain, nanotechnology, quantum processing, biotech, IoT, and self-driving cars.

Similar to other industrial revolutions, the Fourth Industrial Revolution has the potential to raise the level of world income and improve the quality of life. To date, technology has created new products and services that have increased our productivity and our enjoyment of life. Technology is opening new windows to new developments and capabilities (Robandi et al., 2019). IoT, artificial intelligence, and distributed ledger technology are some of the most prominent recent developments. Technology is about to create intelligence with the advances of hardware, software, and data, and the free economy is closer to us than ever.

2.2 CONCEPTUAL FRAMEWORK OF SUPPLY CHAIN

A supply chain is defined as a network between a firm and its suppliers by aiming at manufacturing and distributing a product to the end user. Different people, activities, information, and entities and resources are included in this network. The supply chain also consists of the steps of getting the service or product from its provider or manufacturer to the end user.

2.2.1 The Concept Of Supply Chain

The companies develop supply chains to reduce their expenses and remain competitive in the commercial area.

As mentioned above, several steps should be taken to get a service or product from the provider or manufacturer to the consumer. These steps are converting the stock materials into the finished goods, shipping these products, and distributing these services or products among the consumers. The agents who are involved in the supply chain are the manufacturers, sellers, warehouses, shipment firms, distribution centers, and retailers.

A supply chain has several elements with the functions from placing an order to meeting the need of the end user. The features of the supply chain are production, marketing, operational activities, distribution, financial operation, and end user's services (Chopra and Meindl, 2001).

In other words, the supply chain means a network of organizations, resources, people, technology, and activities applied for manufacturing and selling a product. It ranges from the supply of the raw materials from the supplier to the producer and finally to delivery of the product to the consumer. The distribution channel is a way of getting the end product from the producer to the end user.

As mentioned above, the supply chain involves all producers and suppliers, as well as warehouses, retailers, transporters, and users. The supply chain includes new product development, marketing, operations, distribution, finance, and customer service (Chopra and Meindl, 2001).

2.2.2 Supply Chain Management Process

According to Chopra and Meindl, the cycle view is the traditional view of the supply chain (2001).

In the traditional view of the supply chain, some cycles which are performed between two stages of a supply chain are included in the supply chain means that each period is independent of other cycles optimizing its processes and not being prevented by the issues found in different sequences.

An interesting example is a cycle that delivers products from the producers to the consumers to fill the retailer inventories and which manufactures new finished products to replenish the stock of the producers. The involved processes and holders of the processes, including the roles and responsibilities) are defined by the cycle view of the supply chain (Chopra and Meindl, 2001).

Although the benefits of a process that approach to the supply chain management and business management have been recognized, what process should be taken into account, what activities and sub-processes should be included in each process, and how the processes communicate with each other remain vague.

The business processes which can be involved in the supply chain are as follows:

i. Customer relationship management which determines the service provision agreements with users
ii. Customer service management which gives real information about the transportation date to the customers and product availability via communication with the manufacturing and distribution activities of the organizations

iii. Demand management which creates a balance between the supply abilities of the companies and the customer's needs
iv. Order fulfillment which provides services and meets the customer's needs
v. Production flow management which brings the products to the plant as needed by the consumer
vi. Procurement which expands the strategic plans among the suppliers for the production flow management
vii. Product expansion
viii. Marketing

In summary, eight key processes that are applied in the Supply Chain Management (SCM) are Customer Relationship Management, Customer Service Management, Demand Management, Order Fulfillment, Manufacturing Flow Management, Procurement, Product Development and Commercialization, and Returns.

The marketing time is reduced by integrating the customers and suppliers with the Product Development and Commercialization process. Process of Returns makes alignment in the processes to achieve the return of the items which can be used again.

According to Lambert and Cooper (2000), eight main business processes can be coordinated with the leading members in the supply chain. There is no need to coordinate all processes. For example, if responsiveness is important in order, the focus should be on order fulfillment, and if innovation is important in the order, the focus should be on the development of the product.

Supply chain management is regarded as an important process due to lower costs of the supply chain results and a faster cycle of production. Supply chain management is defined as the integration of the main business processes in the supply chain. The customer relationship management process structures the development and maintenance of interaction with customers. Management identifies key customers and customer groups to be targeted as part of the firm's business mission.

To have successful management (SCM), there should be a change in the management of the business processes in a firm into the integration of the operations with main supply chain processes. Besides, one of the important parts of the business process is supply chain management (SCM). A high amount of expertise and skill should be required for creating different links in this chain.

The effective supply chain management will lower the expenses of a firm and increase its profitability. One broken link will affect the other part of the chain and will increase the costs of the firm.

In other words, supply chain management (SCM) means supervision on the information, materials, and financial matters while these factors are in the process of getting from supplier to producer, to seller, to retailer, or to consumer.

The information flow, the product flow, and the financial flow are three important flows of the supply chain. Supply Chain Management (SCM) means that these three flows should be integrated among the firms.

The term 'Supply Chain Management' is a relatively new term which was first introduced in 1982 in the logistics literature and defined as an innovative management method which focused on the raw materials supply (Oliver and Webber, 1982).

Supply Chain Management (SCM) was first explained in 1990 theoretically, and its difference from the old approaches to the materials management as well as the information flow was clarified (Cooper and Ellram, 1993).

The review of literature about Supply Chain Management (SCM) indicates the necessity of coordination among the chain-like elements from producer to the end users to meet the consumer's need at lower expenses (Bechtel and Jayaram, 1997; Lambert and Cooper, 2000).

In the Supply Chain Management (SCM), it is recognized that if each firm in a supply chain intends to improve its results not to coordinate its activities and goals with other firms, sub-optimization phenomenon will occur (Cooper et al., 1997).

The focus in the Supply Chain Management (SCM) is on the management of the relationship since it aims at coordination and supervision on the business activities and processes of the supply chain, leading to delivery of satisfactory products to consumers as well as fulfilling needs of other factors such as government in the supply chain.

Since 1990, an essential part of the senior management agenda has been Supply Chain Management (SCM).

The ultimate success of a firm is determined by the successful integration and management of the central business processes among the members of the supply chain (Van der Vorst, 2000). Christopher (1998) states that businesses only compete as supply chains, not as independent entities. Information and Communication Technology (ICT) development, which leads to the exchange of a lot of information to coordinate among the firms, results in a high interest in Supply Chain Management (SCM). More efficient and effective supply chains require coordination of the chain partners.

The concept of Supply Chain Management (SCM) attracted a lot of attention from different scientific and business groups such as consultants, academics, and business managers (Chan and Qi, 2003).

The literature on Supply Chain Management (SCM) has been expanded in different fields such as logistics, marketing, transportation, organizational behavior, management information systems, purchasing, operations management, and supply (Keely, 2001).

The Supply Chain Management (SCM) framework had three main elements, i.e., the supply chain structure, business processes of the supply chain, and components of the Supply Chain Management (SCM).

The conceptual framework mainly focuses on the interconnected nature of Supply Chain Management (SCM) and the necessity of taking several steps to design and manage a supply chain successfully. The objectives of the supply chain, i.e., the fulfillment of the consumers' requirements for the critical performance indicators at any cost and any time are related to each step.

Supply chain performance indicators that are well defined will contribute to the establishment of benchmarks and assessment of changes over time. A single entity can manage supply chains using the top member using a partnerships system that necessities fully developed coordination and cooperation. It is not easy to formulate objectives of the supply chain due to the agreement of all partners on the definition of the target values and indicators and choice of the indicators (Keely, 2001).

The performance measures currently used in companies are problematic, preventing useful measurement of the total supply chain performance. Supply chain actors should first identify the order qualifiers related to the supply chain due to the improvement of the supply chain performance under their control (Keely, 2001).

To reduce the marketing costs caused by a mismatch between the products which have reached the market and the intention of the consumer to buy, leading to loss of sales and dissatisfaction of the customers, supply chains related to the innovative products should be designed based on responsiveness and agility. A perfect supply chain doesn't need to be necessarily agile or lean (Bukeviciute, Dier, & Ilzkovit, 2009).

Better delivery of goods, which is accompanied by higher reliability, and responsiveness of the goods delivery, more top quality of the product, more availability of information will lead to a drastic improvement of the supply chain profitability (McCathie, 2004).

Application of Supply Chain Management (SCM) leads to a reduction of the transportation costs, a decrease in overstocks, lowering of the direct and indirect labor expenses, and an increase in the gross profit margins and sales rate (Hanf , 2008).

For the companies to take benefit of the supply chain, they design and make the supply chain network more efficient. If the cooperative and collaborative plans are associated with the operational change, such benefits will be obtained, and manufacturing and distribution planning require a lot of information.

The production of seasonal stock will be postponed with careful planning of demand, leading to shortening and prediction of the order fulfillment cycles.

The distribution and logistics managers can use the product delivery and storage resources better through the guaranteed sales, reducing the costs and increasing the customers' service, which requires matching of the operations (Bukeviciute, Dier, & Ilzkovit, 2009).

Although many efforts have been made to expand the Supply Chain Management (SCM), it has not been realized completely and largely remains only as a promise.

There is no chain transparency as well as coordination among most of the supply chains, and only a part of the supply chain is dealt with in the Supply Chain Management (SCM) projects.

Many concepts related to Supply Chain Management (SCM) including Collaborative Planning, Forecasting, and Replenishment (CPFR), Vendor Managed Inventory (VMI),

and factory gate pricing (FGP) should be more transparent, and the revenues and costs should be calculated clearly to distribute them among the supply chain partners.

However, it is not an easy task to define the cost drivers, which allocate direct and indirect costs to the manufacturing activities and their related norms. There should be sufficient deep insight and trust among the processes, but this is difficult to realize (Bukeviciute, Dier, & Ilzkovit, 2009).

The reason is that the competitive model, which is widely followed, shows that once the suppliers or customers obtain information, the firms will lose their ability to control profits and bargaining power. The main barriers to realization and implementation of Supply Chain Management (SCM) are lack of transparency, trust, differing objectives, and reward structures supporting the goals of the chain, though the firms perceive the benefits of Supply Chain Management (SCM) (Van der Vorst, 2004).

An appropriate and ideal supply chain cannot be developed and exercised on one occasion. There are the driving factors that promote the supply chain, and there is a unique operation condition in each relationship (Van der Vorst, 2004).

For this reason, there are varying breath, closeness, duration, and strength of partnership in varying cases and at different times.

2.2.3 Supply Chain Methods In The Food Retailing

A highly innovative section in the total food chain is food retailing. There is the innovation all over the retail firm, particularly in the new product development activities. Since the mid-20th century, the food retailing structure in Europe has seen three fundamental innovation periods. The dominant business model in the sector has changed. The routine activities of the retailers have been affected by these structural innovations (Nangare, 2018).

The food retailing industry faces low commitment toward customers since there are many food retail outlets, and also the customer tends to change the various products, and the customer wants to try new food when it comes to the marketplace (Vijayan, 2014).

The food industry is dynamically progressing due to the increase of the population all over the world, change in the customer's preferences, and changing economies, leading to the development of many industries such as food packaging.

The retail food market will see increasing online retail shopping via online retail formats in the coming years. The most abundant food retail market is found in Asia-Pacific, which has seen growing education levels, increasing Westernization, and urbanization, smaller families, and high per capita income leading to the development of the food retail industry. The second-largest market for food retail is found in Europe due to the establishment of several branded discounters and stores which offer branded fresh products (Nangare, 2018). Four different distribution channels for food retail are specialist and independent retailers, hypermarkets or supermarkets, stores, etc.

There are many problems, such as food products perishability in the food retail industry. Other problems that the food retailers face all over the world are quality management, continuous food supply, stock forecasting, and waste management. Not only forward supply chain management but also backward product flow management system development is necessary due to the fast change of food products (Vijayan, 2014).

To plan an appropriate reverse supply chain process, the current reverse methods in different retail models should be studied.

There are many problems, such as food products perishability in the retail food industry. Other problems that the food retailers face all over the world are quality management, continuous food supply, stock forecasting, and waste management. Not only forward supply chain management but also backward product flow management system development is necessary due to the fast change of food products.

To plan an appropriate reverse supply chain process, the current reverse methods in different retail models should be studied.

All food retailers should decide where to do their business activities because the successes or failures of the grocery retailing depend on the supply chain management, and their grocery supply chains that have not been developed to adapt to the selected strategies will lead to failure.

In the process of food retailers, successful food retailers dominate over the agile, responsive grocery supply chains as well as the lean, highly efficient grocery supply chains which are required for the fresh food products (Vijayan, 2014).

Various processes encourage consumers to get the appropriate products from the retailing stores based on retail management. There are many steps in the retail management to take the customers into the retailing store and respond to their buying needs. With retail management, the customers will become satisfied with their shopping and will shop easily.

As mentioned above, the best food retailers have proper retail management and make use of the best tools to respond and to predict the demand and select the techniques accurately and robustly.

To meet the needs of the food retailers and the customers and minimize the wastes, the retail supply chains should be more responsive.

The retail food world is so complex that it cannot be managed and controlled intuitively. Retailers design and organize their retail stores to meet the needs of the customers.

The integrated supply chains have played an important role in the agricultural and food business unit. There have been major changes in the retail food industry in most industrialized countries in recent years. In the 1970s, food retailing companies acted instead of the food processors, but today, they have served as the most powerful actor across the entire whole food chain. The growth of companies led to the change of the retailing industry into a powerful group. Due to the increase of their power in the market, which reinforced the relationship and trade between the food chain members, they changed their substitute position leading to the orientation of the consumer toward retailers (Warsi, 2005).

The retailers should take into account the quality of the food chain since the lack of correct decisions about food safety will affect the whole food chain. To reach excellent and safe conditions, food processors and retailers should design their food chain again to encompass all steps of the food chain.

Supply chain networks, which regarded as strategic networks requiring cooperative strategy and chain management, should integrate the company members and connect them.

The food supply chain interconnects three primary sectors agriculture, food processing, and distribution sectors (wholesale and retail).

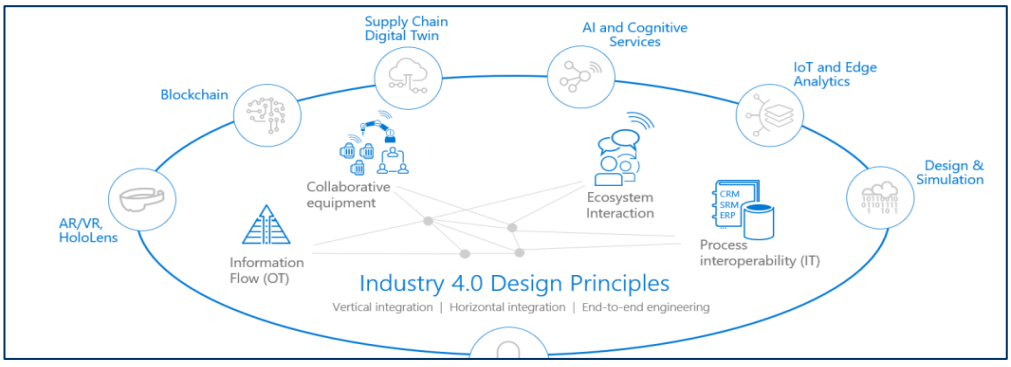
Clarifying the food supply chain will help us understand how prices are determined along this chain, where there are interactions between firms, how different regulations affect, and how the costs of direct material are paid.

Two main characteristics of the food processing industry and the food retail sector affecting the competition and also function of the food supply chain are relative fragmentation of the EU food supply chain among the member states and relatively high concentration of the food retail sector and food processing industry, leading to the consolidation along the food supply chain which will affect the balance between the bargaining power of food manufacturers and food retailers.

2.3 NEW TECHNOLOGICAL DEVELOPMENTS IN THE FOOD RETAILING SUPPLY CHAIN

Internet technology allows the food supply chain to utilize new technological developments in its operations management processes. These technologies in the supply chain enable the system to perform business processes such as monitoring, planning, and optimization remotely and through the Internet (Alfian et al., 2017). In this section, some of the most influential technologies in the food retailing supply chain.will be mentioned.

Table 2.1: Supply Chain Technologies In Industry 4.0 (Alfian et al., 2017)



2.3.1 Supply Chain Technologies In The Food Retailing

This section looks at different ways of managing the food retailing supply chain. Much of the focus here is on using technology to sustain the supply chain. Today, food supply chain management has become an essential area of research that seeks to optimize the relationships between producers, processors, manufacturers, and retailers. The following are some of the most essential evolutionary trends in the field, with emphasis on information technology and its applications in improving the processes of the food retailing supply chain. Although there are many new technologies and trends in this area, here, important cases are addressed.

In general, it can be said that several factors have influenced the evolution of the food supply chain. Stark and Morgan (1995) identified regulations, technology changes, lifestyles, customer tastes, power, market structure, and globalization as the five main factors affecting the food supply chain's evolution. These factors, which are all interconnected, influence the evolution and restructuring of the food supply chain. An example of a common link between these factors is the supply of different foods from around the world (such as fruits or foods from different countries) by food retailers due to consumer demand. The supply of such food requires complex logistical processes and the use of information technology.

On the other hand, success in supplying such a variety of foods is an essential competitive advantage for these retailers over their smaller competitors. This, in turn, can enhance and expand their market and attract the attention of regulators. It can, therefore, be said that all of these factors are interdependent in some ways.

According to Ramsey (2000), the evolution of the food supply chain can be divided into four different phases. In the first phase, from 1900 to 1920, new competition in the food supply chain was between regional wholesalers. In the second phase, from 1920 to 1945, manufacturers nationally played a significant role in the food supply chain. Then came the third phase, between 1945 and 1980, where globalization became widespread, with food manufacturers trying to export their products overseas and controlling the supply chain, and thus food retailers had faced many challenges. In Phase Four, from 1980 to 2000, most of the food supply chain control has been in the hands of retailers.

From then on, food retailers became the mainstay in the food chain and took on the logistics of food. As such, they set food prices at manufacturing plants, and because the logistics and product collection was up to the retailers themselves, the product price was much lower for the retailer. Besides, food retailers have also adopted other cost-cutting initiatives, such as composite distribution, centralization, or the use of third-party logistics services. The composite distribution used warehouses and vehicles that we are able to provide different temperatures for different products. In centralization, food retailers used large local warehouses to meet the demand of their supply chain for thousands of their stores. These retailers also used third-party logistics services to implement all of these changes in their new supply chain approaches. Trends and forecasts indicate that in the future, third-party logistics companies will play a more significant role in the supply chain. This trend reflects the increasing role of downstream members such as retailers and third-party logistics companies as well as foodservice companies such as catering firms in the food supply chain (Zijm et al., 2019).

One of the most critical needs in the supply chain is the exchange of information between different chains and technology nowadays, playing a pivotal role in this process. These technologies can both improve current business processes and activities, and enable the complete transformation of traditional business practices and models in the companies. The supply chain for short-lived and perishable goods has always been one of the most critical and challenging management issues at different times. Short-lived goods, especially foodstuffs, are the ones that pose the most significant challenges to supply chain management. These challenges arise mainly due to variations in the number of such goods, specific needs to track the flow of goods throughout the supply chain, short product life, and the need for temperature control in the supply chain (Wang and Yue, 2017).

In the food sector, looking back over the last decade, it can be seen that e-commerce startups seeking to virtualize their organization in the food sector fully have not achieved significant success. However, on the other hand, we can see the impact of these technologies on improving supply chain processes (Zijm et al., 2019).

The importance of the food supply chain can be seen from its unique properties. Food is a global commodity in which there is always competition. The nature of these products is

perishable, and the tastes of the consumer are vastly different. This diversity is also present in the manufacturing sector, as there are small manufacturers to global companies and retailers. That is why all of these companies are looking for a way to outperform their competitors, and using information technology applications to facilitate the supply chain processes and activities is one of them (Kim et al., 2018).

One of the first innovations in this field was the Worldwide Retail Exchange (WWRE), which was launched in 2000 by 17 international retailers. The purpose of this innovation was to enable participation and relationship between retailers and manufacturers to improve supply chain processes. The Internet played a significant role in facilitating the supply chain processes, but in some chains, it was more productive, and in others, it was less effective. For example, Internet applications have been able to strengthen relationships between retailers and manufacturers, but the relationship between retailers and customers has not expanded to such an extent. This relationship was further weakened by the fact that retailers' suppliers were small or medium-sized companies, such as farmers or product groups, who often did not adopt Internet strategies (Jaque et al., 2018).

In terms of the relationship between manufacturers and retailers, Sainsbury, can be set an example which is one of the UK's largest retailers. The company launched an initiative to minimize the development time of a new product. It brought together all the entities involved in new product development on its website, from chefs, creators, marketers and designers, and artists to legal and safety professionals. This initiative made it possible for any entities in the product development to be notified of any changes in product development, thereby reducing the likelihood of error (Tidy et al., 2016).

There have also been studies of the use of RFID in the food retailers' supply chain. Kärkkäinen (2003) pointed out the benefits of using RFID in retailers with short-life products. Jones et al. (2004) examined the impact of the use of RFID on retailers in the

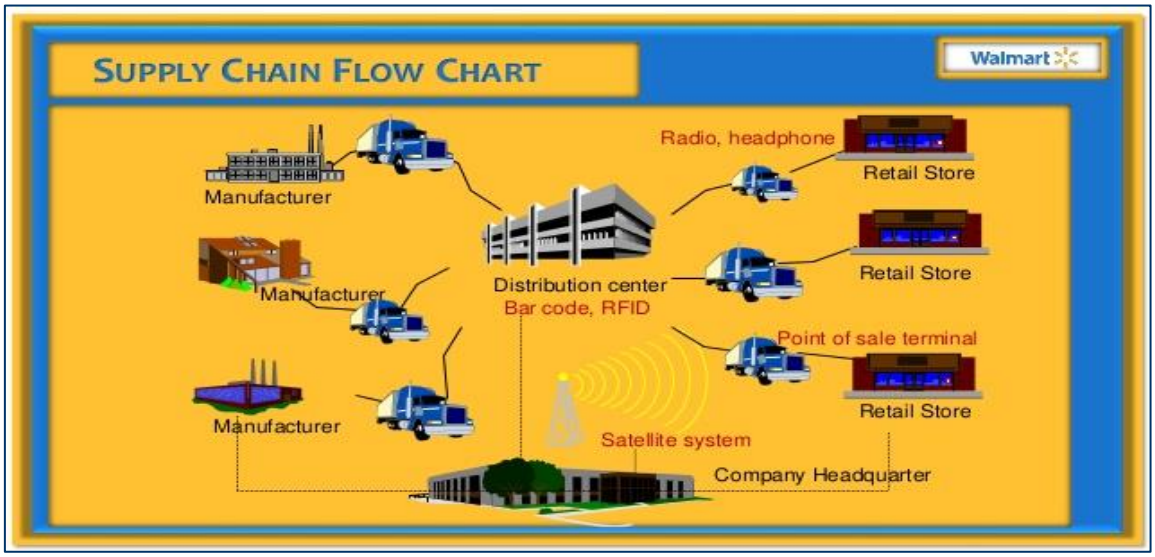
UK and, after referring to the benefits and challenges, presented a report of ongoing efforts and experiments to implement this technology.

In another study, Tan et al. (2018) examined the impact of using technology on Wal-Mart's food supply chain. Wal-Mart is the largest grocery retailer in the United States, with one of the most efficient supply chains in the world.

In 2015, the company invested about $ 10.5 billion in new technologies to improve its e-commerce capacity. Today, Wal-Mart has one of the largest IT supply chains in the world, through which it is able to forecast demand and track inventory levels accurately.

Wal-Mart was the first company to use barcodes in its stores in 1989. They then used a database called Retail Link, where analysts can forecast demands through a satellite connection and using real-time data from Wal-Mart distribution centers and cash registers. This way, all suppliers and manufacturers can match their needs and demands.

Table 3.1: Relationship Between Different Components In Wal-Mart's Supply-Chain (Tan et al, 2018)



Wal-Mart also has a detailed analysis of customer demand and supply in its stores, optimizing its supply chain locally by tracking customer purchasing habits to include the product that their demand is high in that area, not just the company's preferred products.

In recent years, Wal-Mart has also used RFID tags to control its inventory. Recently, the company has begun using smart labels that are read by hand scanners, which allow employees to locate empty shelves and monitor inventory accurately easily (Tan et al., 2018).

According to research by Ali and Hingst (2018), Wal-Mart's inventory shortage reduced 16% after using RFID in its supply chain. Their results also showed that electronic-coded goods were replenished up to three times faster than those using barcode technologies. Their results have shown that these Wal-Mart Supply Chain Management strategies have provided the company with sustainable competitive advantages, such as reduced product costs, reduced inventory shortage, highly competitive pricing for customers, and much diversity for customers to select a product.

2.3.2 New Technologies In The Food Retailing Supply Chain

One of the types of supply chains that have been the focus of researchers due to advances in technology is the food retailing supply chain. This type of supply chain covers all activities related to the production and distribution of agricultural and food products, from farm to end consumer (Petljak et al., 2018).

In the food supply chain, there is a linear relationship between primary producers, final producers, wholesalers, retailers, and end consumers. The food supply chain is divided into several main subdivisions. At the beginning of the chain, there are primary producers, which include agriculture, horticulture, fisheries, and so on. Primary producers in the food supply chain are similar to suppliers in other supply chains, but their products can be consumed directly by the end consumer without further processing. For this reason, the word primary producer is used instead of the supplier. The final producers include the parts that process food. These processes include washing, cooking, packing, and so on.

Finally, there are wholesalers, retailers, and consumers (Bourlakis and Weightman, 2004). The components of the food supply chain can be illustrated in Figure 5:

Table 4.1: Different Components Of The Food Supply Chain (Bourlakis and Weightman, 2004)

In the food industry, safety and quality play an important role because poor quality can cause irreparable life-threatening damage (Jie et al., 2019). For example, if the appropriate products are not delivered to the consumer at the right time, the product is of no value to the customer. For this reason, the cooperation of the food chain components is critical.

The traditional supply chain often involves more than one company in the supplier-customer relationship series and is usually a set of links and collaborative processes that cover all activities from raw material delivery to final delivery to the final customer. Raw materials enter the plant through the supply system and become the final product. The final product is delivered to the end customers through the distribution system. In general, several components are linked in this process, and any added value created for the product is transmitted across the loop (Lamberti and Pero, 2019).

E-commerce and the Internet have fundamentally changed the nature of the supply chain, resulting in the emergence of a new B2B supply chain that is customer-centric rather than

product-centric. At the end of the twentieth century and the beginning of the new millennium, humanity has passed through the great agricultural and industrial revolutions and now entering a new era, an age known as the Information Age. This era was well predicted by Alvin Toffler that referred to it as the Third Wave, a wave that will affect all of human life and rightly so (Stanton, 2018).

All recent developments, such as the emergence of virtual companies and organizations, cyber sales, control, and payment in cyberspace, are a symbol of these changes in the lifestyles and work of today's generation. Supply chain systems are no exception. The use of advanced electronic and information systems in the supply chain, from ordering to supplying goods, has become increasingly important. Even today, it can be argued that a supply and sales chain system is either small or large without the use of these methods and with these inadequate facilities (Minetto et al., 2018).

This situation is especially critical when direct and productive communication with the end customer on the one hand and the main producer of the product on the other are a vital and essential part of the business, as is the case with many food retail stores. Perhaps all food retailers understand this, but the high costs of these systems prevent them from using these systems. However, this is not the case for large retailers that are financially strong. Accordingly, paying attention to technology and its application in supply chain systems is one of the basic needs of a successful food retail system (Heng, 2018).

Nowadays, with the expansion of business activities and the emergence of online retailing, most goods are moving daily into the supply chain. For example, fresh vegetables from Peru are sold daily in US markets (Jie et al., 2019). As a result, logistics activities are globalized, and products and commodities are distributed in a wide geographical area. All of these factors require the coordination and coherence of the transfer of goods and products, so that support must also be able to meet new needs efficiently while being able to provide opportunities for development profitably. In other words, efficient supply chains are needed to be developed in collaboration with manufacturers, suppliers, intermediaries, and distributors. It is also important to increase customer response speed and meet their needs in the shortest possible time. Clearly, the need to achieve an agile and efficient retail system is to establish and develop an efficient supply chain system (Backholer, 2018).

Today, one of the basic needs of an integrated electronic food retail supply chain system is Electronic Data Interchange (EDI). EDI is a direct computer-to-computer connection of business information and documents between an organization and its business partners in an automated and standard structure that allows data to be processed by the receiver without the need for encoding. This information and documentation can be either trading documents such as ordering, cargo notifications, and invoices, or planning-related documents such as demand forecasts, production schedules, and warehouse reports. Sharing information and activity planning enables organizations to reduce costs, increase value, and execute activities with enhanced collaboration between members (Walker et al., 2018).

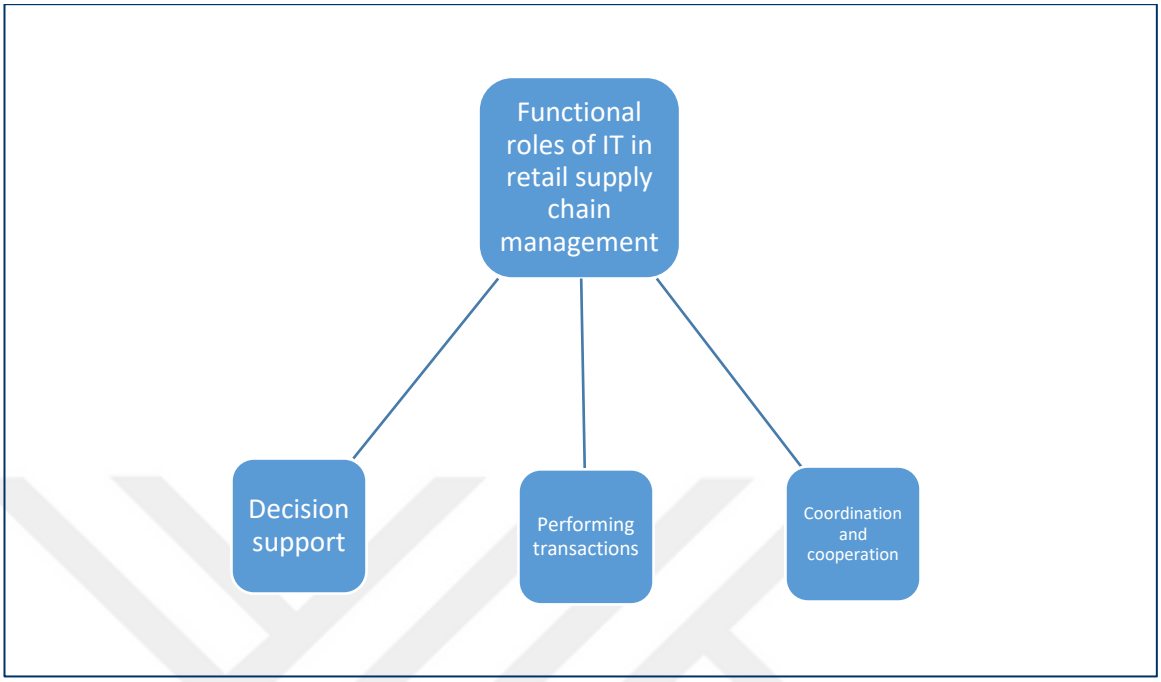
In the past, the cost and complexity of executing EDI transactions made it such that this type of information exchange was only suitable for large corporations, but today the prevalence of Internet-based communication tools makes it possible for any organization of any size to do so. Moreover, this has enabled companies to be able to exchange information effectively with their suppliers, customers, and partners. In fact, the Internet is a unique intermediary that enables a two-way, secure, and fast connection (Gullo et al., 2018).

IT objectives in retail supply chain management include (Mathu, 2019):

i. Providing easy accessibility and visibility of the information
ii. Being able to create a point (place) for communicating with data
iii. Being able to make decisions based on supply chain information
iv. Being able to coordinate and collaborate between supply chain partners

In general, the functional roles of IT in retail supply chain management (SCM) can be summarized in Figure 2.

Table 5.1: The Functional Roles Of IT In Retail Supply Chain Management (SCM) (Mathu, 2019)



The key role of IT in retail supply chain management is to reduce friction in supply chain transactions through a seamless flow of information. Another important role of IT in supporting supply chain partners is through sharing information; for example, IT is an effective way of eliminating the whip effect on supply chains. On the other hand, IT can also be used in decision support. The power of computer analytics is an aid to managerial decisions (Dixon-O'Mara and Ryan, 2008). Technology affects the food retailing supply chain management in a variety of ways, including:

*Cost-Effective communication***:** Traditional communication channels such as telephone and fax require high levels of staff on both the seller and the buyer side. Information technology allows transport companies of all sizes to exchange their information over the Internet to make their document transfer more efficient. As companies move towards digitalizing their processes, error rates decrease, fewer employees are needed for the ordering process, order processing speeds increase, and eventually, overhead costs are reduced. In the past, companies that used traditional EDI because of the high costs and

the proprietary nature of EDI, this connection was created only between the largest providers and customers of each company. Nowadays, open access and lower subscription costs (compared to traditional EDI) give all partners the opportunity to streamline their processes in real-time with the ability to modify and store electronic data (which are essential components of order cycle time reduction) (Morimura and Sakagawa, 2018).

*Transaction efficiency and effectiveness***:** There are two ways to create value in any company (Morimura and Sakagawa, 2018):

i. Through the price that suppliers offer to a demanding company
ii. Through the ability to match the supply chain's extra capacity with non-formal demand

Technology provides the opportunity for both. The Internet makes ordering more convenient from different suppliers of the chain, using more potential suppliers for the pricing process, resulting in a lower cost of goods (due to competition among suppliers) for the customer. B2B retailing e-commerce also provides a mechanism by which a company can forward its request to suppliers based on the status quo (Tsai et al., 2010).

*Distribution system change***:** IT makes business more flexible in managing the complex flow of materials and information between the retailer, suppliers, and customers. Information technology eliminates the gap between customers and retailers, and customers can follow the complex flow of goods throughout the supply chain (Krasyuk et al., 2017).

*Reduce the whip effect***:** Food retailing supply chain activities include the flow of information, materials, and finance between different stages of a supply chain, from suppliers to customers. When different parts of the supply chain plan locally without sharing information, the result is a whip effect whereby a small fluctuation in consumer demand leads to large fluctuations in suppliers and factories. In some supply chains, the supplier order can fluctuate 2 to 5 times higher than the order given by the end customer, resulting in high delays, excess capacity, high shipping costs, high inventory, and customer dissatisfaction. Information technology can solve this problem in two ways (Morimura and Sakagawa, 2018):

i. *Increased visibility in the supply chain***:** by increasing visibility in the food retailing supply chain, IT can reduce the impact of the whip effect as a result of slight changes in the chain, resulting in high service levels and lower costs.

ii. *Through Collaboration***:** Collaboration and coordination will allow supply chain partners to consult and collaborate on decisions about design, introduction, pricing, production, and distribution.

*Tracking***:** IT will allow retailers to obtain instant and online information about their orders. They can also view and compare price lists of suppliers (Gunasekaran et al., 2017).

*Cargo Audit***:** Information technology will enable food cargo invoices to be more effectively verified. As a result, the risk of the overpayment is significantly reduced, eliminating the many hours required for office work and the need for third-party auditors. By controlling and removing duplicate invoices and inaccurate expenses, a certain percentage of the extra costs will be discovered and eliminated (Gunasekaran et al., 2017).

2.3.2.1 The Internet Of Things (IoT)

One of the significant advances in the digital age is the mass production of data of which people realize the real value. There are two types of data: public data and private data. The Internet is the largest source of public data and is unique because of its continued expansion. Private data is more focused on private servers, especially cloud services, and contains sensitive personal information. It is no surprise that tech giants have the most data in the world, companies like Google, Facebook, Amazon, and Baidu. Today most data is collected through apps, for example, Google from search results, Facebook from social profiles, and Amazon from its users' shopping habits. Businesses are catching up and collecting data by launching various applications (Ben-Daya et al., 2019).

Real-time access to data needs to be achieved in order to have the ability to make decisions as fast as humans. Until recently, access to real-time data was difficult, but nowadays, with the help of sensors and actuators, real-time data has come closer to reality than ever. Today, almost everything can be measured from temperature, location, velocity, acceleration, depth, pressure, blood chemistry to air quality, color, image scanning, sound scanning, biometrics, electric, and magnetic fields (Pal and Kant, 2018).

The Internet of Things (IoT) in the food supply chain can be transformed into a self-adapting system where objects can make intelligent decisions and solve problems automatically. The IoT can be defined as a vast world of unique addressable objects based on standard interconnects protocols (Zhu et al., 2018). It means a world-wide-web of interconnected smart objects using sensors and disks. In the Internet of Things, physical entities have digital and virtual identities; objects are transformed into text and are capable of measuring, communicating, interacting, and exchanging information. The Internet acts as a communication and storage infrastructure that links related information to the object. In the concept of the Internet of Things, it should be possible to automatically detect physical objects, using the technology used in the transmitters of the barcodes or using radio frequency (Bottani et al., 2017).

2.3.2.2 Artificial Intelligence (AI)

Data is the fuel of intelligence and is the motor brain that links current data to previous data, categorizes them, makes decisions, and operates in the real world. The brain is an organ that relies on its cognitive ability to make a real difference between humans and other animal species. That is why making technology similar to the human brain is very sophisticated and takes a long time. However, significant advances in artificial intelligence have been seen. These advances have allowed the software to mimic human brain-behavior (Li et al., 2017).

Over the past decades, hardware and software advances have led to the development of machine tools for quality control in various industries. Image processing allows for greater colorimetry, quality control, and grading of food and agricultural products, resulting in lower workforce costs and enhancing product category quality (Wang and Yue, 2017). The machine vision system has had many applications today in the fields of medical diagnosis, mechanization of the production line, aerial surveillance, remote sensing, and, more recently, in the mechanization of the food and agricultural industry. Machine vision is a new technology for capturing and processing images from a real scene with cameras, computers, and other devices capable of receiving, controlling, or processing information (Heard et al., 2018). Today, image processing as a branch of AI is used to mechanize these processes and replace humans with smart machines. Image processing is one of the methods that, due to its satisfactory speed and accuracy, have various applications, including the creation of detailed descriptive data in agriculture and the food industry, grading of fruits and vegetables, grain characterization analysis, and food evaluation (Iqbal et al., 2017).

Object sensing is supported by applications such as smartphones with a barcode reader, which enables humans to perform additional actions such as visual quality inspection. In today's modern agri-food industry, image processing is used to mechanize and replace humans with smart machines. This is because human diagnosis is time-consuming, difficult, unstable, and affected by one's mental state (Arora et al., 2018).

Many companies use artificial intelligence to increase their productivity. For example, SAP HANA is an intelligent database capable of receiving different types of data,

processing them, and detecting an anomaly. Companies like Wal-Mart benefit from SAP HANA because of its ability to process very high volume transactions in just a few seconds. SAP HANA not only reduces costs by dramatically reducing the workforce required, but it also helps forecast the required budget. The commercialization of artificial intelligence has been fueled by the prosperity of data and smart algorithms (Li et al., 2017).

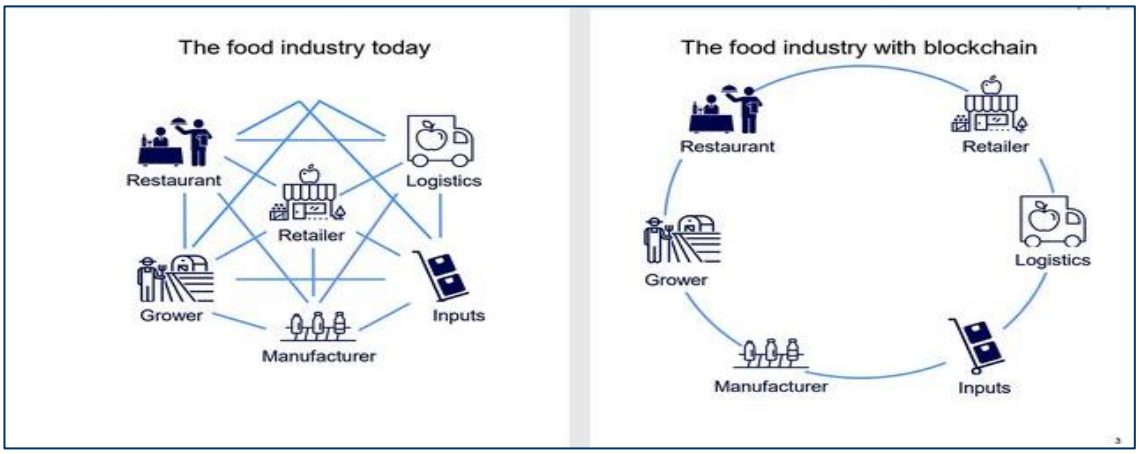
The idea is to design software to make data-driven decisions instead of human interactions. Today's software platforms perform simple tasks relative to their inputs, but artificial intelligence systems can perform much more complex tasks on many more inputs. Artificial intelligence can play a key role in improving food supply chains, including in cases where materials are perishable or unpredictable and need sustainable chains. Also, the Internet of Things is capable of revolutionizing the food chain systems.

2.3.2.3 Distributed Ledger Technology (DLT)

Blockchain, the most well-known DLT, is a shared storage layer that can process its transactions and record results in a shared ledger. It is a technology powered by a vast network of computers that all run the same open-source software. Except for initial setup and periodic reviews by users, blockchain is a fully automated and independent network, minimizing the possibility of attackers and suspicious activity due to its decentralized nature. Blockchain does not have centralized management, and all users can use it. Making peer-to-peer (P2P) applications without the need for intermediaries is one of the characteristics of this technology (Saberi et al., 2019).

Today, consumer’s demand for healthier foods and transparency in the food supply chain and organic foods are rapidly increasing. Using blockchain, people can find out from the label information of a food product that what ingredients the makers used to produce that food. Using blockchain enhances our ability to create a fully transparent and productive supply chain by providing accurate and complete data. Blockchain technology assures that no member of the supply chain can change this information (Montecchi et al., 2019).

Table 6.1: The Impact of Blockchain On The Food Supply Chain (Saberi et al., 2019)



While blockchain can keep this process going, it can build trust between manufacturers and consumers to let customers know where the product is coming from, how it is supplied, and how it is produced. Therefore, it might be optimistic about the decisive role of blockchain technology in the food retail supply chain. Some supply chains are currently using blockchain technology, and some believe that blockchain could become a supply chain operating system. This technology can improve the following (Montecchi et al., 2019):

i. Capture the transfer of assets such as pallets, trailers, containers and more.
ii. Keep track of purchase orders, change orders, receipts, shipping notices or other business-related documents.
iii. Assigning or endorsing specific certifications or features of products, for example determining the organicness and fair trade of the food product.
iv. Link physical goods with serial numbers, barcodes, digital labels such as RFID.
v. Sharing information on the process of manufacturing, assembling, delivering and maintaining products with suppliers and vendors.

Logistics companies and smart distributors are looking for ways to apply this technology and achieve higher profits and stronger communication across the supply chain.

2.3.2.4 Radio Frequency Identification (RFID)

One of the most essential goals in supply chain management is identifying and tracking goods from production to consumption. Barcodes or other means of identification can do this process. Any system that is capable of reading and detecting information about people or goods is called an identification system. In general, automatic identification and data retention is a method by which equipment, whether hardware or software, can read and detect data without assistance from a person. One of these methods is to identify goods is using a Radio Frequency Identification (RFID) system. In the supply chain, different rings of the chain, such as manufacturers, distributors, vendors, and other components, need to know their warehouse inventory, and possessing this information can save a great deal of money, time, and increase productivity (Biswal et al., 2018).

RFID systems are a potential solution that can track the flow of materials and products from the beginning to the end of the supply chain. The system is now widely used in industry to prevent theft, increase inventory efficiency, and reduce inspection and shipping costs (Lorite et al., 2017).

Radio wave identification can provide greater operational efficiency and inventory transparency in the food supply chain. Information on physical objects can be automatically collected and recorded without the intervention of humans by attaching tags or transmitters to transported products or packages and creating an infrastructure of tag reader devices. The RFID system consists of a tag that has a microchip attached to the antenna. The tag is attached to everything that needs to be identified (such as a product pallet in stock) and exchanges information with another device called an RFID reader. The reader communicates with the tags at various stages of the supply chain using electromagnetic waves and reads information from these tags (Hilt et al., 2018).

The use of technologies such as RFID in the supply chain has led to changes that lead to lower costs in supply chain operations, improved service delivery, the ability to provide unique services and products. The capabilities that RFID technology provides in identifying products and obtaining information from different sources of data in real-time opens up new horizons in supply chain operations and decision support. With RFID, different companies can share information

with their business partners in a standardized data sharing method and collaborate in decision support (Huang et al., 2018).

Implementing RFID in the supply chain allows partners to quickly know where a product is located, where its destination is, and where it came from. The new, low-cost generations of RFID tags, with the help of related software solutions, have created new capabilities for supply chain management such as real-time access to item information as well as significant changes in how item lists are managed in the supply chain (Zhu et al., 2018).

The most important advantage of RFID is transparency in the supply chain. The most critical issue that concerns managers in the supply chain are the uncertainty in inventory and warehousing. This problem is minimized by using RFID technology. The following are some of the most essential uses of RFID in supply chain management (Iqbal et al., 2017):

i. Support for an overview of the inventory flow in the supply chain
ii. Track discontinuous changes in the tagged items list
iii. A timely alert on the item list when changes to business rules occur
iv. Ability to act promptly
v. Maximize storage space
vi. Minimize deficiency in goods
vii. Benefits for customers
viii. Innovation in customer service

Despite all of the benefits that RFID has to the supply chain, there are some disadvantages to some of the following (Hilt et al., 2018):

i. High Price
ii. Interference
iii. Safety Issue
iv. Lack of Standards

Critics of RFID implementation in the food supply chain point out that RFID technology is costly and that investing with this magnitude has a little potential and a chance to be profitable. At present, prices of RFID equipment are not economically feasible to allocate tags to each customer package. Still, if the tags are used at the transport unit level, cartons, and boxes rather than for each customer package, it leads to a significant reduction in investment costs. Maximum cost efficiency can be achieved by using RFID tags in conjunction with retrievable containers, in which containers with RFID tags can be repeatedly used again (Lorite et al., 2017).

2.4 THE FUTURE OF SUPPLY CHAIN TECHNOLOGIES IN THE FOOD RETAILING

In today's increasingly competitive environment of food retailers, the number of innovations, and the use of technology for the convenience and efficiency of customer shopping are increasing every day. These technologies include smart shelf tags, artificial intelligence, and many more, including Blockchain. This section examines some of these technologies that are predicted to have a future in the food supply chain.

2.4.1 Green Supply Chain Management (GSCM) For The Future

With increasing public awareness of the environment, environmental challenges, and their impact on various activities have become an important issue. This also appears to have been the result of new environmental laws and regulations in the countries. As such,

the number of green supply chain management policies and regulations is increasing each year (Fernie and Sparks, 2018).

Given the complexity of the immediate and incidental effects on products and processes in the environment, GSCM can be considered as an extended example of traditional supply chain management. It covers all components of the traditional chain, including retrieval, packaging, reuse, or product reprocessing operations (Jabbour and Sousa, 2016).

Companies are taking the lead in green supply chain management activities such as profit-making, production, distribution, and retrieval. As such, GSCM can be addressed as a branch of supply chain management to reduce the environmental impact of current industrial processes and activities around the world. Food retailers can collaborate with suppliers of their products to enhance their environmental or social characteristics. Efforts such as greening the supply chain and implementing green shopping can encourage suppliers to develop environmentally friendly products and provide information on the sustainability aspects of their products with environmental labels (Gunasekaran et al., 2015).

Food retailers can also encourage customers to buy environmentally friendly products, as well as advice on the use and disposal of products, and offer facilities and services such as a battery reclaim system and reusable bags, and so on. On the one hand, the food retail sector for production in a more sustainable way (for example, by questioning the use of energy and resources) can influence suppliers. On the other hand, the food retail sector is at the forefront of helping the general public in environmentally friendly practices and changing their shopping habits by offering customers the right options (Shaharudin et al., 2019).

Retail inventory management is a practice of inventory replenishment in the supply chain provided by the use of information technology. This practice enables suppliers to make decisions about the level of inventory, the number of goods shipped, and the time of delivery to retailers, knowing the demand from end-customers. This has helped coordinate transportation planning and inventory management in the food retailing supply

chain. Optimizing environmentally friendly transport routes, modernizing the transport fleet to reduce unnecessary greenhouse gases, using alternative fuels, using information and communication technology to improve planning Road transport, sharing transportation resources with other companies, and monitoring CO2 emissions are ways for green transportation in the food retail supply chain (Kusi-Sarpong et al., 2019).

2.4.2 Blockchain In The Food Retailing Supply Chain

More than a hundred years ago, supply chains were relatively simple because it was local businesses in there, but today these chains are very complex. Throughout history, various changes have occurred in the supply chains, such as changes in the type of transport and the use of trucks instead of railways or the use of computers in the 1980s, leading to dramatic changes in supply chain management. The food retail supply chain has also been no exception, and these complexities have increased over the years due to the increased variety of products and the expansion of the supply chain to different countries. New technologies like Blockchain can, therefore, be used to deal with these complexities (Francisco and Swanson, 2018) **.**

While the most important use of blockchain technology is in digital currencies such as Bitcoin, the reality is that Blockchain is essentially a distributed digital ledger that has many applications and can be used for any transaction, contract, tracking and, of course, financial payments. Blockchain technology can increase food retailing supply chain transparency and efficiency and have a positive impact on all sectors from warehousing to delivery and payment. The chain of command is essential for many parts, and Blockchain has the chain of command in its essence. The components that are needed to build trust and integrity in a food retailing supply chain are provided by Blockchain (Schmidt and Wagner, 2019).

In the food industry, having comprehensive records of each product is essential for tracking each product to its source. For this reason, Wal-Mart uses blockchain technology to track its meat sources in China, and Blockchain records where each piece of meat came from, where it was prepared, where it was stored, and on what date it was sold. Unilever, Nestle, Tyson, and Dole also use Blockchain for similar purposes. In these companies, Blockchain was used to digitally monitor food products that were delivered from

suppliers to the store and then to the customer (Francisco and Swanson, 2018). Among the product data used for tracking, there were product code, the source farm, and factory details and expiry date. Any data entered in Blockchain was used to verify the health and quality of the products. Blockchain technology also enhances business performance and transparency. With this technology, retailers can also improve their workflow and gain a new competitive advantage over their competitors (Saberi et al., 2019).

Since 2015, Carrefour has used Blockchain in its quality control lines. In collaboration with Rougeline, the company used the technology first in its chicken line and then in tomatoes. This technology made it possible for all information related to a chicken or tomato product, from field production conditions to preparation and transfer to the store, all to be enclosed via a QR code on the product, and the customer can use his/her smartphone to access all this information. This technology creates transparency and improves reliability in the food supply chain, as blockchain information is unchangeable and complete by different components of the chain (Kshetri, 2019).

2.4.3 Robotics In The Food Retailing Supply Chain

In the modern age, robots have taken their place in a variety of fields, including the supply chain, and became an integral part of industrial automation systems. There are many benefits to using robots, including increased productivity, safety, efficiency, and high speed in operation (Keow and Nee, 2018).

Wal-Mart uses its shelf-reader robot in more than 50 stores across the United States. The robot, which automatically moves and scans shelves, is used to control inventory and price on the shelves (Kumar and Shoghli, 2018).

Nowadays, the experimental uses of robots are mainly focused on delivering packages to customers and supply chain endpoints. For example, Domino's Pizza recently had a pilot program to use robots to deliver their pizzas. These robots automatically find their way and even have a built-in heater to keep the pizza warm until it reaches the customer (Jennings and Figliozzi, 2019).

Today, however, robots are used in routine tasks such as reading shelves or checking stocks in retail stores. However, in the future, robots are predicted to play a significant

role in the food supply chain, from farm production and factories to self-driving cars for transportation and even the last mile distribution of online grocery shopping (Keow and Nee, 2018). Although most of these technologies are currently being tested, the future of robotics in the food supply chain is bright.

2.4.4 IoT In The Food Retailing Supply Chain

The Internet of Things can affect any global industry, from food retail to connected vehicles. Its impact on the food retailing supply chain can also be an interesting topic in the future. The IoT aims to make a major difference in the supply chain by improving operational efficiency and increasing the profitability opportunities that are possible only with this kind of transparency. In the future, the IoT for the supply chain is not just used for product tracking; it is also a way to gain competitive advantage (Ben-Daya et al., 2019).

Migros, for example, recently used IoT to monitor refrigerator temperatures in one of its stores. Through a partnership with a startup called Axino, the company has installed new sensors in its refrigerators that monitor each product separately and deliver real-time data. Then, an algorithm predicts future temperatures for each product, taking into account historical data and changing temperature over time or even receiving weather status as input. This innovation is said to be effective in optimizing energy and improving maintenance and extending the equipment's life. It also increases the quality of monitoring and reduces the need for staff checking, thus freeing up more staff time (Appel, 2016).

As IoT progresses, these improvements and changes will be in the future:

*Tracking***:** In the past, numbers and barcodes were used to manage the supply chain better. With the advent of the Internet of Things, these methods are no longer appropriate. New RFID and GPS sensors can be used to track food products from planting to delivery. Manufacturers can even have the most detailed information about their food products at any time and place, such as the temperature of the product being stored, the shipment time, and even the time elapsed since the opening of the package. The information gained through the IoT helps companies to monitor the quality and health of food products, deliver them on time, and predict future orders for their products (Radanliev et al., 2019a).

*Vendor Relationships***:** Tracking data is important because it helps companies change their production plans and identify costly relationships with vendors. According to IBM, more than 2 percent of the value of the company's products or services comes from its suppliers. This gives a great incentive to pay more attention to how vendors manage resources and how the product is managed after it is manufactured. Better quality goods will lead to better customer relationships and overall customer retention (Radanliev et al., 2019b).

*Prediction and Inventory***:** IoT sensors can manage inventories more accurately than humans. Amazon, for example, uses WiFi robots to scan QR codes for its products to track and sort orders.

*Scheduled Maintenance***:** IoT can also use smart sensors in the manufacturing class and prevent costly downtimes by managing scheduled and anticipated maintenance (Ben-Daya et al., 2019).

Research shows that 5% of retailers and manufacturing plants are already beginning their transformation of the supply chain processes (Radanliev et al., 2019a). However, when talking about the supply chain, for the Internet of Things to really work, all members of this ecosystem must be connected. At a time when many retailers are grasping the concept of IoT, it may take some time. However, with the advent of technologies such as Blockchain and Cloud computing, the food retailing supply chain can be transformed more efficiently and creatively than ever.

3. RESEARCH ON NEW TECHNOLOGIES IN SUPPLY CHAIN IN FOOD RETAIL SECTOR

This part, consisting of the research method, the data collection process, the sample structure, the research questions and the analysis results, contains the expression of the methods used for the intended purpose.

3.1 THE AIM OF THE RESEARCH

The aim of this research is to determine the supply chain methods and technologies currently used in the food retail sector in the market and to investigate what new technologies are waiting for the employees working in this sector in the future.

3.2 THE RESEARCH QUESTIONS

This study targets to find answers to the following five questions:

i. What technologies are currently used along the supply chain process?

ii. New technologies on supply chain provides what type of competitive advantages for the companies?

iii. What kind of supply chain tehcologies are currently used in the food retailer sector?

iv. What are the impacts of technology on enhancing the quality level of supply chain management in food retailers?

v. What new technologies are waiting for the employees in the food retail sector in the future?

3.3 POPULATION & SAMPLING METHOD

The target population of the study includes all the employees who is working on the food retail sector. The reason for this choice is that the employees in this sector have high level of knowledge and are familiar with the food supply chain, and besides they are able to using the technologies properly in this sector and know the internal dynamics of the industry well.

The convenience sampling method has been used as sampling method. The first step in selecting the target sample is the "expert" definition based on the exact specifications of the experts. A comprehensive definition of the experts must be provided. In this study, an interview has been made with Migros Store Manager. This choice was made since Migros is one of the market leaders in food retail sector with its subsidiaries such as M-Jet, Kipa & MacroCenter, and this expert could answer all predetermined questions related to the impact of technology on the food retail supply chain at stores.

2018 market share, sales data of the Turkish food retailers and a short introduction of Migros have been shared below.

Table 7.1: Market Shares of Organized Grocery Retailing in Turkey: Top 10 (Euromonitor International - RETAIL FOOD REPORT: TURKEY)

	Grocery Chain	Chain Type	Market Share (%) 2018	Sales ($mil. USD) 2018
1	BIM	National Discount	8.4	5,662.10
2	A101	National Discount	5.3	3,593.70
3	Sok	National	3.9	2,640.80
4	Migros*	National Discount	3.4	2,358.60
5	CarrefourSA	National (Int. Owned)	1.1	768.80
6	M-Jet	National Convenience	0.7	501.10
7	Kipa	Regional	0.5	361.10
8	Ekomini	National Discount	0.5	354.30
9	Hakmar	Discount - Istanbul	0.4	296.00
10	Yunus	National	0.2	155.80
	Total of Top 10	All types above	**24.40**	**16,692.30**

**M, MM, MMM, 5M Stores of Migros are displayed together. M-Jet, the convenience store of Migros, is not included. When M-Jet and Kipa is combined with Migros, actually Migros would be ranked number 3. ** The market shares are in the organized grocery retail category, traditional grocers are not included.*

Migros is a multi-format supermarket chain. They opened their first grocery store in Turkey in 1954. The large part of the shares were purchased by Koç Group in 1975. After various ownership changes, a large part of its shares were purchased by Anadolu Group.

It is currently a 100% Turkish company. Migros has different types of stores. The smallest of them is the buffet-style stores, called M-Jet, which were established to compete with grocery and discount sales stores. Small supermarket concept is M Migros, larger is MM Migros and hypermarket concepts are MMM and 5M Migros. MakroCenter brand stores are food stores that sell high quality store experience. Migros store chains operate in 73 of 81 provinces and 22% of the offered products to the market consists their own private label products. In addition, Migros brings processed and packaged imported food products to its customers, especially in MacroCenter stores. Migros stores also offer all kinds of alcoholic beverages, including imported wine and spirits, other than tobacco products. Besides, in 1997,Migros has started its online sales channel operations, They, carry on business in 24 provinces and they, continues to transport the grocery shopping needs of their customers within the requested time frame.

3.4 DATA COLLECTION & RESEARCH METHODOLOGY

Qualitative research is a research method which means any kind of research that provides findings that are achieved by methods other than quantitative methods. Some data may be statistically quantitative, but their analysis is qualitative (Denzin, 1994). This research method often uses an inductive explanation. A qualitative research methodology is often referred to as methods used to obtain subjective data. In general, qualitative research tends towards a perception of the natural world, and its nature is entirely interpretative. The purpose of this is not to emphasize the causal relation through the rejection of the hypothesis based on the absence of a relation; on the contrary, the qualitative research recognizes the multifaceted interpretations of human experience and the recurring relation within social and cultural systems (Mcleod, 2011).

This study looked at technologies that can help businesses, and especially food retailers, manage their supply chains

To do this, it was decided to use a qualitative interview method. The qualitative method was used for this research because the effects of technologies on industries are unique in each industry, and the best way to get these changes is to interview the target population.

This study aspires to evaluate the impact of technologies on the supply chain of the food retail sector. For this purpose, after determining the potential candidates for collecting data, it was decided to collect the data through an interview with an expert within the industry. The selected population and interviewing method will be discussed further.

In a qualitative study, there are usually three ways to collect the data (Patton, 1990): observing, using available documents, and interviewing. The interview is one of the methods for collecting information, in which individuals or groups of individuals are questioned in person (Dummay, 2011). The important point is that interview questions have been pre-considered and determined. Another characteristic of the interview is its degree of flexibility and how it is implemented. Interviews have been considered as one of the ways in which the opportunity to respond is more than other methods, since during the interview, it is possible to stimulate the subject to respond, and in the case of ambiguity, it can be clarified with the explanation to the subject.

In this case, the most important tool for collecting data related to the impact of the technologies in the food retailing sector was the in-depth interview. So it was decided to collect the required data by having an interview with a food retailing sector manager. The interview was done via skype.

4. FINDINGS OF THE RESEARCH

After reviewing the topics, the author came up with a total of five key questions about the impact of technology on the supply chain of food retail, which will be covered below. The interviewed expert answered these five questions.

Situation analysis of the Turkish food retail sector:

Food retailers are categorized within two main groups in Turkey, such as organized / good contemporary retailers and traditional good retailers. Organized market retailers are multiple formatted retail chains, off-price grocery store chains, regional grocery store chains, and gas station markets. The biggest part of the traditional local market retailers is the self-directed markets, which called "bakkal" that sell highly recurrent food products. Traditionally, in every town or neighborhood, there are different types of stores specialized in fresh products, meats, nuts, dry foods, and bakery products such as bread. The other important channel in the traditional market structure is outdoor markets where fresh products, dried fruits, fishes, and even some textile products are sold by the producers and traders. These are weekly farmers' markets, and they continue their existence in different neighborhoods and streets.

The retail food sales by creating %55 of all retail industry sales through 352.000, chain stores, and self-directed food retailers are valued about to 83,8 billion USD. Total retail industry sales (excluding sales tax) have amounted to 123,6 billion USD in 2018.

Consumers in Turkey, prefer to do shopping from the stores near their homes or workplaces in the cities such as İstanbul, Ankara, and İzmir, where there is a high incidence of traffic and population density. Since Turkey is a price-sensitive market as well, consumers started to prefer the off-price markets, which is averagely %30 cheaper, considering the brand and offer private label products. For this reason, the off-price food retailers such as BIM and A101 transform the market and maintain their positioning by opening compact stores in the neighborhoods and streets (usually between 100 and 400 m2). The grocery stores (traditional small single markets) are closing increasingly. Supermarket retailers such as Migros and CarrefourSA continue to open smaller markets such as M-Jet and CarrefourSA Express to compete with discount markets. As a result of

lack of organized or contemporary retailers in the smaller towns and villages, traditional food retailers such as grocery stores (traditional small markets) and the outdoor markets (street product markets) are still the most significant channels of food shopping in these places

The importance of technology in competition within this sector:

Technological developments force traditional retail to transform. These developments transform both the way of work of the business in the retail value chain and their relationships with each other and with customers. This transformation occurs in three significant points. The first point is that more customers make a purchasing transaction by researching the field of online retailing. As a result, the importance of physical retailing decreases. The second point is that the retail business system has no longer clearly drawn lines. This means that businesses that have just entered the market have surpassed the fields dominated by traditional store-based retailers. Thus, it means that anyone who can attract customer traffic can become a retailer. As a third point, big data and technological progress have the potential to increase the efficiency of retailing and to provide good service to the customers in more dimensions. The first two points reflect how the technology that once helped the retailer strengthen its functional position between the supplier and the consumer fundamentally changed the competition. Retailing tasks such as product range, collection of products at the point of sale and movement of physical inventories are no longer in the value-added protection of traditional retailers. These thoughts and operational activities will bring too much damage to those who still hold to the old traditional retailing model. The third point reflects new opportunities that technology can offer to the old and new participating businesses in the digital age of retailing.

The retail technologies currently used along the supply chain in the market:

In recent years, the increase in the success achieved by e-commerce companies, which are usually realized their selling through digital channels such as Amazon and Alibaba and the proliferation of these companies have revealed the dimensions of alteration in retail in industry. As it is stated before, the areas where dominating conventional retailers rule over the market and the barriers set by them are easily exceeded by the online retailers

whose numbers are increasing day by day. Thanks to the variety of products and services offered by online retailers and the ease of instant access to accurate information, customers can compare prices and features of products and services within seconds. Internet of things (IoT) is a network technology where physical objects communicate with each other or with larger systems through internet technologies. Cloud-based software enables the sharing and analysis of data on this network. Combining digital technologies with physical stores, IoT enables retailers to provide a real multi-channel experience to their consumers.

Through mobile technologies, applications that automatically track the customers from the moment they enter the store and direct the customers towards the products in their shopping lists have started to be developed. The solutions facilitating the shopping processes, such as Amazon Go and Walmart Scan, enable customers to complete their shopping without needing the help of store employees by utilizing the technologies like smart shelves, smart cameras, smartphones, gateways, smart sensors, cashier-free system. By integrating its catalogs to digital media, IKEA, with its mobile application using augmented reality technology, offers its customers the opportunity to digitally position the product they are planning to purchase and to make a decision after seeing it. Thanks to the assistant devices working with voice interactions such as Amazon Echo, Google Home, and Apple HomePod, customers have the opportunity to order, receive information or make research on products and services. Especially Amazon is able to take action according to the current situation by instantly monitoring the comparisons of the product price and feature made by its customers with using Amazon Echo; and the other related data.

The retailers are developing more efficient methods for the customers to complete their payments. Through the mobile-based payment systems, Near Field Communication (NFC) technology and mobile wallets, both customers can make their payments more quickly, and operating expenses can be reduced. It is enough for customers to enable an application on their smartphones in order to use NFC technology, which allows the data flow between two wireless devices when these are brought together. In this way, the customers become able to complete their payments only through a smartphone without using a credit card or cash.

Smartphones have the potential to offer their customers a different experience with a technological application called "scan and go." For instance, with this application started to use in Migros stores in Turkey, with the name of 'Mkolay,' customers can scan the products and put them in their carts via their smartphones, so they can see the accurate information about products and their prices, control the total amount of current basket and without emptying the cart, they can complete the payment at the exit point. Regarding the digital payment, although payments with QR codes are at the forefront, it is thought that the payment methods based on the face-recognition technology will come into prominence. The China-based company, Alibaba, provides its customers the opportunity to shop with taking a selfie from the screen in its stores

The advantages and disadvantages of these technologies:

There are essentially three important advantages that are brought by technological applications in food retailing.

i. Fluidity in processes throughout the entire supply chain and productivity increase

ii. Cost reduction

iii. Customer service with higher quality and increasing customer satisfactio

Some disadvantages are:

i. Under the fascinating technological developments, in consideration of numerous emerging technological applications, while the decision-making directors decide on what technologies can create added value in real terms for their companies, due to not having sufficient equipment, waste of money, time, and energy loss can happen as a result of wrong decisions

ii. The lack of qualified staff, especially IT (information technology) staff which will maintain and improve the process, or the process blockage due to not being able to hold to these staffs

The technologies to be used in this sector in the future:

The major technologies expected to arise in the future as follows:

Internet of Things, IoT

The technology of IoT has been offering considerable opportunities and innovations in the retail industry.

i. Through the beacon technologies that can be placed outside the store, information about store visitors' purchase history, personal preferences, etc. can be provided through, in order to help salespeople provide an exclusive service to their valued customers.

ii. IoT connected digital signages whose content is delivered to stores in real-time, customized for specific stores, cities, or regions can be placed in stores.

iii. Intelligent packaging systems monitoring the freshness or shelf life of perishable products can be built.

iv. The installed sensors can check the quality or expiration date of perishable items, inform or warn the supplier to renew the product, or make a discount on it.

v. Customers can call for help or check stock availability via their mobile devices or wearable technologies.

vi. Following the demand or other trends, smart price tags can be implemented, which can be changed in real-time.

vii. Smart shopping carts can help customers navigate the store's corridors according to their digital shopping lists.

viii. Independent working, intelligent robots will be able to assist in various points, from inventory replacement to product assembly and the transportation of hazardous materials.

ix. Customers will be able to use their smartphones or wearable technologies to quickly scan a product and call for information, product reviews, or social media reviews regarding this product.

x. Intelligent thermostats and lighting that increase energy efficiency can be used.

xi. RFID solutions can be implemented to monitor inventory while moving along the supply chain.

xii. Smart shelves informing the inventory level can be positioned within the stores.

xiii. When it is integrated with the technology of augmented reality, smart mirrors that enable the customers to try on different clothes at the time virtually can be placed.

xiv. For a cloth or another product, RFID technology can be used in order to show the product information or to find other colors, sizes, or versions of the product on the retailer's e-commerce site.

xv. When the customer leaves the store, a contactless payment which can automatically scan the products can be applied.

Each of those above, currently existing or possible applications of IoT technology is providing or is expected to provide high value-added services to customers.

Artificial Intelligence (AI)

Artificial intelligence is a computer science that aims to create intelligent machines working and reacting like humans. Voice recognition and learning are some of the areas where Artificial Intelligence is most effective. As a consequence of the opportunities provided by the internet and the exponential growth of the data, it has become widespread in recent years. Practices in the retail sector are expected to be very different from partially or fully-automated types of customer services. The emergence of voice-operated intelligent systems such as Amazon Echo or Google Home has made Artificial Intelligence enter into the homes.

One of the most prominent examples of Artificial Intelligence in the retail sector in recent years has been the use of a robot at the Information Desk of a store in Japan. Aiko Chihira,

the robot with female-looking, speaks sign language as well as Japanese. Chihira uses human-like facial expressions and guides customers requiring information about the store. With the advancement of Artificial Intelligence technology, it is also expected to guide the shopping in the foreseeable future.

Image Recognition

Image recognition is a technology that is used in order to process, analyze, and understand images. As well as being utilized for recognizing the still objects such as a product, it is also used to recognize moving objects like a human face in its more complicated versions. Ordinarily, objects are attempted to be identified through a live camera or from a photograph taken. The technology of image recognition has a diverse range of applications and is used with technologies such as artificial intelligence and augmented reality.

In the retail sector, it has numerous applications in the fields of security, marketing, paying, shopping, and customer services. Recently, a robot named Tally has been developed in one of the innovative studies conducted on the recognition of shelves and objects on the shelves. This robot captures the real-time images of the shelves by moving around the store and able to detect many situations such as a decrease in the product numbers, wrong price tags, products placed on the wrong shelves, etc. by instantly analyzing these images.

One of the innovative products developed in recent years intended to the retail sector is the "Selfie Pay (Selfie Pay), which is using face recognition technology. When users want to make payment via the smartphone application, they ensure the system work by taking a selfie with the front camera. The picture is then used to authenticate the user. Payment is confirmed by cross-matching of the user's photos existing at the service provider.

5. CONCLUSION

Given the enormous global changes in today's world, and with the advances in information technology and its applications in various industries and services, companies must have diverse capabilities such as multi-faceted communication, combining capabilities, fast and diverse mobility, agile processes and activities and so on. Today's organizations need to move from the static and slow-moving business of today to dynamic, fast-moving, easy-to-access, and real-time frameworks of the future. Traditional approaches have been costly to businesses due to their inability to deliver complex and varied products, as well as the inability to deliver services promptly. However, the new approaches seek to deliver the services and products needed in global changing markets based on the combination of traditional business networks and business interactions with the help of ICT.

It is examined the impact of technology on the supply chain and in particular, the food retail sector. Although countless technologies are being introduced every day and it is almost impossible to explore all of these technologies, it is discussed the most important technologies and their uses in different food retailers and looked at the future of these technologies and the role they might have in the future food retailing supply chain. These are just a few of the new technologies that have changed supply chain management and transformed it into a digital supply chain. Although, as in any industries, at first it seems difficult to use new technologies and approaches, and the food retailing supply chain is no exception, but with the adoption of these changes and the use of up-to-date technologies and transforming into digital supply chains, the benefits are certainly endless, benefits such as reducing costs and increasing productivity. Supply chain management is changing rapidly. From small and medium-sized to big businesses, the key is identifying new technology trends and implementing them in the supply chain processes.

The management of the supply chain is one of the major topics of food retailing. Delivering the right product to the final consumer at the right place, at the right time and in the right amount, and managing this process efficient and productive is one of the fields where the whole industry is working on and investing. The fact that developing

technologies penetrate and used more in this field increases productivity and provides important advantages in competition. However, the limited availability of the qualified employee that will manage the process of adding, applying and developing the right technologies are the important problems of the sector. For this reason, both those working in the sector and those who want to build a career in the sector should follow closely the technological applications that interest the sector particularly. Especially in order to meet the orders in the fastest way possible by taking the orders from the customers, many systems based on the artificial intelligence technologies are being developed the flow from the producer to the consumer in a way to be independant from the individuals. Those who work or are willing to work in the sector should follow these developments closely and be informed of the right practices according to the size and suitability of their company.

Academic studies in the field of food retail supply chain management are limited. In the technological applications used by the business organizations in this field, the adaptation of the employees to these technological applications and perceived service quality seem to be as important topics. Academic studies to be carried out with the support of sector representatives on these issues will make important contributions to the sector. As noted in this thesis, blockchain and the Internet of Things are two relatively new technologies whose potential is still unknown in many areas. It is suggested to researchers in this field to take a closer look at the numerous applications of blockchain and Internet of Things technologies and the application of these technologies in supply chain management and stores. Considering the recent environmental concerns and increasing public attention to the environmental impact of companies, it is suggested to focus on the field of green supply chain management as well.

REFERENCES

Books

Bourlakis, M.A. and Weightman, P.W. eds., 2004. *Food supply chain management*. Blackwell Pub.

Fernie, J. and Sparks, L. eds., 2018. *Logistics and retail management: emerging issues and new challenges in the retail supply chain*. Kogan page publishers.

Strak, J. and Morgan, C.W., 1995. The UK Food and drink industry. *Northborough, Euro PA & Associates*.

Taylor, S.J., Bogdan, R. and DeVault, M., 2015. Introduction to qualitative research methods: A guidebook and resource. John Wiley & Sons.

Ramsey, B. ed., 2000. *The global food industry: Strategic directions*. Financial Times Retail & Consumer.

Periodicals

Alfian, G., Syafrudin, M., and Rhee, J., 2017. Real-time monitoring system using smartphone-based sensors and NoSQL database for the perishable supply chain. *Sustainability*, *9*(11), p.2073.

Ali, O. and Hingst, R., 2018. Improving the retailer industry performance through RFID technology: a case study of Wal-Mart and Metro Group. In *Cases on Quality Initiatives for Organizational Longevity (pp. 196-220). IGI Global.*

Appel, A., 2016. Embeddedness and the (re) making of retail space in the realm of multichannel retailing: The case of Migros Sanal market in Turkey. *Geografiska Annaler: Series B, Human Geography*, *98*(1), pp.55-69.

Arora, R., Haleem, A. and Farooquie, J.A., 2018, March. Barriers affecting successful technology enablement of supply chain: An Indian perspective. In *IOP Conference Series: Materials Science and Engineering* (Vol. 330, No. 1, p. 012101). IOP Publishing.

Backholer, K., 2018. We must ensure new food retail technologies are pathways-not barriers-to better health. *Journal of the Home Economics Institute of Australia*, *25*(1), p.36.

Ben-Daya, M., Hassini, E. and Bahroun, Z., 2019. Internet of things and supply chain management: a literature review. *International Journal of Production Research*, *57*(15-16), pp.4719-4742.

Biswal, A.K., Jenamani, M. and Kumar, S.K., 2018. Warehouse efficiency improvement using RFID in a humanitarian supply chain: Implications for Indian food security system. *Transportation Research Part E: Logistics and Transportation Review*, *109*, pp.205-224.

Bottani, E., Bertolini, M., Rizzi, A. and Romagnoli, G., 2017. Monitoring on-shelf availability, out-of-stock and product freshness through RFID in the fresh food supply chain. *International Journal of RF Technologies*, *8*(1-2), pp.33-55.

Bryman, A., 2003. Quantity and quality in social research. Routledge , pp.135.

Chopra, S. and P. Meindl (2001), Supply Chain Management, Prentice Hall Cooper, M.C., Ellram, L.M. (1993), Characteristics of SCM and the implications for purchasing and logistics strategy, The International Journal of Logistics Management, 4, 2, , pp. 13-24

Cooper, M.C., Lambert, D.M., Pagh, J.D. (1997), Supply Chain Management: more than a new name for logistics, International Journal of Logistics Management, 8, 1, 1-13

Denzin, N.K. and Lincoln, Y.S., 1994. Handbook of qualitative research Thousand Oaks. Cal.: Sage , pp.15.

Dixon-O'Mara, C. and Ryan, L., 2018. Energy efficiency in the food retail sector: barriers, drivers and acceptable policies. *Energy Efficiency*, *11*(2), pp.445-464.

Francisco, K. and Swanson, D., 2018. The supply chain has no clothes: Technology adoption of Blockchain for supply chain transparency. *Logistics*, *2*(1), p.2.

Gullo, P., Hafner, A. and Banasiak, K., 2018. Efficient R744 technology for supermarket heating, cooling and refrigeration-a theoretical assessment of energy advantages in various Spanish cities. In *Proceedings of the 13th IIR Gustav Lorentzen Conference, Valencia, 2018*. IIR, pp.123-125.

Gummesson, E., 2000. Qualitative methods in management research. Sage, pp.350.

Gunasekaran, A., Subramanian, N. and Papadopoulos, T., 2017. Information technology for competitive advantage within logistics and supply chains: A review. *Transportation Research Part E: Logistics and Transportation Review*, *99*, pp.14-33.

Gunasekaran, A., Subramanian, N. and Rahman, S., 2015. Green supply chain collaboration and incentives: Current trends and future directions , pp.25-28.

Heard, B.R., Taiebat, M., Xu, M. and Miller, S.A., 2018. Sustainability implications of connected and autonomous vehicles for the food supply chain. *Resources, conservation and recycling*, *128*, pp.22-24.

Heng, T.M., 2018. *Lifting Productivity in Singapore's Retail and Food Services Sectors: The Role of Technology, Manpower and Marketing*. World Scientific , pp.188.

Hilt, M., Shao, D. and Yang, B., 2018, September. RFID security, verification, and Blockchain: vulnerabilities within the supply chain for food security. In *Proceedings of the 19th Annual SIG Conference on Information Technology Education* (pp. 145-145). International World Wide Web Conferences Steering Committee.

Huang, Y.F., Weng, M.W., Lai, K.K., Do, MH and Su, R.H., 2018, September. RFID impacts on franchise-friendly supply chain. In *2018 9th International Conference on Awareness Science and Technology (iCAST)* (pp. 257-263). IEEE.

Iqbal, J., Khan, Z.H. and Khalid, A., 2017. Prospects of robotics in food industry. *Food Science and Technology*, *37*(2), pp.159-165.

Jabbour, C.J.C. and de Sousa Jabbour, A.B.L., 2016. Green human resource management and green supply chain management: Linking two emerging agendas. *Journal of Cleaner Production*, *112*, pp.1824-1833.

Jaque, R., Sarygulov, M. and Leitao, J., 2018. Electronic platforms as a new ecosystem of the organization and the conduct of business. In *SHS Web of Conferences* (Vol. 44, p. 00042). EDP Sciences , pp. 356.

Jennings, D. and Figliozzi, M., 2019. Study of Sidewalk Autonomous Delivery Robots and Their Potential Impacts on Freight Efficiency and Travel. *Transportation Research Record*, p.0361198119849398.

Jie, F. and Gengatharen, D., 2019. Australian food retail supply chain analysis. *Business Process Management Journal*, *25*(2), pp.271-287.

Jones, P., Clarke-Hill, C., Shears, P., Comfort, D. and Hillier, D., 2004. Radio frequency identification in the UK: opportunities and challenges. *International Journal of Retail & Distribution Management*, *32*(3), pp.164-171.

Kärkkäinen, M., 2003. Increasing efficiency in the supply chain for short shelf life goods using RFID tagging. *International Journal of Retail & Distribution Management*, *31*(10), pp.529-536.

Keow, MAKS and Nee, A.Y.H., 2018. Robotics in Supply Chain. *Emerging Technologies for Supply Chain Management*, p.25.

Kim, H.M. and Laskowski, M., 2018. Toward an ontology-driven blockchain design for supply-chain provenance. *Intelligent Systems in Accounting, Finance and Management*, *25*(1), pp.18-27.

Krasyuk, I.A., Kirillova, T.V. and Kozlova, N.A., 2017. Network technologies as innovative solution in commodity circulation. In *SHS web of conferences* (Vol. 35, p. 01055). EDP Sciences , pp.256-259.

Kshetri, N., 2019. Blockchain and the Economics of Food Safety. *IT Professional*, *21*(3), pp.63-66.

Kumar, A. and Shoghli, O., 2018. A review of IoT applications in Supply Chain Optimization of Construction Materials. In *ISARC. Proceedings of the International Symposium on Automation and Robotics in Construction* (Vol. 35, pp. 1-8). IAARC Publications , pp.187-190.

Kusi-Sarpong, S., Gupta, H. and Sarkis, J., 2019. A supply chain sustainability innovation framework and evaluation methodology. *International Journal of Production Research*, *57*(7), pp.1990-2008.

Lambert, D. and Martha C. Cooper (2000) Issues in Supply Chain Management, Industrial Marketing Management 29, p.p 65–83

Lamberti, L. and Pero, M., 2019. Special issue editorial: Managing the supply chain management–marketing interface. *Business Process Management Journal*, *25*(2), pp.246-249.

Li, Z., Liu, G., Liu, L., Lai, X. and Xu, G., 2017. IoT-based tracking and tracing platform for prepackaged food supply chain. *Industrial Management & Data Systems*, *117*(9), pp.1906-1916.

Lorite, G.S., Selkälä, T., Sipola, T., Palenzuela, J., Jubete, E., Viñuales, A., Cabañero, G., Grande, H.J., Tuominen, J., Uusitalo, S. and Hakalahti, L., 2017. Novel, smart and RFID assisted critical temperature indicator for supply chain monitoring. *Journal of Food Engineering*, *193*, pp.20-28.

Mathu, K.M., 2019. The information technology role in supplier-customer information-sharing in the supply chain management of South African small and medium-sized enterprises. *South African Journal of Economic and Management Sciences*, *22*(1), pp.1-8.

McCathie, L. (2004). The advantages and disadvantages of barcodes and radio frequency identification in supply chain management, pp.158.

McLeod, J., 2011. Qualitative research in counselling and psychotherapy. Sage, pp.279.

Minetto, S., Marinetti, S., Saglia, P., Masson, N. and Rossetti, A., 2018. Non-technological barriers to the diffusion of energy-efficient HVAC&R solutions in the food retail sector. *International Journal of Refrigeration*, *86*, pp.422-434.

Moavenzadeh, J., 2015, October. The 4th Industrial Revolution: Reshaping the Future of Production. In *World Economic Forum*, pp.283.

Montecchi, M., Plangger, K. and Etter, M., 2019. It is real, trust me! Establishing supply chain provenance using Blockchain. *Business Horizons*, *62*(3), pp.283-293.

Morimura, F. and Sakagawa, Y., 2018. Information technology use in retail chains: Impact on the standardisation of pricing and promotion strategies and performance. Journal of Retailing and Consumer Services, 45, pp.81-91.

Oliver, R.K., Webber, M.D. (1982), Supply Chain Management: Logistics catches up with strategy, Outlook, cit. Christopher, M.C. (1992), Logistics, The strategic issue, London: Chapman and Hall), pp.42-47.

Pal, A. and Kant, K., 2018. IoT-based sensing and communications infrastructure for the fresh food supply chain. *Computer*, *51*(2), pp.76-80.

Petljak, K., Zulauf, K., Štulec, I., Seuring, S. and Wagner, R., 2018. Green supply chain management in food retailing: survey-based evidence in Croatia. *Supply Chain Management: An International Journal*, *23*(1), pp.1-15.

Pfohl, H.C., Yahsi, B. and Kurnaz, T., 2015. The impact of Industry 4.0 on the Supply Chain. *Innovation and Strategies for Logistics and Supply Chain; RePEc: Hamburg, Germany*, pp.31-58.

Radanliev, P., De Roure, D.C., Nurse, J.R., Burnap, P., Anthi, E., Ani, U., Maddox, L., Santos, O. and Montalvo, R.M., 2019. Cyber risk from IoT technologies in the supply chain–discussion on supply chains decision support system for the digital economy. *Univ. Oxford*, pp.1-9.

Radanliev, P., Roure, D.C.D., Nurse, J., Montalvo, R.M. and Burnap, P., 2019. Supply Chain Design for the Industrial Internet of Things and the Industry 4.0 , pp.1-10.

Robandi, B., Kurniati, E. and Sari, R.P., 2019, April. Pedagogy In The Era Of Industrial Revolution 4.0. In *8th UPI-UPSI International Conference 2018 (UPI-UPSI 2018)*. Atlantis Press pp.38-46.

Saberi, S., Kouhizadeh, M., Sarkis, J. and Shen, L., 2019. Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, *57*(7), pp.2117-2135.

Schmidt, C.G. and Wagner, S.M., 2019. Blockchain and supply chain relations: A transaction cost theory perspective. *Journal of Purchasing and Supply Management*, *25*(4), p.100552.

Shaharudin, M.R., Tan, K.C., Kannan, V. and Zailani, S., 2019. The mediating effects of product returns on the relationship between green capabilities and closed-loop supply chain adoption. *Journal of cleaner production*, *211*, pp.233-246.

Stanton, J.L., 2018. A brief history of food retail. *British Food Journal*, *120*(1), pp.172-180.

Tan, B., Yan, J., Chen, S. and Liu, X., 2018, December. The Impact of Blockchain on Food Supply Chain: The Case of Walmart. In *International Conference on Smart Blockchain* (pp. 167-177). Springer, Cham.

Tidy, M., Wang, X. and Hall, M., 2016. The role of Supplier Relationship Management in reducing Greenhouse Gas emissions from food supply chains: supplier engagement in the UK supermarket sector. *Journal of Cleaner Production*, *112*, pp.3294-3305.

Tsai, M.C., Lee, W. and Wu, H.C., 2010. Determinants of RFID adoption intention: Evidence from Taiwanese retail chains. *Information & Management*, *47*(5-6), pp.255-261.

Walker, M.J., Gowland, M.H. and Points, J., 2018. Managing food allergens in the UK retail supply chain. *Journal of AOAC International*, *101*(1), pp.45-55.

Wang, J. and Yue, H., 2017. Food safety pre-warning system based on data mining for a sustainable food supply chain. *Food Control*, *73*, pp.223-229.

Zhu, Z., Chu, F., Dolgui, A., Chu, C., Zhou, W. and Piramuthu, S., 2018. Recent advances and opportunities in sustainable food supply chain: a model-oriented review. *International Journal of Production Research*, *56*(17), pp.5700-5722.

Zijm, H., Klumpp, M., Heragu, S. and Regattieri, A., 2019. Operations, Logistics and Supply Chain Management: Definitions and Objectives. In *Operations, Logistics and Supply Chain Management* (pp. 27-42). Springer, Cham.

APPENDICES

APPENDIX 1: The Interview Questions

Question 1

Could you please analyse the situation of the Turkish food retail sector?

Question 2

What is the importance of technology in competition within this sector?

Question 3

What are the retail technologies currently used along the supply chain in the market?

Question 4

What are the advantages and disadvantages of these technologies?

Question 5

What technologies will be used in this sector in the future?

APPENDIX 2: Curriculum Vitae of Interviewee

CURRICULUM VITAE

KORAY TASTEKİN

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Bogaziçi Sitesi B Blok
Daire :12 Istinye
Sariyer / ISTANBUL

WORK EXPERIENCE

2000/ - **MIGROS TICARET A.Ş**
İstanbul
Store Manager

JOB DESCRIPTION:

-Budget Preparation
-Product Management
-Inventory Management
-White-Collar Working Plan
-Blue-Collar Working Plan
-Adjustment of the Governmental Agencies Affairs and Follow-Up
-Food Security Applications and Follow-Up
-Reporting to Top Management
-Regulate The Modification and Reparation and Follow-Up

Activities, in-house training and inspection in these stores, except for the above mentioned job descriptions:

To provide the educating of successful managers by training the white-collar executives to make strategic decisions in terms of sales, cost and profitability by understanding the store figures, the analysis and interpretation of financial statements.

1999/ 2000- BAYMAK A.Ş
Marketing Manager
İstanbul

JOB DESCRIPTION:

-Product Management
-Purchasing
-Business Follow-Up Based On Project
-Vendor Channel Inspection & New Vendors Creation

PERSONAL DETAILS

Date of Birth	: 01.01.1975
Civil Status	: Married, Father of 2 Children
Military Service	: Done
Driving License	: C Class

EDUCATIONAL BACKGROUND

ISTANBUL COMMERCE UNIVERSITY **DOCTORATE OF BUSINES (MANAGEMENT AND ORGANIZATION)** **2013-2020**

ISTANBUL UNIVERSITY **MASTER OF BUSINESS** **2009-2011**

ISTANBUL UNIVERSITY **FOREST INDUSTRIE ENGINEERING** **1994-1999**

CERTIFICATES

BOGAZICI UNIVERSITY RETAİL MANAGEMENT **2016-2017**

KOC UNIVERSITY LEADERSHIP SKILLS **2016-2017**

COURSES AND WORKSHOPS

SECURED COMMUNICATION	PDR İNTERNATİONAL DNŞ.	**2010**
PROBLEM SOLVING TECHNIQUES	EKSER DANIŞMANLIK	**2009**
MANAGERİAL SKILLS IMPROVEMENT	EKSER DANIŞMANLIK	**2009**
STORE MANAGEMENT DEVELOPMENT	PROF.DR. SEVGİN EROĞLU	**2006**
CREATE THE DIFFERENCE	EKSER DANIŞMANLIK	**2007**