

T.C.
ISTANBUL SABAHATTIN ZAIM UNIVERSITY
GRADUATE EDUCATION INSTITUTE
BUSINESS ADMINISTRATION DEPARTMENT

**ARTIFICIAL INTELLIGENCE APPLICATIONS IN
SUPPLY CHAIN MANAGEMENT AND ANALYSIS IN
TURKEY**

MASTER THESIS

Mohamed MOSTAFA

Istanbul
November, 2020

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November, 2020

THESIS APPROVAL

To the Institute of Graduate Education

This study has been approved in partial fulfillment of the requirements for MASTER THESIS in **Business Administration**

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DECLARATION OF SCIENTIFIC ETHICS AND ORIGINALITY

This is to certify that this MA thesis dissertation titled “**Artificial Intelligence Applications in Supply Chain Management and Analysis in Turkey**” is my own work and I have acted according to scientific ethics and academic rules while producing it. I have collected and used all information and data according to scientific ethics and guidelines on thesis writing of Sabahattin Zaim University. I have fully referenced, in both the text and bibliography, all direct and indirect quotations and all sources I have used in this work.

Signature

Mohamed MOSTAFA

Istanbul, November 2020

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ABSTRACT
**ARTIFICIAL INTELLIGENCE APPLICATIONS IN SUPPLY
CHAIN MANAGEMENT AND ANALYSIS IN TURKEY**

Mohamed Mostafa
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Artificial Intelligence (AI) systems and their applications are assumed to be today's high-end technologies. AI applications reconfigures the supply chain management (SCM) including logistics, transportation, inventory management, warehousing, etc.,. This research focuses on how important AI applications are to the organizations success and to what degree they affect and facilitates supply chain (SC) processes. The research also investigates the AI applications in different business sectors with a focus on retail sector, both in Turkey and worldwide in a comparative way.

This research aims to prove its hypotheses through the examination the impact of applying the AI applications such as Machine Learning, Neural Networks, Deep Learning, Robotics, and Natural language processing on Supply Chain Management's different areas like demand management, transportation and delivery, and inventory management etc.AI, and their relations with the SCM is the major subject of this research with a spot on the retail sector. However, since the AI applications impact on the SCM with a focus on retail sector not examined yet, there are no preceding studies carried out in Turkey on this specific subject to our knowledge. Therefore, this research targets to fill that gap. Results have proved that AI applications have a high impact on SC sub-areas, and that Turkey has advances in CRM area, and has shown a moderate impact in the demand, inventory, and transportation areas. Also, the results have proved that Turkey has not applied AI in the warehouse management area yet.

Keywords: Artificial Intelligence, Supply Chain Management, Retail, AI Applications, Digital Supply Chain

Related Topics: Demand, Inventory, CRM, Delivery and Transportation, Digitalization of Business, Big Data

ÖZET
PERAKENDE SEKTÖRÜ TEDARİK ZİNCİRİ YÖNETİMİNDE
YAPAY ZEKA (YZ) KULLANIMI VE TÜRKİYE
UYGULAMALARI

Mohamed Mostafa
Yüksek Lisans, İşletme Yönetimi
Danışman: Dr.Öğr.Üyesi Canser Bilir
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Yapay Zeka (YZ) sistemleri ve uygulamalarının günümüzün ileri teknoloji trendi olduğu varsayılmaktadır. YZ uygulamaları, lojistik, nakliye, envanter yönetimi, depolama vb. dahil olmak üzere tedarik zinciri yönetimi (TZY) operasyonlarını yeniden yapılandırmaktadır. Bu araştırma, Türkiye ve dünya çapında perakende sektörüne odaklanarak farklı iş sektörlerindeki YZ uygulamalarını araştırarak kuruluş için YZ uygulamalarının ne kadar önemli olduğu ve süreçleri nasıl etkilediği konularına odaklanmaktadır. Bu araştırma, YZ 'nın tedarik zincirinin farklı alanlarında ve genel olarak iş dünyasında ne ölçüde uygulandığını ölçmeyi ve Türkiye ile dünya çapını karşılaştırmayı amaçlamaktadır. Bu araştırma aynı zamanda, Makine Öğrenimi, Yapay Sinir Ağları ve Derin Öğrenme, Robotik, Doğal dil işleme gibi yapay zeka uygulamalarının Uygulama Yönetimi, taşıma ve teslimat, envanter yönetimi gibi farklı alanlarına etkisini incelemeyi amaçlamaktadır. Yapay zeka ve TZY ile ilişkileri, perakende sektörüne de odaklanan bu araştırmanın ana konusudur. Bununla birlikte, YZ uygulamalarının perakende sektörüne odaklanmış TZY 'ye olan etkisi henüz incelenmemiş bir konu olduğundan, bilginiz dahilinde Türkiye'de tam olarak bu konuda daha önce yapılmış bir çalışma da bulunmamaktadır. Bu nedenle, bu çalışma bu boşluğu doldurmayı amaçlamaktadır. Sonuçlar, YZ uygulamalarının TZ alt alanları üzerinde yüksek bir etkiye sahip olduğunu ve Türkiye'nin müşteri ilişkileri alanında ilerlemeler kaydettiğini ve talep, envanter ve taşımacılık alanlarında orta düzeyde bir etkisi olduğunu göstermiştir. Ayrıca sonuçlar, Türkiye'nin depo yönetimi alanında henüz YZ uygulamadığını da göstermiştir.

Anahtar Kelimeler: Yapay Zeka, TZY, Perakende, YZ Uygulamaları, Dijital TZ

İlgili Konular: Talep, Envanter, Müşteri İlişkileri, Teslimat ve Taşımacılık, İşletmenin Dijitalleştirilmesi, Büyük Veri

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LIST OF ABBREVIATIONS

TZY	Tedarik Zinciri Yönetimi
YZ	Yapay Zeka
AI	Artificial Intelligence
AIMA	Artificial Intelligence, a Modern Approach
FGCS	Fifth Generation Computer Systems
DARPA	The Defense Advanced Research Project Agency
SNARC	Stochastic Neural Analog Reinforcement Calculator
GPS	General Problem Solver
MIT	Massachusetts Institute of Technology
ALPAC	The Automatic Language Processing Advisory Committee
PROLOG	The logic programming language
DARPA	The Defense Advanced Research Projects Agency
IoT	Internet of Things
ML	Machine Learning
AGV	Autonomous guided vehicles
SKU	Stock Keeping Unit
OMS	Order Management System
WMS	Warehouse Management System
GPS	Geographic Positioning System
RFID	Radio Frequency Identification
JIT	Just in Time
TMS	Transportation Management System
ERP	Enterprise Resource Planning

SRM	Supplier Relationship Management
WSN	Wireless sensor networks
ROI	Return on Investment
IRL	Intelligent Retail Lab
SDS	Smart Dialogue System
ASR	Automatic Speech Recognition
NLP	Natural Language Processing
CRM	Customer Service Management
SCM	Supply Chain Management

CHAPTER 1

INTRODUCTION

The Supply Chain Management (SCM) concept is intended to ensure an efficient exchange of physical, finance and information flows between all components of the supply chain; both within intra-organizational and inter-organizational coordination (suppliers, sub-contractors, wholesalers, retailers, customers etc.). Nowadays, this perception could be a strategic mission for any company that seeks to achieve its targets in terms of monetary competitiveness, delivery, and excellence of service. This is extra challenging in a global economy characterized by means of the globalization-of-trade, the complication of trade-flows, the accelerated competition, and the sustainable improvement requirements. Throughout this dynamic and volatile world characterized by tremendous data sharing, the use of information technology and systems to communicate with each supply chain partner is essential. Among these systems, there are Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP), and Artificial Intelligence (AI), Radio Frequency Identification (RFID). (Aguezzoul, A., & Pires, S., 2019)

Advanced technologies like artificial intelligence are now a strong and ever-growing platform. From self-driving vehicles to social media, everything is defined by how fast technology can teach - or maybe even overcome - machines to act like humans. This allows us to describe artificial intelligence as the computer science area, which focuses on the design of intelligent computer systems, such as systems with linguistic capability, learning, reasoning, and problem solving. (Barr, A., & Feigenbaum, E. A., 1981, p. 1). However, it's almost limitless ability is what's most significant about AI. Algorithms are much more effective in conjunction with related technologies such as machine learning, the Internet of Things (IoT) as well as predictive analysis. Additionally, access to extra data allows businesses a greater view of their global networks in the supply chain. The degree of transparency is important as it recognizes that our perspective on the supply chain management and logistics is evolving.

Taking into account that commonly the artificial intelligence (AI) technology applied to supply chain management (SCM) consists of learning, detecting, and processing

components, with a possibility to focus on some main points concerning the use of artificial intelligence in supply chain management. While enterprise resource planning (ERP) systems still are classified in the extent of transactional-management; the systems using AI such as Big-Data analytics and Machine Learning -for example- allowing more capabilities rather than transactional-management, facilitating broader, complex and analytical supply chains management. Moreover, artificial intelligence (AI) enables the optimization and adaptation of supply chains effectiveness and efficiency which would not be accomplished with transactional-management systems only.

At both strategic and tactical level, the utilization of artificial intelligence (AI) in supply chain management (SCM) can deliver more effective use of optimization-tools in tasks such as; the company's business planning, better formation of supply chains, predicting demand, and risk-analysis, among many other tasks.

At the operational-level, the utilization of AI will give optimization in the SCM framework and enhance its complex traced transport paths in both its internally input and output material flows. It also enhances product/process quality management and stock management using machine learning algorithm, through the use of modern visual pattern object detection/recognition methods, for example. In addition, it gives more precise product/process quality management, enabling for more strategic decision-making and optimization. AI allows better preparation and control of the shop-floor, enabling for more complex, wide-ranging and efficient management of operations. As well as giving a better predictive management of the inventory, maximize their usage, and prevent disruptions in supply chains because of machinery and equipment shutdowns (Aguzzoul, A., & Pires, S., 2019).

The aspirations for improved performance, increased profitability and enhanced safety and health records are more process-centered in the sectors such as Retail and Manufacturing & Resources. AI and digital solutions will result in substantial changes in production costs, optimized and intelligent supply chains, and a more capable and effective staff. This modern technique of working will build connected value chains that will require all of the concerned partners to collaborate and integrate together.

In many businesses, people are talking about artificial intelligence (AI). While the excitement is overwhelming, many don't completely realize its technological

capability, which area it can add value in, or how it can progress. This research represents a practical applying of artificial intelligence (AI) in supply chain management, investigating why organizations in both Turkey and worldwide are investing in artificial intelligence (AI), what is the application they are/willing to invest in, and how these organizations are handling the complex process of implementing these new technologies and obtaining value.

In our research, we aim to focus on how important AI applications are to the organization and how it affects and facilitates the processes; investigating the AI applications in different business sectors with a focus on retail sector, in both Turkey and worldwide. This research aims to measure, to which extent the AI is applied in the different areas of SC and in business in general, and aims to compare between Turkey and worldwide.

Mixed methods have been used through the research. Case studies from publicly open documents has been used to gather data for the applications of AI in the SCM in order to reinforce our comparison. Also, an online interview with managerial level personnel has been applied to companies from Turkey and worldwide such as U.S, Egypt, UAE, Saudi Arabia, Bahrain and Malaysia.

This research consists of five chapters. The first chapter is the introduction which contains an introductory on the investigated subjects of the research and a brief description of its contents, the second chapter is the theoretical background, which contains definitions and demonstrations for SCM elements and systems, as well as AI definitions and an overview on some of its applications and models. The third chapter demonstrates the research method, questions, limitations, and research questionnaire. The fourth chapter contains case studies from both Turkey and worldwide, with a comparative analysis, as well as an analysis of the research questionnaire which has been performed on companies from Turkey and worldwide. Finally, the fifth chapter which represents the obtained results, conclusions, and future research suggestions.

CHAPTER 2

THEORETICAL BACKGROUND

2.1 Supply Chain Management Definition

The word supply chain management (SCM) was created in the 1980s to reflect the need to incorporate the main business processes, from end-users to original suppliers. Initial suppliers are those that provide consumers and other stakeholders with goods, services and data that add value. The core concept behind SCM is that by sharing knowledge about market conditions and production capacities, businesses and organizations are involved in a supply chain. Keith Oliver, a Booz Allen Hamilton consultant, is credited with the invention of the expression after using it in a 1982 Financial Times interview (Ryan, 2017, p. 79).

The idea of supply chain management is to apply a total network approach for managing the flow of data, products, and services from suppliers of raw materials to the end customer through factories and warehouses.

Chopra and Meindl conclude that a supply chain consists of all parties directly or indirectly involved in the fulfilment of a consumer demand. The supply chain covers all roles within each company, such as a supplier, involved in obtaining and filling a customer order. Such functions include new product creation, marketing, logistics, delivery, finance, and customer support, but are not limited to (Chopra, S., & Meindl, P., 2007, p. 1) .

Christopher M. says The Supply Chain Management (SCM) is the strategic and efficient integration of traditional business functions and strategies across these business functions within a particular organization and across companies across the supply chain, with the goal of improving the long-term achievement of the organization and the entire supply chain (Christopher, 2011, pp. 1-4).

Supply chain management refers to the integration of organization business processes from end users by suppliers providing information, products, and services that add value to customers (Janvier-James, A. M., 2012).

Supply Chain Management (SCM) involves the integration of activities between networks of facilities that procure raw material, turn it into intermediate products and then finished goods and supply goods to consumers via a distribution system (Lee, H. L., & Billington, C., 1995).

2.2 Components and Elements of Supply Chain Management

Supply Chain Management (SCM) refers to a group of methods used to efficiently manage manufacturers, distributors, warehouses and stores so that goods are manufactured and delivered in the right quantities, at the right locations and at the right time to minimize system costs while meeting service level requirements. (Kaminsky, P., Simchi-Levi, E., & Simchi-Levi, D., 2003). Every industry has a different supply chain; therefore, we discussed the most commonly elements in the following sections.

2.2.1 Demand Management

Demand represents what the consumers want, and how much. Demand therefore determines supply and consequently production plans, which in effect determine financial, logistics, and marketing plans for the company. The key source of business failures is unreliable demand information as it contributes to inadequate supply, which causes consumers dissatisfied or unnecessary supply, that causes the loss of worthy resources. Nevertheless, due to the unpredictable and uncertain existence of demand, reliable information on demand is hard to come by. A standard method to acquire information on demand includes forecasting ahead of time potential demand based on past market trends (Min, 2015, pp. 89-96).

Even though demand forecasting is an essential element of demand management, its reliability also depends on the predictive methods, the time horizons, and the nature of demand. More importantly, if accurate demand information is not transmitted to producers and their suppliers, prediction will be pointless. The pace at which demand information is transferred amongst partners of supply chain can also have an effect on the way demand is handled.

The management of demand may take the following steps: -

1. Demand planning: is more complicated than forecasting process.
2. Transmitting demand: involves the supply chain partners to be integrated, production strategy throughout the whole supply chain.
3. Demand influencing: embraces strategies for marketing and promotion, pricing, and product positioning.
4. Demand prioritizing: involves monitoring of consumer orders and classification of customers.

(Min, 2015, pp. 89-96)

2.2.2 Customer Relationship Management (CRM)

Customer Relationship Management (CRM) is an approach to maintaining an engagement between an organization and current and future possible customers. The CRM approach aims to evaluate data for an organization about customer behaviour, strengthen business relationships for consumers, focus primarily on customer retention, and eventually drive growth in revenue.

One essential feature of the CRM approach is the CRM systems that collect information from a variety of different means of communication, including the website of a client, telephone, email, live chat, marketing materials, social media and more. Businesses learn more about their target markets and how to better respond to their needs through the CRM approach and the tools used to promote CRM.

CRM's key components are creating and maintaining customer relationships through advertising campaigns, monitoring relationships as they grow through distinct stages, maintaining such relationships at each level and understanding that a relationship's value distribution to the firm is not homogeneous. Companies may benefit from using a range of resources to support organizational design, reward programs, customer processes, and more to leverage the impact of their marketing strategies while creating

and maintaining customer relationships through marketing; through understanding the distinct phases of CRM, companies would be able to benefit from seeing multiple partnerships connect as associated transactions. CRM's final element highlights the value of CRM by taking into account the effectiveness of customer interactions. By researching customers' particular buying patterns, a business may allocate various resources and amounts of attention to different types of consumers.

With CRM systems, customers are served better in the day-to-day cycle, and their demand for self-service from companies will decrease with more accurate information. If the need to contact the organization for specific issues is less, the degree of customer satisfaction increases. Such key advantages of CRM are hypothetically related to the three forms of equity that are connection, value and brand, and essentially, consumer equity (Ryan, 2017, p. 268).

2.2.3 Order Management

Practically every framework and mechanism in the supply chain approaches order management. Many organizations no longer have control of orders within their company. These include several parties, such as manufacturers of parts and materials assembly, and packaging facilities, or distribution centres, making it possible to lose visibility and delivery power. This leads to expensive manual procedures for completing and fulfilling the order without mistake. An order management system (OMS) can help reduce costs and generate revenue through manual process automation and error reduction.

Externally, the management of orders has a significant effect on how a customer perceives a company or brand. Customers expect a seamless experience in an omnichannel world. A customer can order online; however, they have questions therefore they finalize a purchase through a call centre. The customer hopes to see notifications such as emails along the way, when the order is being fulfilled. If an issue exists, they may want to return it via a physical channel such as a shop. Every point of the path provides an opportunity to provide a better customer experience and improve engagement and sales. The omnichannel path also provides incentives for making up-selling and cross-selling suggestions, and for increasing revenue.

An order management system (OMS) is a modern way to handle an order's lifecycle. It monitors all the information and processes, including order entry, inventory, fulfillment, and after-sales support. An OMS allows both company and customer visibility. Organizations can provide close-to-real insight into inventories, and consumers can verify when an order arrives (Glasheen, 2020).

2.2.4 Inventory Management

An inventory can be a valuable asset that can help a company respond to its consumers promptly by playing the role of intermediary against unforeseen demand fluctuations, quality problems and disruptions to its supply chain. On the other side, stock might be a liability which drain existing company resources by sustaining the expense of maintaining inventory, binding company staff in managing inventory, and hides the origins of logistics/quality issues.

Inventory management is essentially a science of determining the form and location of stored products. It is required to precede the normal and scheduled course of material production and storing at different locations within a facility or within several locations of a supply chain.

The scope of inventory management relates to the fine lines between replenishment lead time, carrying inventory costs, asset management, inventory forecasting, inventory valuation, inventory visibility, future product price forecasting, physical stock, available inventory space, quality management, replenishment, returning faulty products, and demand forecasting. Balancing these conflicting objectives leads to optimum levels of inventory, which is an evolving process as business needs change and respond to the larger framework.

Inventory management requires a retailer that trying to procure and retain a sufficient range of products while sourcing, shipping, storage and other costs are being held in check. It also includes systems and processes that define inventory requirements, set objectives, include replenishment procedures, monitor actual and estimated inventory status and handle all of the monitoring and material management functions.

This will involve tracking inventory flowing in and out of stockroom locations and re-establishing the balance of inventories. These can also provide ABC analysis, batch

monitoring, and support for cycle counting, etc. Inventory management, with the primary objective of assessing/managing stock volumes within the physical distribution network, balances the need for product availability against the need to reduce stock keeping and handling costs (Ryan, 2017, pp. 114-116)

2.2.5 Warehouse Management Systems

Despite growing demand for flawless customer service, today's warehousing is being forced to increase the standards for stock quality, reliable distribution service, individually tailored order fulfilment, customizable value-added features, and sensitivity to consumer specific requirements. To achieve these high-standards targets, the warehousing needed to minimize waste, optimise processes, and boost warehousing activity quality in every area.

A Warehouse Management System (WMS) is one of the most pro-active ways of doing this to speed up the order completion, improve the accuracy of inventory, give instant information regarding the order status, manage storage space and improve labour productivity.

WMS has completely changed the process in which orders are scheduled, prepared and executed, inventories tracked and the correct goods delivered in right time. Recently, WMS has extended to include new features capable of managing light production, transportation, ordering process and full accounting practises. Typically, WMS is regarded as the "live" stock-tracking, control of resources and communication system which connects manufacturing, sourcing, scheduling, and logistics activities at the corporate level through enhanced visibility of the supply chain.

WMS tracks inventory level lively and fulfils client orders in the distribution area by enabling more visibility of the inventory. The WMS ' main targets include:

- Prevent order fulfilment mistakes by item identification and ongoing cycle counting.
- By electronic transmission send and receive essential customer/warehouse information with minimal lead time.
- Maximize labour efficiency by work management and priority setting.
- Optimize space usage by choosing a convenient place for storage.

- Minimize inventory and handling requirements by on-going data flow (Min, 2015, pp. 198-205).

2.2.6 Transportation and Transportation Management System

Transportation generates utility position via transferring people and/or products from one place to a targeted end point. Therefore, transportation is a critical link in the supply chain, because of its role in linking the spots in the supply chain. That means the efficiency of transportation should reflect the efficiency of the supply chain. As such, designing an effective transport strategy is the first step toward supply chain effectiveness.

Given its importance for the supply chain, the supply chain specialists will prepare, handle and optimise transportation better. However, as human culture progresses, transport becomes more complicated. Part of the complexity of transportation stems from expanded geographic reach, different modal choices, evolving regulatory/deregulatory laws/rules on transportation, restricted fuel availability, and multiple stakeholders.

To facilitate the complexities of transportation we should begin to understand and evaluate the essential functions and contexts surrounding it. Transportation, for example, enables the delivery of raw resources and components/parts necessary for production to the locations of the manufacturers. Similarly, transportation enables the delivery of finished products produced by manufacturers to the locations of customers. Therefore, transport generates value by shifting the position of the raw resources, components/parts, and finished products to the locations where they are required or consumed.

Transportation can also establish time-based utility through the transportation of the necessary resources at the same time at the same location. Throughout the manufacturing plant, for example, assembly needs some components and staff at the same time. Transportation allows them to concurrently arrive at the same production venue, thereby preventing disruptions in production (waste of time). The incremental alters in business conditions and theory of management over the past years have

significantly extended these basic transport functions. Those alters contain the following:

- Innovations in technology, such as geographic positioning systems (GPS), satellite tracking systems, and radio frequency identification (RFID) that enable monitoring of the position of shipments during movement.
- Involvement by the government in transport practises with the aim of regulating the size of competition on the marketplace and improving transport safety.
- High fuel costs, requiring the growing usage of other types of fuel.
- Due to business globalization, operations stretching the whole supply chain and eventually involving intermodal transport with regular modal transfer.
- Just-in-time (JIT) delivery systems that require rapid, undisturbed delivery within a limited time frame.

With rising transport costs arising from unpredictable prices of the fuel and a high labour charges, there is an increasing necessity to modernise the aspects of the operations of transportation, recognize any possible saving in cost, and increase the visibility of the supply chain by effective transport planning. With such a need a transport management system (TMS) suits the purpose. Transportation management system typically points out a software programme that enables control all aspects of the incoming/outgoing transportation activities involving preparation of order, loading plan, selection of courier, truck routes/scheduling, freight aggregation, managing complaints, freight billing and audit. As a reaction to expanding complexity and globalization of transportation exercises, TMS has as of late extended to incorporate extra highlights that can control/manage resource lively, space management, managing unexpected occasions with shipment following, palletization, documentation needed for import/export, dangerous material shipping, and reverse supply chain / logistics.

A TMS offers various organizational advantages if properly implemented. Those benefits include:

- Reductions in costs.
- Improved customer loyalty through optimal route planning/scheduling, assurance of delivery and prompt processing of claims.

- Enhanced visibility of the supply chain by live monitoring of shipment and detailed shipping notification.
- Decreased administrative burdens by automation.

2.2.7 Information Technology IT

Information technology (IT) lets businesses connect with each other at anytime, anywhere, and therefore allows them to create a strong business relationship, which in effect will promote data-sharing activities and further increase the visibility of the supply chains.

The rapid development of E-commerce has completely changed the way people perform business. Since it lets organizations become nearer to their clients without the intermediates ' interference, it speeds up the process of decreasing the usage of conventional channel such as retailers/distributors. But from another prospective, it also raises the pressure of manufacturers ' manufacturing and distribution obligations, who might choose to market and deliver the goods directly to the consumers. Consequently, logistics can be a major differentiating factor for companies that compete in the E-commerce industry.

As integration has turn out to be the core concentration of supply chain management, an increasing extent of businesses have aimed to strengthen the capability to efficiently coordinate, communicate and collaborate with their clients/suppliers. These efforts allow their enterprise-wide business functions and channel-wide business operations to be incorporated and harmonised. Many companies have begun to understand the utility of strategic information systems such as customer relationship management (CRM), supplier relationship management (SRM), and enterprise resource planning (ERP) for such integration and harmonization.

RFID shows great promise among new emerging technologies in automating supply chain processes, with its capability to maximize the visibility of supply chain. Not only does it help enhance customer satisfaction through optimized inventory quality, it also helps improve protection of the supply chain through the moving inventory's real-time monitoring capability. Another advantage of RFID includes better use of warehouse and retail space through improved inventory location management (Min, 2015).

2.2.8 Forecasting

Precisely predicting one hundred per cent is impractical. This is when demand is balanced with supply. The main aim of forecasting however is the ability to evaluate accurate predictions over time on average. In addition, the emphasis is on reducing the ambiguity and forecasting errors, which in effect would help refine the information to be used. Predictions in the supply chain are mostly composed of a combination of basic statistical forecasting and judgment (Fildes R., & Goodwin P., 2007). A widely used method is when a judgmental adjustment is made to an original statistical forecast. Proceeding with the statistical forecast that has been made, the data may be gathered by the analyst from multiple departments within the company, such as the marketing department, therefore the estimate could be modified to clarify the additional details. Many forecasts that have been updated will then be treated as the final forecast in the supply chain. It is argued that such predictions made within operational integration are of great significance in the predictive activity (Moon, M. A., Mentzer, J. T., & Smith, C. D., 2003).

Precise forecasts are crucial to any supply chain system success. In previous works it has been very clear that providing a higher range of data is important. Sharing information and collaborative predictions may allow the supply chain to increase profitability and minimize waste or lead time. Likewise, negative data could also result in downward changes in the statistical forecast, which as a result may guide to downward changes in the estimates (Rashed, 2017).

For another case study made for a company that manufactures electronics there was what would be called functional silos, there were certain obstacles that could not be integrated from various roles within the business. Olivia & Watson (2011) addressed with extreme care the design of the supply chain and the activity process that this will contribute to successful forecasting (Oliva, R., & Watson, N., 2011). There is insufficient evidence, however, that better information integration or statistical characteristics of forecasting activities will enhance predicting. To obtain an overview on the advantages of collecting additional information by the use of statistical analysis, attention must be given to a considerable amount of factors. There are several different misleading interactions between the use of different information

sources and the predictive performance metrics which rely on the organizational processes (Rashed, 2017).

2.2.9 Bullwhip Effect

The bullwhip effect is characterized as the magnification of the variation in demand from downward to upward location. It was also explained that there are four factors for the bullwhip effect to arise, and some changes have been made in the management approaches to minimize the repercussions this creates. Through the observation of the bullwhip effect in other corporations such as Procter & Gamble in the product of their diaper, the study which was highly inspired by Procter & Gamble found that, there was uncertainty in the demand of their manufacturing units, and been quite enormous, while the demand remained stable. Another case will be in the pasta supply chain of Barilla, and in a soup factory. In 1989 Sterman claimed that when topics are handled as a specific product within a virtual supply chain, the bullwhip effect occurs. Furthermore, the bullwhip effect was proportional to the degree of unpredictability in the industry. A reference to their findings concerning a bullwhip effect in the extensive macro-economic literature was made to indicate the large volatility in the machine tool industry, which found that output at the industrial level was more uncertain in demand (Rashed, 2017).

Lee explains that the presence of bullwhip effect might result in an undesirable result with reference to SCM, where slight change in demands made by the consumer will result from changes in the supplier's stocking volumes because of the misinterpreting of the demand data between the supply chain members. More attention has been paid recently to the bullwhip effect, trying to find out how its supply chain efficiency can be influenced (Lee, H. L., Padmanabhan, V., & Whang, S., 1997).

If we interpreted the bullwhip effect, it is an intensification which can be regularly measured in terms of changing the orders made at any link in the supply chain. Such misunderstanding occurrence in the demand exists at any tier. Lee and other analysts have found several causes behind the bullwhip impact. The explanations for this are order batching, market instability, forecast change demand and gaming shortages. This in effect affects the supply chain profitability, where the alignment of the supply chain

cannot be sustained any more due to the irregularity of the data flows of supply/demand between the supply chain parties (Rashed, 2017).

An alternative method was proposed for addressing the negatives arising from the bullwhip effect, the alternative method utilized was the auto-regressive-moving-average algorithm. Occasionally, companies were supposed to run into auto regressive demand for the first order. Unless the coefficient is positive, then the demand will be supportively correlated gradually and the supply will most probably be more unpredictable than the sales. Unless there is a good stimulation of demand that allows the organization to substitute the stimulation of demand and it will also help to increase production with the anticipation of potential demand growth. (Rashed, 2017). Another recommendation which can reduce the bullwhip effect that to postpone the demand for forecast data (Zhang, 2005).

2.2.10 Just in Time

Just-in-time system needs routine shipping service and unique equipment control. Organizations that implement the JIT must be extremely versatile and responsive in order to consider the rigid cooperation required in this network of transport and distribution. The JIT strategy calls for a complex and systematic thought on sourcing and locations of the warehouses, and the other plants to be nearby. Adjusting the system to the JIT transportation system may trigger or contribute in many adjustments: firstly, by reducing the lead time requirements, faster transportation would result; secondly, by shrinking the size of shipments and daily dispatch may effect transportation costs being reduced. (Rashed, 2017).

2.3 Artificial Intelligence and Aided Tools

Artificial Intelligence is a comprehensive branch of computer science interested in creating smart machines which usually do things that require human intelligence. Artificial intelligence is a multi-approach interdisciplinary discipline, but developments in machine learning and deep learning generate a paradigm change in virtually every technology sector.

2.3.1 Artificial Intelligence Definition

John McCarthy first developed the word "artificial intelligence," when he conducted the first academic conference on this subject in 1956. He defined artificial intelligence as "intelligent machines, especially the science and engineering of making intelligent computer programs" (Bringsjord, S., Govindarajulu, NS., & Sundar, N., 2020). McCarthy believes that if a feature of learning or intelligence can be fully defined, a machine can also imitate it.

According to Shi, artificial intelligence is the science and engineering of imitating, expanding and increasing human intelligence with artificial ways and techniques to create smart machines (Shi, 2011, p. 1).

Thanks to rapid changes, concepts have evolved over time too. Definitions which are newer and mean "imitating intelligent human behaviour," this concept is also far stronger. People with Artificial Intelligence have been attempting to replicate intelligent behaviour with computer programs for some time. This is not a simple task because a computer program needs to be able to do a number of different things to be considered smart.

“Artificial intelligence, a computer or computer-controlled machine is often capable of fulfilling the tasks of higher mental processes such as reasoning, making sense, generalization and learning from past experiences” (Özen, Z., Kartal, E., & Gülseçen, S., 2017, p. 523).

The mathematician Alan Turing also changed the history with an unsophisticated question: "Can machines think?" in the article "Computer Machines and Intelligence" by Turing's (1950), and then Turing Test developed the key objective and dream of artificial intelligence. The broad goal of artificial intelligence has led to various questions and debates. So much so that there is still no universally agreed single field description.

In the book *Artificial Intelligence: A Modern Approach*, writers Russell and Norvig approach this question by combining their work with the idea of smart agents on machines. Stating in their book's preface that, artificial intelligence is "the work of

agents that take perceptions from the environment and perform actions" (Russell, S., & Norvig, P., 2009).

P. Norvig and S. Russell offer four different approaches that define the area of Artificial Intelligence, groups are summarized in table 2.3.1:

Table 2.3.1: Four Possible Objectives for Artificial Intelligence According to AIMA

	Human-Based	Ideal Rationality
Reasoning-Based:	Systems that think like humans.	Systems that think rationally.
Behavior-Based:	Systems that act like humans.	Systems that act rationally.

Source: (Russell, S. J., & Norvig, P., 2003, p. 5)

The first two ideas concern thinking processes and reasoning, while others are concerned with behaviour:

- 1) Systems that behave like human: For this approach, we first need to understand how people think, knowing the inner workings of the human brain can be provided by psychological experiments. This area of research integrates Artificial Intelligence computer models with psychological testing methods to seek to establish accurate and testable hypotheses regarding the human mind's work.
- 2) Systems that think rationally: The purpose of this approach is to create programs that represent "correct thinking" to create smart systems.
- 3) Systems acting like a human: This approach emerged when Alan Turing designed the Turing Test in 1950. In essence, this test is designed to provide a satisfactory operational intelligence concept, when a computer interrogator is unable to say whether written responses come from an individual or a computer after asking some written questions, the computer passes the test.
- 4) Rational agent approach (Systems that act rationally): A rational agent is the agent acting to achieve the best result expected when there is uncertainty.

2.3.2 A Brief History of Artificial Intelligence

Aristotle's deductive reasoning development was an important moment in the task of understanding humanity's own intelligence. While its origins are long and deep, it takes less than a century for the artificial intelligence we discuss today. In artificial intelligence some of the most significant activities are presented below:

1943, Warren McCullough and Walter Pitts issued the "Logical Ideas Account Involved in Nerve Activity" In the article it introduced the first mathematical model to construct a neural network.

1949 In his book "Organization of Behaviours: A Neuropsychological Theory", Donald Hebb proposes the theory that the nerve pathways are composed of experiences and how often the connections between neurons are used. Hebb's learning continues to be an important model in artificial intelligence.

1950 A. Turing has released "Computer and Intelligence Science", which proposes what is recognized as the Turing Test, a technique to decide whether a machine is smart.

Harvard Univ. students, Marvin Minsky and Dean Edmonds, founded their first neural network computer, SNARC.

Claude Shannon published the article "Programming Computer to Play Chess".

Isaac Asimov published the "Three Robotic Laws".

1952 Arthur Samuel is creating a system of self-learning software to play checkers.

1954 The machine translation project at Georgetown-IBM automatically translates 60 selected Russian sentences into English.

1956 The word artificial intelligence is written in "Dartmouth Artificial Intelligence Summer Research Project" Defining AI's vision and aims, John McCarthy leads the conference as the birthplace of the AI we know today. Allen Newell and Herbert Simon give a demonstration on the first reasoning software, Logic Theory, in the same year.

1958 John McCarthy developed the Artificial Intelligence programming language Lisp and published the article "Common Sense Programs". This article proposed hypothetical Advice Taking, a complete Artificial Intelligence system capable of learning as well as humans.

1959 Allen Newell, Simon Herbert and J.C. Shaw have created the General Problem Solver (GPS), a software for mimicking human problems.

The program Geometry Theorem Prover is developed by Herbert Gelernter.

The expression machine learning was developed by Arthur Samuel while he was at IBM.

The MIT Artificial Intelligence Project was founded by John McCarthy and Marvin Minsky.

1963 John McCarthy founded the Artificial Intelligence Lab at Stanford.

1972 Logic programming language PROLOG was developed.

1974-1980 Among the disappointment in the development of artificial intelligence leads to a reduction in DARPA in academic funding. When merged with the previous ALPAC report and the previous year's "Lighthill Report", AI funds are set up and research has been delayed. With the ALPAC report and the Lighthill Report of the previous year, AI funds have decreased and research has been delayed. This time is called "First Artificial Intelligence Winter".

1980 The digital equipment company developed the first successful commercial expert system, the R1. The R1 started an explosion of investment in expert systems that would last for ten years, this was the end of the "First Artificial intelligence winter".

1982 The Fifth Generation Computer Systems (FGCS) project was initiated by Japan's Ministry of Foreign Trade and Industry. This project's goal is to build a framework for the advancement of supercomputers and artificial intelligence.

1983 As a reaction to Japan's project, the U.S.A government launched the DARPA project in advanced computing and artificial intelligence.

1987-1993 When computer technology progressed, more cheap options appeared, and the Lisp machinery market crashed in 1987, leading to "artificial intelligence's second winter." Expert systems have been very costly to maintain and upgrade during this time span. Japan ended the FGCS project in 1992 because it did not achieve the ambitious goals set out ten years ago. DARPA ends after spending approximately \$ 1 billion on the Strategic Computing Initiative in 1993 and lagging far behind expectations.

1997 IBM's Deep Blue defeats Garry Kasparov the champion of world chess.

2005 The self-driving car STANLEY, won the DARPA's big competition. In the same year, the US army began investing in autonomous robots such as Boston Dynamic's "Big Dog" and iRobot's "PackBot".

2008 Google makes progresses in speech recognition and promotes the feature on the iPhone app.

2012 Andrew Ng, founder of Google's deep learning brain project, presents a neural network that uses 10 million YouTube videos as a training kit for deep learning algorithms. Through learning to identify a cat without being told what a cat is, the neural network contributed to a pioneering era for neural networks.

2014 Google made the first self-driving car to pass the state driving test.

2016 Google DeepMind's AlphaGo beat world champion Lee Sedol, a Go professional. The ancient Chinese game's difficulty was seen as a major leap that sprung up in Artificial Intelligence (Soma, J., & Shanker, Y., 2016).

2.3.3 Machines Learn (ML)

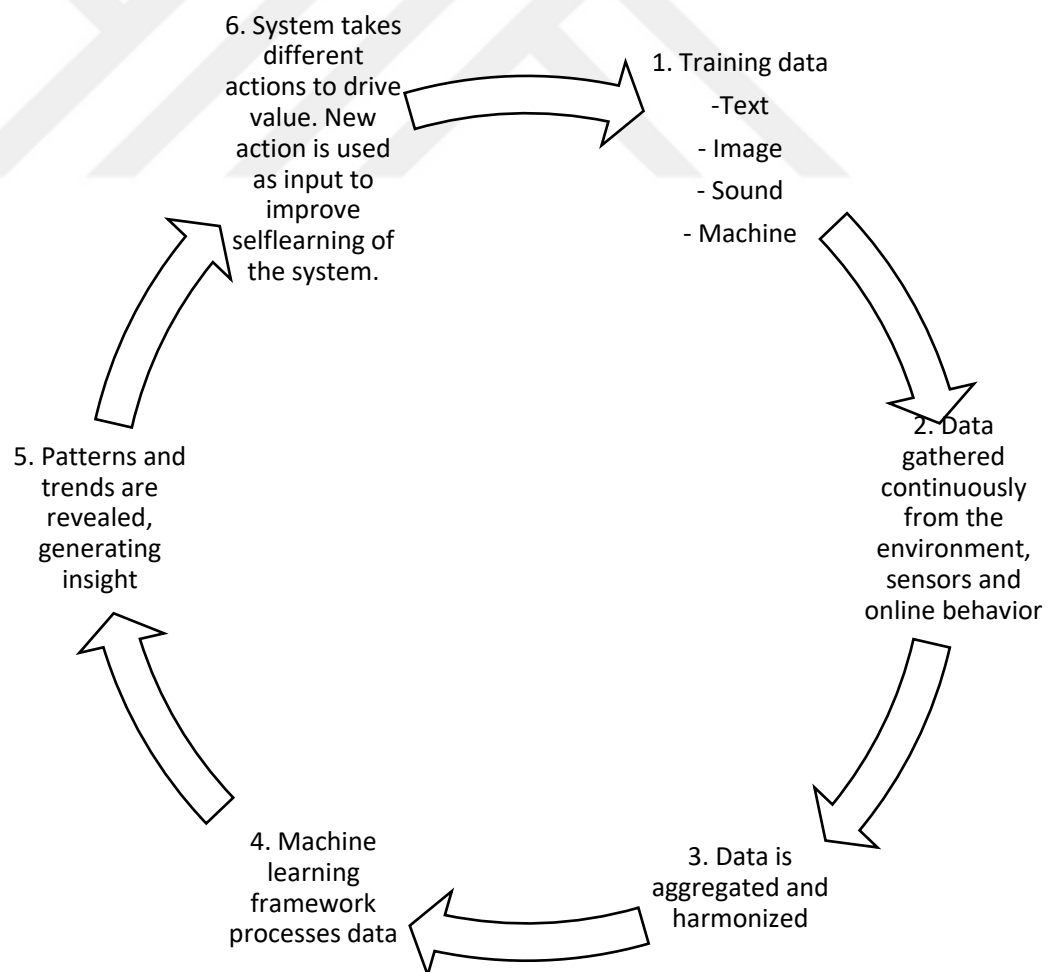
ML is an artificial intelligence sub-area, which reflects another form of programming. Example data is a replacement for strict software calculation rules. Information, learning methods or algorithms extract statistical regularities from the given example, and represent those in the form of models. The models can react and classify new unknown data into categories or make predictions (Wenzel,H., Smit ,D., & Sardesa, S., 2019).

It is defined as a process using experience to improve performance or to make predictions meaningful. The experience relates to accumulated knowledge from an electronic data collection which is given to the procedure. ML includes the development of effective and precise algorithms (Mohri, M., Rostamizadeh, A., & Talwalkar, A., 2012, p. 1).

2.3.3.1 How Machines Learn: Three Components of AI

Notwithstanding the oversimplification that the popular press appears to describe AI, AI isn't a single, standardized technology. AI is in essence a collection of interrelated components of the technology that can be used in a wide range of configurations depending on the issue it solves. AI technology typically consists of components for the sensing, processing, and learning functions.

Figure 2.3.3.1: A full AI learning cycle



Source (Gesing, B., Peterson, S. J., & Michelsen, D., 2018)

2.3.3.2 Supervised Learning

Supervised learning is the most commonly used type of ML (Marsland, 2015, p. 7). Supervised learning is a method whereby a computer program is educated using data from known examples. This learning process, as the output is also known, aims at finding a relation in the form of rules that relate input data to output data and finally apply the learned rules to new data. The computer program is getting training at this stage. For this newly gained experience, it can now forecast input and output data for the future. Classification and regression are two very important tasks (Wenzel,H., Smit ,D., & Sardesa, S., 2019).

2.3.3.3 Unsupervised Learning

Unsupervised learning describes a framework where information is uncovered. In this form of learning, correct answers are not given, therefore, there are no pre-labelled reference values. This technique is often called teacher-less instruction. Clustering is a popular activity in unsupervised learning. The approach detects similarities between the inputs through raising patterns to categorize inputs. There are related activities e.g. laws of interaction, self-organizing maps, multidimensional scaling and reduction of the non-linear dimensions (Wenzel,H., Smit ,D., & Sardesa, S., 2019).

2.3.3.4 Reinforcement Learning

Reinforcement learning trains a machine through many iterations of decision making and provides reinforcement signals when the machine achieves a good outcome. Reinforcement learning can train a machine to successfully play a game or optimize a task without explicitly encoding the rules of play or strategies for winning. As with unsupervised learning, reinforcement learning can be used when humans don't even know the correct answer. In the case of reinforcement learning, the trainer only needs to be able to recognize a better answer from a worse one.

As an example of supply chain application of reinforcement learning, could be the task of organizing inventory in a warehouse. The machine would try to minimize pick-and-pack labour for complex orders, while avoiding overcrowding in any part of the warehouse. The machine might try various inventory placements and rearrangements of placements, which are then compensated or fined based on the amount of labour

hours spent on fulfilment. Reinforcement learning often relies on computer simulations. Simulations are a very inexpensive and fast way to give the machine a lot of experience and a lot of time to try different strategies and tactics.

2.3.3.5 Machine Learning with Neural Networks

Neural networks are an important class of current-day machine learning algorithms that can be adapted to solve supervised, unsupervised, and reinforcement learning problems. Modelled very loosely on biological nerve tissue, a neural network for machine learning consists of one or more layers of nodes (neurons) connected to each other and to a set of inputs and outputs. The training process for a neural network adjusts the weights on the connections and other parameters to optimize the outputs that the network produces when given a set of inputs. As with other machine learning methods, neural networks come in many types, each suited for different applications such as speech recognition, natural language processing, and image recognition.

Deep learning algorithms use more complex multi-level architectures to model complex relationships. Deep learning requires less feature engineering to pre-structure the inputs and outputs for the learning model. However, deep learning requires both much more data and more computer resources to successfully train the model.

Example of deep learning include voice assistants such as Alexa and Siri, advanced game-playing AI such as AlphaGo, and autonomous vehicle control systems.

Supply chains could also adopt deep learning technologies such as voice recognition that could be used in pick-n-pack, with a voice telling the person what to pick rather than them having to read it. Another application could be voice interfaces for truck drivers, who could communicate with their trucks such as saying, “tell me where the terminal is.”

Similarly, image recognition could be used for product identification (for picking or inventory management) or for detecting cargo damage, such as if a box has been partially crushed. Inside a truck, image recognition could tell whether the truck was empty or full or what it was carrying. Inventory cams could take pictures of the warehouse and estimate how many cases of product there (Caballero, S., & Rice, J. B., 2018).

2.3.4 RFID and WSN

As important features for internet of things usage, the wireless sensor networks and Radio Frequency Identification (RFID) have been emphasised. RFID is best expressed through radio waves or wireless communication as a technology which allows the identification of entities. This technology can help to make tremendous improvements as it helps to increase productivity, the increase in productivity can be seen in the management of warehouses and operations. Wireless sensor technology is synonymous with sensors and the ability to capture, track and analyse data under various environmental conditions (Gubbi J., Buyya R., Marusic S., & Palaniswami M., 2013).

This has also been shown that the use of this application enables the consumer to have visibility of the real world. It illustrates how the consumer can track and control the goods, while also monitoring the functioning in real time. In addition to data collection, the sensors will track previous uncontrollable problems by smoother transitions. In turn, the technology helps improve the quality and time management of data that the company requires to achieve competitive advantages when it comes to operation optimization. Few organizations have used the RFID devices in their supply chains like Walmart, Procter & Gamble and the US Department of defence. But still the RFID's functionality goes beyond that. RFID has now been implemented for tracking, stock monitoring, library book tracking, access control, airline baggage tracking, electronic security keys, toll payment, theft prevention, and health care in different supply chains.

There is a need for the RFID system to work, two elements which are readers and tags. The tag has a number to identify it and is the ID number, and a memory which stores such data as the name of the manufacturer, the type of product and certain values such as temperature. A reader which works using wireless transmissions is needed to read the data stored on the tags. Two forms of communications exist between readers and tags.

Communications can be achieved either by inductive coupling, this communication method involves antenna structures making an important feature in the tags as well as the readers. The other form is coupling of the propagation, this works by propagating

electromagnetic waves. Tags are attached or inserted in items that need to be identified or monitored in an occasional RFID-application. A background database is established when the tags are read. The database allows to synchronize IDs to objects, so that the reader can monitor the objects' presence (Rashed, 2017).

There are a large number of sensor nodes in a sensor network and they can be positioned in various positions, whether in vehicles, at the ground or in air. In the areas of tracking, control, security and many other uses, the sensor network is implemented. Since sensors need a great quantity of energy to reach long range data sources, wireless multi-hop communication is necessary to send the data to remote places. Wireless Sensor Networks (WSNs), which are usually used for monitoring objects in areas concerned or detecting environmental problems, are distinct from RFID networks. Therefore, RFID systems typically detect the presence and location of the object from its tags. The relay nodes are released in normal applications from sensor nodes on remote WSN sinks via data transmission. This literally creates multiple hop networks in which RFID is just one hop, consisting of tag and reader lots. Intelligence sensor nodes are higher than RFID tags, under which the sensor nodes firmware can be quickly reprogrammed compared to RFID tags, which it's not. (Merino, M., & Mariño, P., 2012).

RFID's applications provide numerous solutions for specific scenarios and industries, especially those that use international standards like the automotive industry. WSN sensors will possibly gather and make all the required information available for SCM. RFID will increase the productivity of cargo terminals in five areas: access controls, safety of containers, container identification and location, activity surveillance and regulatory enforcement. (Rashed, 2017).

2.3.5 The Internet of Things (IoT)

The Internet of Things can be identified as an embedded network of physical objects to connect and senses or interact with its inner or external conditions. The start of the Fourth Industrial Revolution is considered a crucial driver of technological development that is included in the nine-component technologies of the Industrial Platform. Due to its claimed creative potential, many companies still have vague perceptions of the IoT.

In this state of vagueness, the World Economic Forum (2015) contrasts the concept of web future applications with the 1990s; the Internet of things is supposed to fundamentally transform the world in the same way the Internet has. For businesses that search for the way to make use of technological ability to gain competitive advantages, the juxta position of the IoT and the poor awareness of its consequences is disturbing. Although the technology is still recent, few success cases or failures have been reported by businesses using IoT. Therefore, it remains uncertain if a company will have to take steps to improve the performance of its supply chain with the aid of IoT capabilities (Rashed, 2017).

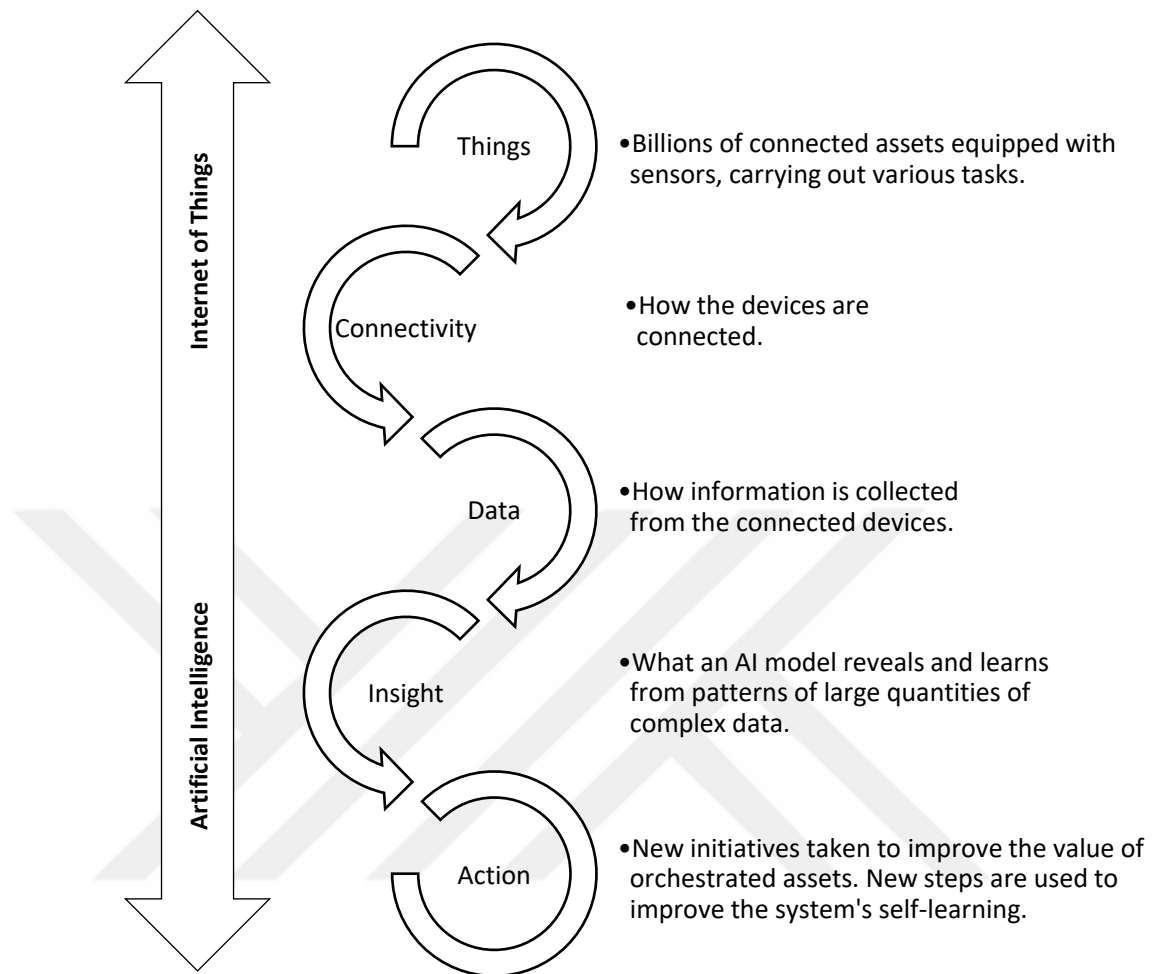
Looking to how IoT is applied and been benefit from today, The IoT already makes computer data available, mostly for the first time that can be used by AI-based devices. IoT involves the processing of huge, heterogeneous data from large quantities of heterogeneous devices. Nevertheless, only today's advanced data analysis tools will make sense of and learn from such data, which considered as a challenging task.

We may summarize the nature of IoT in five components:

1. The "things" connected themselves.
2. Why it binds them.
3. How to collect data.
4. What the data will tell you.
5. How could you do differently.

At the possibility of being oversimplified, in the fourth and fifth element of this model AI steps to improve IoT.

Figure 2.3.5: AI and IoT broken into five key components:



Source: (Gesing, B., Peterson, S. J., & Michelsen, D., 2018)

2.3.6 Warehouse Automation

Automation in warehouses is one of the highly studied areas for AI recognition approaches. Not only the research, but the industry in particular as well, is interested in using AI advances and robotics to automate conventional warehouse operations, for example bin picking. Giant Amazon has organized a 'bin picking contest' to encourage teams from several universities and to allow their robots picking solutions compete against each other (Hellingrath B., & Lechtenberg S., 2019).

The idea of picking robots seems to be a highly fascinating subject and many scientists are looking at various aspects of these robots. One of the most significant is that the robot can classify the items to be collected. It is typically done by the implementation

of a qualified learning algorithm and by learning from the example images. The basic configuration of a bin picking robot is stationary and includes a robot arm with a gripper that detects objects using a 3D sensor and moves accordingly. Holz et al. (2014) and Nieuwenhuisen et al. (2013) are suggesting a complete solution with a mobile robot that can be active object recognition and even captured in order to boost this scenario and make it more versatile in terms of operating space for the robot. The robot studies Object models in graphs describing basic forms and contours such as cylinders before operation. Upon training, the robot can recognize objects by detection of parts of the plot to be found in a captured scene, such as a single screw detection in a conveyor box that has a lot of screws or even other items. Even in the presence of distortions, optical abnormalities, improper readings and missing details, the method presented shows a stable functioning (Hellingrath B., & Lechtenberg S., 2019).

Laskey et al. (2016) also suggest a picking robot that has the ability of selecting items even though other items obstruct access to it, i.e. grabbing them in a mess. They dynamically teach the robot, according to people who demonstrate the picking actions and send the robot detailed information on its established policy. A control hierarchy is often used to reduce the amount of human observations required for the robot to learn how to select objects in the middle of a clutter. The robot learns from a basic motion planner at the first stage that avoids the obstacles, i.e. other things, while grabbing the targeted item. On the second level, crowd-sourced human staff are then used as controllers and eventually, the robot is supervised by a specialist from the robotics industry. With this technique a 90 per cent reliability can be achieved. Another example of using AI approaches to fix detection issues in a warehouse system, esp. in the sense of picking, in Mo and Lorchirachoonkul (2016), the physical encounters and movements of the employees are captured with a variety of 3D cameras within the picking frame and the objects being selected.

Not only bin packing but also AI approaches are discussed. Robots of equal scale respectively approaches which allowing them to identify objects, may also be extended to automated unloading of containers. Stoyanov et al. (2016), for example, suggest a robot for automated unloading of coffee sacks. In addition, Uriarte et al. (2016) suggest the so-called "celluveyor," a compact conveyor system that can be used to automate material flow inside a warehouse (Hellingrath B., & Lechtenberg S., 2019).

The examples demonstrate that AI methods are capable of automating several warehouse processes in conjunction with developments in robotics and other technologies. This indicates a high potential for AI use. DHL states, for example, that only 5% of today's warehouses are automated. This number shows that the potential still needs to be realized somehow (Hellingrath B., & Lechtenberg S., 2019).

2.3.7 Operation Support

This category covers software that assist people in their daily operations for example in the manufacturing or transport business. Sharma et al. (2018), for example, use a neural network to automatically scan geographical addresses. In particular, the growing amount of e-commerce orders etc. facilitates the distribution process of mails and packages of high value. The particular difficulties with regard to addresses are that they take place in various formats and that an approach must be taken to distinguish important sections such as the name of the street. It provides a neural network which can actually extract individual fields from a raw text address and provide a standardized representation (Hellingrath B., & Lechtenberg S., 2019) .

Benefit in production can also be obtained. Longo et al. (2016) create a device that is fitted with a neural network to interpret human speech and is capable of understanding what the user is doing at the moment; for example, which sections are being managed. Based on this information, the program will answer questions and provide relevant and correct information for the current situation and issue. Certain systems to help industrial operations include, for example, the automatic detection of faked electronic components in order to prevent their installation and the related problems, or the detection of parts automatically for re-manufacturing, i.e. the identification of parts that may and may not be used in future (Hellingrath B., & Lechtenberg S., 2019).

Tuszynski et al. (2013) offers another example of how to help activities that happen on a routine basis. To examine so-called container manifests, documents specifying the items are already in a container, and the associated container, they apply a deep learning neural network. Radiography images of the container are taken and can be identified on the basis of containers with different loads from their manifest (Hellingrath B., & Lechtenberg S., 2019).

As stated earlier, these are the areas that have been identified in supply chain execution as promising fields of implementation of AI recognition techniques. Although the list of classes or examples is not comprehensive, it still gives an impression of what has been developed in this field and offers suggestions for future applications. Generally speaking, it should also be noted that significant advances have only been made about approaches such as robotics, deep learning, and computer vision and are a necessity for successful applications (Hellingrath B., & Lechtenberg S., 2019).

2.3.8 Big Data

Big data has grown to be capital nowadays. Some of the biggest technology firms in the world, most of their importance comes from the data they continuously analyse to create more efficiency and create new goods.

The cost of data storage and computation has been reduced exponentially by recent technological advances, making data saved simpler and cheaper than ever before. Now, more accurate and precise business decisions can be made with an increased amount of big data that are now cheaper and more obtainable.

It's not just about evaluating the value of big data (which is a whole other advantage), it's a whole cycle of learning involving experienced researchers, business users and managers who have the right questions, trends, educated observations and behaviours.

2.3.8.1 The Definition of Big Data

Gartner's description states that in about 2001, big data is data with a wider variety that comes with an ever-higher velocity and rising volume. It is known as the three V's. With simplifying, big data is greater than existing, more complex data sets. These data sets are so large that they cannot be handled by conventional data processing tools. But these large amounts of data can be used to deal with business issues that you could not solve before.

2.3.8.2 The Three V's of Big Data

Volume: The amount of information is significant. We will be able to process high volumes of unstructured, low-density data with big data. It may be unidentified data

such as Twitter data feeds, web-based click sources, smartphone devices, or sensor equipment. It could be hundreds of terabytes of data for certain organizations. Thousands of petabytes can be for others.

Velocity: Velocity is the fast rate at which data is received and (perhaps) acted on. Normally, the highest velocity of data streams directly into memory versus being written to disk. Some smart devices with internet connectivity work in real or almost real time and involve analysis and response in real time.

Variety: Variety refers to the many different types of data. Standard data types have been structured in a relational database and match perfectly. With the rise of big data, new unstructured data forms come into being. Unstructured and semi-structured types of data, such as text, audio, and video, need more pre-processing for meaning and metadata support.

2.3.8.3 Big Data Use Cases

Big data can aid in a range of activities, from customer service to research. A few can be summarized below:

Product development: Big data was used by organizations including Netflix and Procter & Gamble for forecasting market demand. Researchers develop predictive models for new products and services, classifying the core features of past and existing products and services and establishing a connection between these features and their market performance. P&G also uses data and analytics from focus groups, social media, market research and early retail results to develop, create and launch new products.

Predictive Maintenance: In structured data such as year, equipment and version, as well as in non-structured data covering millions of sensor data, log entries, engine temperature, and error messages, variables that could predict mechanical faults may be buried extensively. By analysing these signs of potential issues before the problems arise, organizations can adopt maintenance more cost effectively and maximize parts and equipment uptime.

Customer Experience: Nowadays more than ever, a better understanding of customer service is possible. Big data helps us gather data from social media, site visits, call logs, and other sources, in order to maximize the resulting benefit like start delivering custom services, cut back on customer turnover and proactively dealing with issues.

Fraud and Compliance: In security, it's not just a couple of criminal hackers, the case is normally up against whole teams of experts. There are continually changing security environments and compliance criteria. Big data lets us identify trends in data that show fraud and incorporate vast volumes of data in order to speed up regulatory reporting.

Machine Learning: Right now, machine learning is a big topic that is been discussed widely, and data – big data in particular – is one of the reasons. Instead of programming, we can teach computers. This is made possible by the availability of big data for training machine models.

Operational Efficiency: The operational output and efficiency is an environment where big data have the greatest impact. With big data, growth, client feedback and returns, and other variables can be analysed and assessed to reduce failures and predict future demands. In accordance with the increasing market demand, big data can also be used to enhance decision-making.

Drive Innovation: Big data can support innovation by looking at individual, organizational and process interdependencies and creating new ways to leverage these perceptions. Using data analysis to strengthen financial and planning decisions, understand the trends and what potential goods and services consumers would like to be offered, and adopt market dynamics, unlimited promises are provided (Oracle, 2020).

2.3.9 Potential Benefits from AI

In their paper, EY-Microsoft, 2019 suggested a system for mapping potential benefits from AI. In the study, participating organizations typically plan to benefit in all four core areas as illustrated in the Digital Transformation Framework for Microsoft: improving operations; engaging customers; transforming goods and services; and empowering employees.

Each domain is focused on fundamental AI features - the "reasoning" of an interpretation and drawing of conclusions from inconsistent data; the 'understanding' of information such as text, speech and images; and the normal 'interactions' between employees, clients and other stakeholders. The implementation of AI in these environments can be revolutionary for an enterprise, primarily changing its business environment and its markets and eco-systems. Looking at what that entails in more detail:

1- Improved manufacturing and performance through streamlined operations: while digital change is typically based on customer interaction, enhancing operations is what organizations look for primarily while using AI. It relies on several levers such as:

- intelligent forecasting, e.g. detection of chronic illnesses, anticipation of non-performing goods or predictive modelling to flag corrective actions;
- operational productivity such as optimization of forecasting and order to completion in the supply chain or processing in a fraction of time significant volumes of documentation;
- deep observations, for example, detecting surface discrepancies such as fraud, or discovering new opportunities before competitors do.

2- Communicating consumers more efficiently using AI:

After streamlined activities, companies are looking to customer engagement as the area where most business benefits are to be found. Early examples include: tools for conversational agents, such as bots for personal recommendations and transaction-based advice; personal advisors, such as decision-making guidance, minimizing change cycles; self-service solutions to help customers reduce time to fix their issues.

3- By improving services and goods, keeping ahead of the competition:

Improving goods and services and empowering workers came out at the same point, marginally just under the above two domains when it happens to come to where businesses intend to achieve potential market benefits. Improving goods and services, eventually creating completely new business models, is often preferred in R&D-heavy industries where organizations perceive AI and advanced analytics as tools to accelerate product development and exploration.

In B2C-oriented industries, AI makes new services, which transcend sectors into new levels of added value, through multilingual cognitive equipment, geo-location modules, sensitivity analyses, cognitive robotic advisory capability, personalized services and more.

4- Enabling workers to be more productive and capable:

Various AI use cases across industries concentrate on increasing employee efficiency or improving human creativity and the capacity to fulfil a task. AI helps workers in B2C organizations extend their corporate expertise by analysing large datasets of consumer activity to adjust online and offline shop designs, drive transformation and sales. Personalization of customers is used in scale, powered by AI solutions that highlight customer insights in real time, identify the next best upselling and cross-selling opportunities as well as predictive models which achieve a customer experience at a 360-degree level, by integrating customer information into a targeted offering (Abu-Ltaif, S., & Galviz, J., 2019).

2.3.10 AI Maturity Model

2.3.10.1 What Is AI-Maturity and an Explanation of Why It Is Important

Organizations targeting the benefits of this milestone should also try to learn, build and own AI-based systems of digital transformation as their target. Owning an AI-based system, however, is wildly different from possessing conventional standardized software or even developing a solution that is non-AI-based using code. Because AI-oriented systems operate in the probability field, they must always be trained, managed and tested for results. Throughout this phase, AI organizations should protect against the degradation, harm and damage associated with it, and against AI deviating from their original purpose. To ensure the continued benefit of these systems, retention of AI performance, predictability and accuracy is necessary. Organizations which do not evaluate their own capability to develop, own and operate AI-based systems may face challenges and dangers. Such organizations can have several negative consequences, from obsolete structures that slowly fail to structures that may unintentionally affect organizational employees or customers (Charran, E., & Sweetman, S., 2019).

2.3.10.2 Dangers of Disregarding Maturity

Organizations which attempt to implement AI technologies without taking their own maturity into account may face slight or even major challenges. Probabilistic systems vary significantly from traditional deterministic systems and codes operating within a regulatory framework. Although organizations that understand the potential of AI technologies in traditional approaches, over-reaching problems are important to consider, in the implementation of AI based systems that do not take maturity into account. The following are few threats or potential consequences.

2.3.10.2.1 Fairness and Bias Harms

Fairness may be a subjective term for various individuals, cultures and geographies around the world. Nonetheless, the concept of fairness as it relates to AI technology and interaction includes minimizing bias and the effect that bias may have when not observed or controlled.

When training an AI-based program, users can encounter unequal, discriminatory, or prejudicial experiences unless bias is mitigated. This can lead to allocation damages when the program equally discriminates between entitled individuals' access to resources (i.e., an AI-enabled loan creditworthiness program that discriminates on the basis of partially dependent data sets). Other harms include grouping and representative damage that can adversely affect program users.

2.3.10.2.2 Turning the System Off

Some non-maturity companies may include professional staff or consulting organisations, who are expert at implementing AI to carry on advanced digital experiences. If the AI development act is functional, organizations will take advantage of the program for such a period. However, if the organization isn't sufficiently competent and experienced enough to manage advanced AI technologies that operationalize over time, the system can gradually decline. This decline may result from the model that needs retraining and evaluation at the heart of the program, or even reimplementing to preserve accuracy and fairness.

Several companies find that it goes beyond their current skills to see why declines arise and solve these problems. A lot of these companies move back to non-AI systems and have turned off the AI-based digital interface as a last option in order to avoid damage yet to maintain operations.

2.3.10.2.3 Mistrust and Withdrawal from AI

Groups of individuals might see AI clearly as the solution to their company's digital transformation and believe it. They may also continue to encourage the company to pursue additional experiments and implementations without regard to maturity following failed attempts to develop, own and implement advanced AI technologies. Although there is strong need for AI-enabled systems to achieve goals and objectives, corporate leadership usually loses confidence in AI when a system is not adequately controlled, begins to fail and acting unpredictably.

For some situations, this may result in the removal or rejection of AI systems on the basis of failed AI implementation efforts. Organizations or consumers may lose their faith in AI as a technology and make it untrustworthy or too complicated to operate. This outcome will push away real digital transformation and cause AI to lose out on its business' powerful impact.

2.3.10.3 The AI Maturity Model

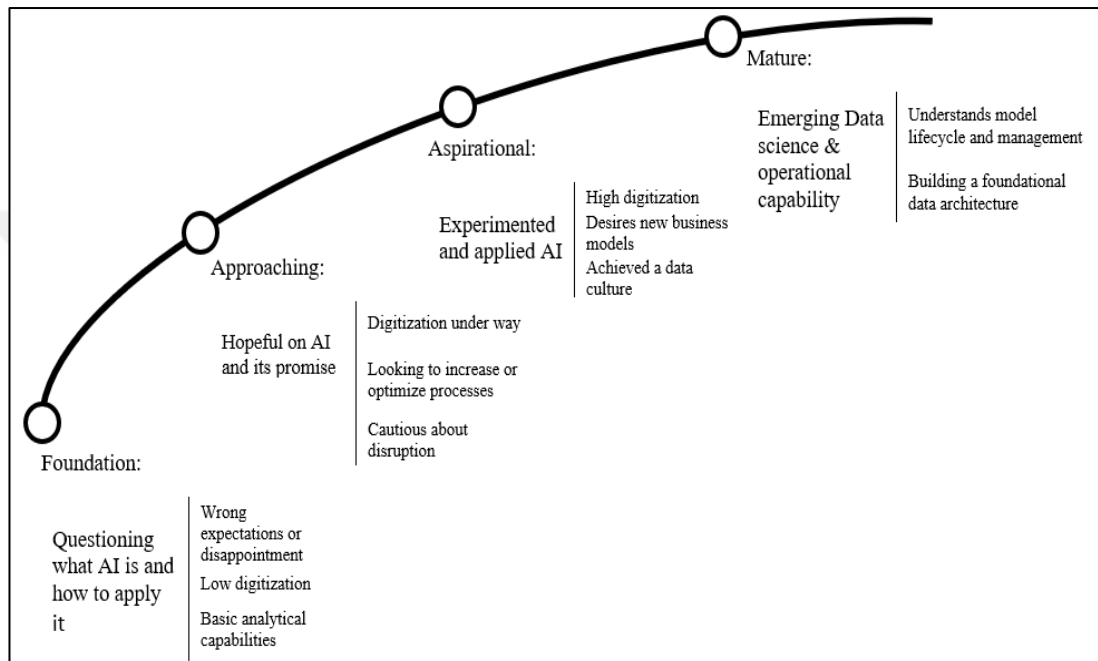
Microsoft as leading IT company has been working to develop a functional model that helps companies determine their own capabilities that lead to AI technology adoption. This AI maturity model allows companies to gain insight into the core aspects of AI ownership by the teams and businesses which contribute to appropriate AI solutions being introduced at the right time. Furthermore, Microsoft has compiled guidance on the implementation of the AI technology for an established company's maturity and has suggested how to develop the maturity to accommodate advanced AI capability.

The following is a brief overview of the AI maturity model that describes the maturity levels and other relevant characteristics.

The model is an organizational maturity curve in which concentrations are raised while comparing to the left side of the diagram. What level of maturity underlie main

principles correlated with core focus areas that lead directly to maturity. All of them are important qualities to rising maturity, such as the changing cultural understandings of the design and operation of AI, the ethical modifications in the challenge to the effects of these systems, and a change in the ownership, evaluation and adjustment (Figure 2.3.10.3).

Figure 2.3.10.3: AI Maturity Model (Curve)



Source: (Charran, E., & Sweetman, S., 2019)

2.3.10.3.1 Foundational

A foundational corporation should invest time to illustrate AI and the limits and constraints of the various related technologies. Organizations are -at this stage- trying to grasp the definition, implementation and scenarios of AI across a wide variety of possibilities. Foundational companies often seek to understand how others use AI and how to apply it to their business.

Organizations at this maturity stage are seeking to develop systems and processes to help make decisions that are guided by the data. Often these organizations depend on leaders' skills, intuition and expertise to make decisions. For specific organisations, existing assessment systems are in place but cannot be accessed in favour of input from an expert leader.

Foundational organizations must invest in quick, iterative innovation development projects. Investments are also made to recognize AI, and how it will continue to evolve digitally. A shift to a data-driven culture together with company members focus productivity and development mindset, would be influential in implementing AI.

AI will be implemented by foundational organisations. Companies at this maturity stage will aim to incorporate AI technologies that companies like Microsoft are hosting to infuse AI into digital experiences. The adoption of configurable AI will resolve organizational ownership and obstacles, and allow businesses to become a digital entity.

2.3.10.3.2 Approaching

Approaching companies are beginning to introduce organizational improvements that help inspire staff to make decisions that are based on data. These organizations focus on data culture adoption, and continue to use priority-based strategic approaches to improve their businesses by leveraging AI to build new business models and streamline business processes. Such companies are able to learn about owning custom AI solutions due to the digitalisation of resources, and the implementation of AI to simplify activities.

Approaching organizations have shown the ability to use fast iterative sprints to adopt innovations and to value learning from such efforts. Such organizations are able to accept fast experiments. These organizations should operationally spend more in learning how to adopt, track and develop AI over time.

Investments in AI transparency protocols will continue, monitoring, coordinating, and updating AI over time and will provide ethical views as AI based systems are implemented. Given certain things, companies can gain experience by using AI to transform digitally.

2.3.10.3.3 Aspirational

Aspiring companies recognize that AI would be contributory in helping them succeed and improve themselves. Also, these companies are conscious that many use AI and are concerned about other competitors' competitive threat or disruption to industry.

Aspirational companies are also on a path to digital change through process enhancement, and efforts to use data to support decision making.

Organizations at this maturity stage concentrate on shifting behaviour to inspire workforces. Employee motivation promotes collaboration and stimulates ideas for optimisation, and helps develop new business models. Those businesses are more willing to take risks and are looking to switch from sequential fixed to more iterative programs.

Customized AI system, which is AI hosted by technology companies such as Microsoft, should be introduced. This outlines the operational difficulty of retaining core AI while permitting AI to infuse with digital experiences. In addition, more sophisticated AI systems such as customized AI are expected to learn about control and organizational problems. Aspirational businesses should invest in advanced research to direct decisions, move culture towards creativity and even study customized AI to build innovative insights.

2.3.10.3.4 Mature

Mature corporations changed their culture to include lifelong learning and a perspective about development. Incremental and fast experiments come naturally when part of a completely supported data culture and strategic initiatives are built, and help turn visions into accomplishment.

Mature companies tend to effectively personalize AI creative talent and understand how such tools can be used concurrently for many AI initiatives. The company also realizes how digital experiences can be created to have an impact over time. Mature companies infuse ethical insights in the creative process of their experiences, asking sometimes "We know that AI can do things, but should we do it?" Continued to evaluate tools for customizable and personalized AI at this stage, organizations will maintain organizational discipline with regard to the control, retraining and deployment of AI-based systems. Focus areas for mature organizations are expected to retain AI talent, prioritize new strategic approaches and continued agile experiments (Charran, E., & Sweetman, S., 2019).

CHAPTER 3

RESEARCH METHODOLOGY & QUESTIONNAIRE DESIGN

This research is aiming to investigate and measure the effect of the application of AI in supply chain management, with a focus on the retail sector, and to investigate the situation in Turkey compared to worldwide. Also, it measures the maturity of the organizations for the application of AI.

3.1 Research Scope

In our research we investigated the application of AI both in world and in Turkey, and a comparative analysis has been performed to demonstrate to which extent the Turkish companies has reached in the field of applying AI technologies in SCM compared to worldwide. Thus, five companies in Turkey, and nine worldwide are questioned to understand their AI applications. We reviewed applications in subareas of SCM and various industries with a focus on organizations that working in the retail sector. Accordingly, we were able to investigate the current situation.

The participants in our research have been selected to be -mostly- on a managerial level, or from the top of the organization's hierarchy. The reason of that is the staff who work in a top management level is capable of view the full picture of the company's situation, and has enough data to judge, or make an opinion on the effect of one or more of the newly applied systems or applications. We had only two exceptions from staff that are not in a managerial level but work in the IT management because they are directly involved with our study.

3.2 Research Methodology

We used a combination of different methods in our research includes a case study analysis, a questionnaire form and interviews (but due to the current situation of COVID-19 precautions, we had to perform the interviews online because of the ban of physical meetings) which made this study to be able to:

- 1- Perform a comparative case analysis on publicly researches and documents from Turkey and worldwide.
- 2- Measure the maturity of companies for the application of AI.
- 3- To produce a stable and clear conclusion based on the comparison between the situation in Turkey and worldwide regarding the application of AI in supply chain management.
- 4- Measure the effect of the application of AI in supply chain management in Turkey and other countries as well.

3.3 Questionnaire Design

The questionnaire has been built on the Microsoft AI maturity test for organizations, and has been modified, and new sections/questions been added to it, though the aims of the research can be achieved.

The primary data collection is based on a formal and documented online interview. The questionnaire is made up of three main sections and 18 questions in total.

The first 5 questions are, participant's name, company's working country, role, and sector were investigated, so the categorization can be determined. The next 11 questions are designed to measure the maturity of the company to AI applications and to measure the strategic impact of AI. The third part includes 2 questions and it is aimed to measure the direct impact of AI applications on supply chain management. And, an open-ended question has been added so that the participants can share his/her own point of view. The results of the survey were analysed using simple percentage calculations ($X / Y = Z\%$, where X = no. of measures, Y = total no. of sample, and Z = the percentage).

3.4 The Limitations of the Study

The fact that the know-how of AI is still not correspondingly widespread in the business sector, with the addition of Corona-Virus outbreak, have created difficulties in identifying and performing such work by adding restrictions to the movement and interaction with business experts. This research was carried out in Turkey with knowledgeable people; the expertise in the relevant field may be comparatively less than experts from western countries, the United States as an example, since Turkey has recently implemented these applications.

3.5 Questions

The questions that been asked to the participants, was been divided to three sections as mentioned above, each section investigates and measures a targeted value and situation. As has been shown in the Appendix of this research.

CHAPTER 4

DISCUSSION AND ANALYSIS

In the discussion and analysis section, as one of the methods used in this research for better understanding of AI and its applications in supply chain management in a comparative way, some case studies, from market leaders and leading enterprises from Turkey and worldwide, are discussed. Pioneering companies have been demonstrating a focused example on “The Effect of Applying AI in Supply Chain Management”. These examples and the data extracted from published case studies have been used in the comparison, which is the core of this research.

In the first part of this chapter, case studies demonstrating AI applications in SCM from worldwide and Turkey, and the impact of these practices, are being presented. Followed by a comparative analysis for the usage and the impact, all have been classified according to subsectors of retail industry.

The second part of the analysis is based on the answers from the interviews which contains a quantitative and qualitative analysis. Microsoft had also performed an AI maturity analysis, but with a different aim than ours.

The AI technologies prove to be a game-changer in the supply chain and logistics industries. McKinsey & Co expects companies to gain from AI in their supply chain between \$1.3 and \$2 billion per year in economic value. The AI could contribute nearly \$15.7 billion to the global economy in 2030. One key reason AI's being implemented by organizations in the supply chain is the realization of its potential for solving the complications of running a global logistics network. When correctly applied, AI helps organizations make intelligent and responsive decisions and predict problems (Khasis, 2019). Some of the main elements of SCM such as demand management, inventory management and delivery etc, and how AI applications affect them have been demonstrated below:

Demand Management and optimizing demand forecast is essential to supply chain. To use AI aided tools to support such element is an added value to an organization. AI tools are used by companies in a variety of ways, such as predicting demand to stock only the specific amounts of specific products they sell and therefore reduce waste, and anticipating sales trends so that they can order more products that are expected to be sold quickly (Bughin, J., Hazan, E., Ramaswamy, S., Chui, M., Allas, T., Dahlström, P., Henke, N. & Trench, M.,, 2017).

Inventory Management and reaching the optimum stock levels is considered one of the everyday jobs of supply chain. For the retail sector, the advantages of AI-enabled demand forecasts in retail are impressive. AI-based demand forecasting approaches are expected to reduce forecast errors in some settings by 20 % to 50% from conventional approaches. Due to non-availability, lost sales can be cut by up to 65% (Bauer, H., Richter, G., Wüllenweber, J., BREUNIG, M., WEE, D., & Klein, H. , 2017).

As the **Delivery and Transportation** keeps developing everyday now, the need for innovative solutions for the old or rising problems related to it is a necessity. Some AI applications include drones for rapid medical delivery to save lives. Smart transport systems to lower congestion and pollution and driverless cargo shuttles from manufacturers to purchasers are best examples of AI applications in transportation (Conde ,M.L., & Twinn, I., 2019).

For the **Customer Service Management**, there are many advantages that the company can benefit from integrating AI applications in customer service, such as facilitating the rapid growth, identifying customer concerns, providing proactive support to customers, learning and adopting new changes, predicting future trends, and creating a synergy with other sectors (Hoffmann, 2019).

As AI applications is based mainly on dealing with enormous amount of data, it's essential to illustrate how **Information Sharing and Integration** will be handled either within the organization or with outsiders. There should be careful consideration for deciding what tasks the system can perform and how human handling functions (e.g. between virtual agents and advisers). In many cases, the challenges of changing management, shifting how people are accustomed to do things in an organization,

exceeds many of the technical challenges of implementing AI (Bughin, J., Hazan, E., Ramaswamy, S., Chui, M., Allas, T., Dahlström, P., Henke, N. & Trench, M., 2017).

For the AI & **Profitability** of the organization, McKinsey analysts believe, as AI remains unclear whether the potential value of technology promises is worth bringing in large AI investments. The concern is that any careless technical implementation can have unforeseeable, costly or severe implications, particularly in sensitive areas such as health or legal systems (Peng, T., & Sarazen, M., 2020).

Moving to the analysis sections of this research, the direct impact of AI applications on some of supply chain elements in different sectors is measured, and the degree to which the AI can influence the organization's supply chain is demonstrated. It also demonstrates a situation comparison between Turkey and worldwide.

4.1 A Comparative Analysis of Cases between Worldwide & Turkey for AI Applications in Various Industries

In the following section, cases from various subsections of retail industry (logistics & transportation, retail, E-commerce, and retail banking sectors) are discussed and analysed. The analysis investigated the impact of AI applications on supply chain management, and compared the situation between Turkey and Worldwide.

4.1.1 Logistics, Transportation, and Delivery Sector

Cases from worldwide are presented first followed by the cases from Turkey, then a comparative analysis is discussed at the end of this section.

4.1.1.1 DHL and AI (Predictive Logistics)

Throughout the current world of supply chain that is distinguished by ambiguity and uncertainty, AI will mainly assist the logistics sector, changing the operational model from responsive behaviour and forecasting to predictive intelligence proactive operations. The below will describe both global predictive opportunities at the network-level as well as process-specific predictive opportunities (Gesing, B., Peterson, S. J., & Michelsen, D., 2018).

4.1.1.1.1 Predictive Network Management

Utilizing AI will improve the efficiency of supply chain activities significantly. For air cargo, timely and in-full cargo is important (as it accounts for just 1 percent of the world tonnage trade but 35 percent of value). Many air cargo channels and networks are designed using historical information and understanding from experts with decades of experience in the industry. DHL developed a machine-based learning system to predict air cargo time delays in order to achieve constructive improvement. The machine learning model will determine whether the average daily transit time for a given path is expected to increase or decrease up to a week in advance across 58 different internal data parameters. In addition, this approach will classify the top factors affecting shipment delays, including temporary factors such as day of departure or functional factors such as on-time performance by airlines. It will help air freight forwarders prepare ahead by reducing subjective guesswork on when or through which airlines they will release their shipments (Gesing, B., Peterson, S. J., & Michelsen, D., 2018).

4.1.1.1.2 Predictive Demand and Capacity Planning

The need for predictive demand and capacity preparation has become apparent with the 'fidget spinner' explosion of 2017. Instantly and unexpectedly, the three-paddle spinning game sold around 50 million units in the USA over several months, while fidget spinners shot up to 20 percent of all retail product sales in that period. This overloaded air freight and express shipping networks as toy traders have ignored the standard lead times associated with the sea shipping of manufactured goods.

The first videos of youngsters doing tricks on YouTube started in February 2017. Hidden in the depths of web browsing, YouTube video numbers and social media messages, AI is able to detect both the quantitative interest increase in a topic and the context of the semantical analysis of the current non-structured content. This makes it possible to predict which trends will boom like fidget spinners. As global supply chains and express networks are fast and efficient, just a few weeks' time offers traders significant advantages in sudden demand.

DHL's Global Trade Barometer is a particular tool for early indicators of current and potential global trade growth. The tool uses a wide range of corporate logistics data,

complex statistical modelling and AI to provide a monthly view of global economic prospects. In order to operate as the system's basic input in air freight and ocean freight containerized volumes, the model takes a bottom-up approach and utilizes intermediate and early-cycle data on import and export goods from 7 countries. Ultimately, the program routinely tests 240 million variables from countries (South Korea, Germany, China, Great Britain, Japan, India, and the US), which account for 75% of world trade. Along with other non-cognitive analytical models, an AI algorithm communicates a single value representing a current weighted average trade growth and global trade for the next two months. Historical analysis has shown a good correlation between the global DHL trade barometer and actual containerized trading, which provides significant global trade prospects for three months. (Gesing, B., Peterson, S. J., & Michelsen, D., 2018).

4.1.1.1.3 Predictive Risk Management (DHL Resilience-360 Platform)

Predictive risk management is important to keep the supply chain consistent. A cloud-based supplier channel risk management system, tailored to the needs of multinational logistics operators, is the DHL Resilience-360 platform. Supply chain executives in many sectors, including automotive, electrical and engineering & manufacturing, handle the movements of goods from thousands of suppliers worldwide every day. Supplier problems may cause major problems in the supply chain, from inventory shortages to unfair labour practices and even legal inquiries.

The Resilience-360 Supply Watch module demonstrates that AI can recognise the risks of suppliers. Supply Watch uses machine learning and natural language processing technologies to monitor the content and context of 8 million messages from over 300,000 websites and social media networks. This helps the application to recognize how online communications sound from unstructured text in order to determine risk factors in advance. It in turn enables supply chain executives to take prompt preventive steps to avoid instability (Gesing, B., Peterson, S. J., & Michelsen, D., 2018).

4.1.1.2 AI and Logistics Assets

AI now continues to benefit substantially from the physical demands of modern logistics. The usage of robots, conversational interfaces, computer vision systems, and driverless vehicles is considered the physical representation of AI in logistics

processes, embracing today's employees in a new generation of technologies to improve its capabilities.

4.1.1.2.1 Intelligent Robotic Sorting and AI (Case Studies)

Intelligent sorting is the efficient high-speed sorting of letters, packages, and even palletized deliveries, and has become one of modern package and express operators' most important operations. Millions of shipments are processed daily with a complicated array of conveyors, network screening, manual handling tools, and staff. The logistics industry will benefit from recycling industry technologies focused on AI-driven robots. Since 2011 the Finnish corporation ZenRobotics has been creating and developing smart robotic waste sorting solutions.

The company's ZRR2 robotic system uses a mix of machine vision and machine learning algorithms incorporated in off - the-shelf robotic arms, to sort and collect recyclables from rotating conveyor belts in a coordinated manner. The AI algorithm takes in real-time information from three different types of cameras and sensors, and is equipped by identifying logos, names, and 3D shapes to recognize a wide range of food and beverage boxes. The output is a system consisting of two AI-powered robot arms which can sort unorganized recyclables with extremely high levels of accuracy on a moving conveyor belt at a rate of 4000 objects per hour. This indicates a valuable logistics method for AI, and similar sorting technologies may be extended potentially to package and letter-sized items to minimize human effort and mistakes rates.

In logistics activities autonomous guided vehicles (AGVs) were already starting to play a significant role. In any particular logistics process, it is common to have several persons running material handling devices such as pallet jacks, wheeled totes, forklifts, and even tugging vehicles to transport goods across places or vessels. Today businesses are starting to use non-industrial, collaborative robotics, like AGVs, to do that. AI is an integral part of the system (Gesing, B., Peterson, S. J., & Michelsen, D., 2018).

4.1.1.2.2 AI & Inventory Management (AI Computer Vision Cases)

The French company Qopius, is developing computer-based vision AI to calculate shelf efficiency, monitor items and enhance the performance of retail stores. In order to obtain the characteristics of products, such as brands, names, logos, price tags and shelf conditions, Qopius can provide these and more using deep learning and smooth image recognition, such as:

1. Out of stock products.
2. Percentage of shelf and on-shelf
3. Products availability in inventory

Inventory management uses computer-based vision similarly, in which AI provides in-time inventory management ability at the individual item and SKU tier.

TwentyBN, a Canadian organization, is developing a deep learning AI that can translate complicated human actions in video streams. This technology had former uses which include automated identification of incidents like a slipping older person from video streams alone, violent actions on public transport and shop thefts. Given that many warehouses today are fitted for safety reasons with security cameras. This type of AI technology can also be used to improve efficiency by trying to detect:

- Effective pick-and-pack activities.
- Improved workplace safety (for example, prompt alerting of personnel who are being included in accidents).

4.1.1.2.3 AI & Customer Relation Management (DHL & Amazon A Smart Solution)

The dynamics are changing between logistics companies and consumers. With most customers, touch points with a logistics provider, starts with an online store at checkout and end by means of a good delivery, or often a return of the product. Contact points with logistics providers for companies are distinguished by long-term contracts, service levels and complicated global supply chains. AI could help logistics companies customize all of these consumer contact points, increased customer satisfaction and retention.

Speech agents for logistics suppliers can greatly enhance and individualize the consumer experience. DHL Parcel became one of the first last-mile delivery organizations in 2017 to provide a voice-based service to track deliveries and provide information about shipments using Amazon's Alexa. Consumers who have an Amazon Echo speaker at home will only ask stuff like "Alexa, where's my parcel?" and "Say DHL where my package is". Consumers will then talk their alphanumeric tracking number and provide feedback to their shipments. When a shipment has a problem, consumers can ask for assistance from DHL and be redirected to customer service.

4.1.1.2.4 AI & Anticipatory Logistics

It carries the consumer experience with AI-driven logistics to next stage, and delivers products to consumers even prior to their order or realizing they need to buy it. Anticipatory logistics aims to maximize AI's ability to analyse and draw predictions, using enormous volume of information such as online behaviours, purchasing habits and demographic trends, along with apparently unrelated sources of information such as social media activity, news reports, and weather data, to anticipate what consumers are going to buy. Companies can accurately forecast demand by opening these data sources to AI analysis and shorten delivery times by shifting inventory closer to consumer locations and assigning resources and energy to accommodate for previously unpredictable demand. In certain situations, even getting unpurchased inventory in constant transit would be necessary to enable immediate delivery for an order placed while the products are in transit. (Gesing, B., Peterson, S. J., & Michelsen, D., 2018)

4.1.1.2.5 AI & Predicting Ships' Destinations

Tracking and monitoring the movement of important freight can use radio transponders, but these typically use cellular radio networks that are only available on land. Tracking freight on the ocean often uses vessel tracking as a proxy for tracking the cargo carried on the vessel. Using maritime data and vessel shipping data, one company was able to see when a vessel arrived at a port, and when it departed, so that the company could match the container that was on board and continue to track it. However, the movement in the ocean between ports was still hidden, meaning that the company couldn't tell if there were delays on the water. So, the company continued to look for missing information to analyse and understand the performance on the water,

such as analysing how congestion and different contextual pieces impacted vessel speed. The challenge on the analytics side was to identify when a vessel started its journey. Was it when it arrived at a port or left the port? Moreover, the customer only cared about their own products on the vessels, not others. If the vessel was being operated by a 3PL, the company had little to no visibility into arrivals and departures.

The project required multiple steps to identify different types of data, and then learn from that data. For example, the company used AIS (Automatic Identification System) data that all ships are supposed to transmit to surrounding vessels as a safety measure. With AIS, each ship broadcasts its location, speed, heading, and other data every minute—500 million daily messages worldwide. The company used over 10 years of data as its training data for ML. To use data efficiently for the purpose of making predictions, however, it is better to use less data. Thus, the company down-samples it to use only data that represents a state change, such as a speedup, slowdown, or change in heading. That leaves 2 million data points per day. Looking only at commercial traffic reduces it down to 500,000 data points per day.

Other information comes from manual entries keyed in by the captain, such as the vessel's destination. Unfortunately, different captains use different codes for a port, such as SNG or SNP for Singapore. Or, the captain might key in "Panama Canal" but the ultimate destination is the port in Jacksonville, Mississippi. The company used ML to predict which port the captain meant by correlating it with the vessel's current location, speed, and direction. Another piece of information that helped predict the right port was the nature of the ship's cargo and the subset of worldwide ports that handled the type of cargo—some ports only handle particular bulk products. Based on the port of origin, the company could predict the type of cargo on board and then limit the possible destination ports to those handling that type of cargo. A key facet of ML using big data with today's fast computers is that it can leverage too many noisy or weak sources of data to develop very accurate predictions. (Caballero, S., & Rice, J. B., 2018)

4.1.1.2.6 AI & Predicting Asset Availability

Both presenters during the transportation planning session spoke of efforts to predict asset availability, shippers and brokers seek transportation assets that are available and willing to carry their cargo from a given origin to a given destination. In times of tight capacity, shippers struggle to lock in available assets before someone else does. And at all times, they seek the lowest-cost asset. The two participants had used ML to predict carriers' asset availability—who might have a ship or truck available at some future date, location, and destination? Both participants developed ML systems to forecast where assets were going and whether they might be available for hire at those forecast locations.

The ocean freight data company used ML techniques such as recurrent neural networks (RNN) for predicting vessels' port sequences. By knowing what a vessel has done previously, that information could be re-coded to convert the raw data into abstract data that would go into a predictor trained by a supervised learning method of what the company believed would be the next event/location. Then, the company could take that abstract sequence and convert it back to events/locations that would be applicable to the vessel. The company also used public information on who has contracted with which vessel, to predict whether a vessel was on a long-term charter or whether it might become available. Other publicly-available data, such as weather data, impacted vessel speed and thus could be used to enrich AIS data.

Other hidden factors also impacted availability. Bulk vessels can carry many types of cargo, but a vessel that carried dirty cargo such as crude oil could not be used for more refined cargos such as jet fuel without being cleaned. A vessel would remain dirty and thus not available for some kinds of cargo unless it visited a maintenance facility. The ocean freight company achieved a 95% accuracy on ships' clean/dirty status, which in turn improved the prediction of affected asset availability. (Caballero, S., & Rice, J. B., 2018)

4.1.1.2.7 AI & Predicting Spoilage and Problems in Transit

Several examples showed how ML could be used to predict problems in transportation. For example, a beverage company was writing off \$20 million a year due to freezing that occurred during ocean voyages. The company wanted some way to forecast which

shipments should be checked or reordered if there might be a problem. Analysing a combination of historical data on vessel trajectories, weather, and quality control outcomes helped them determine that shipments were only in danger if they spent more than six hours in freezing conditions. With that rule, the company could monitor future shipments—vessel tracks and weather data—to predict which shipments had been spoiled and take corrective action.

Similarly, a large food manufacturer faced problems with freezing mayonnaise. To prevent this in the past, the manufacturer pre-emptively shipped the goods during winter months in temperature-controlled trucks. When a risk analytics company studied the situation, it found that the manufacturer was over-using the more costly trucks by a factor of two. A more accurate model helped them predict which loads would really need temperature control. The results were both a lower shipping bill and no loads lost to freezing.

Another client of the risk analytics firm is a car maker with only three hours' worth of inventory for certain parts. Any disruption can cost the manufacturer hundreds of thousands of dollars per hour of disruption. The analytics firm developed a model to predict whether a port would have to close due to weather. Forecasts of disruption enable the car maker to make alternate arrangements as necessary to keep parts coming. (Caballero, S., & Rice, J. B., 2018)

4.1.1.2.8 AI & Predicting Arrival Times

The ocean freight data company could also predict ETAs (estimated time of arrival) by using the current speed, heading, and predicted destination to draw a great circle path and calculate point A to point B distances and travel times. The company used a year's worth of data of the whole world to generate a spoke map – the map would show where vessels had moved in order to find the most efficient route on the water. Likewise, the company could forecast the line-up of inbound vessels at the port to predict if a given vessel might be delayed due to congestion.

This company used these kinds of predictive models of travel time to help a large client improve coordination among assets that needed to arrive together. The client company moved freight from China to the US, which took about 22 days but each day had a cost of \$24 million on the business. Thus, improving velocity by one day could have an

immediate savings of \$24 million. Even more crucial, however, was that some of the ocean vessels needed to arrive at the same time. If 9 out of 10 ships arrived at port but the tenth one was late, there was a daily cost of holding the inventory on the other nine ships. Thus, coordination based on accurate predictions had huge value as well. (Caballero, S., & Rice, J. B., 2018)

4.1.1.2.9 AI & Transportation Document Recognition

Another transportation challenge is classifying all the documents associated with transportation, such as which ones are bills-of-lading (BOL) and whether or not the BOLs have any mark-ups that might indicate damage to the freight. A transportation broker built a basic image recognition algorithm to do this so that when a customer requests the BOL, the company can find and deliver it quickly without manual labour. The automated system is still in the testing phase but is expected to help accelerate payments. With \$2 billion per day tied up in the company's receivables, that acceleration would have a very big impact on the company. (Caballero, S., & Rice, J. B., 2018)

4.1.1.2.10 Maritime Transportation and AI

Hong Kong's OOCL shipping company collaborated with the AI Research Center of Microsoft in 2018 to automate its network operations, a 15-week project, which saved \$10 million a year on OOCL. During the same year, the American firm Sea Machines Robotics worked on the ice-grade container vessels for Maersk the world's largest shipping corporation. It was the first time a functioning ship used computer vision, Light and Ranging Detection (LiDAR) and intelligent technologies. Sea Machines reported that they estimate that operating expenses can be reduced by 40% (Conde, M.L., & Twinn, I., 2019).

4.1.1.2.11 Railways and AI

GE transport has developed smart technology to increase their trains' performance. The smart freight trains are fitted with sensors that collect and provide information for a machine learning system. The program processes the information and makes it possible in real time to make decisions. 250 freight trains from Deutsche Bahn Freight in Europe were equipped with the GE Performance Management system to control

brake efficiency, engine temperature and other parameters for forecasting maintenance. Instead of metrics like travel distances, it has become more accurate because the system provides live train information. The intelligent trains reported a 25 percent reduction of the train failure rate by Deutsche Bahn's pilot project (Conde ,M.L., & Twinn, I., 2019).

4.1.1.3 Turkish Airlines - Turkey

The Turkish airline has developed an AI chatbot in which clients are able to check-in and board flights. It has also established a Chat-bot platform with Facebook Messenger that also offers seating detail. They have a chatbot using an app called 'bip' for local Turkish messaging. The first edition is a minimal viable product (MVP) which the whole check-in process can be done through.

Turkish Airlines claims that its customers can retrieve their PNR (passenger name record) number, review available seats and pick their boarding pass through chatting with the chatbot. Turkish Airlines also claimed that they work on a chatbot project that would deliver most online services.

Turkish Airlines aims to deliver more real-time information on flights by developing Big-Data technology and delivering personalized updates to customers on their mobile devices. They claim that they are trying to provide new innovative technologies to better digital customer experience (IoB, 2020).

4.1.1.4 Pegasus Airlines - Turkey

Competition is high in the low-cost aviation industry, and brands like Pegasus will have to establish creative strategies that ensure a favourable return. These tactics are implemented throughout airline operations and daily operations. One field in which Pegasus plans to invest even more is using online marketing to attract new customers or gain extra revenue from current customers. It is therefore essential that Pegasus exercises precise control over its digital publicity spending, so that they can make benefit from their spending.

1- Releasing Insider's Predictive Ad Audiences:

Initial Predictive Ad Audiences (PAA), which relies on AI and machine learning algorithms to create ready-to-use segments based on predicted computations of travellers, have been released by Pegasus. Pegasus is been targeting visitors who are more interested to book from advertising networks to create tailor-made experiences to improve the return-on-ad-spending (ROAS) and conversions. Pegasus was able to quickly recognize potential customers with a high chance of purchasing tickets, booking hotels or organizing possible vacations, business trips and much more. This led to the improvement of Pegasus' Return-On-Ad-Spend (ROAS), since PAA allowed them to use the consumers that is interested instead of the full range.

2- The use of social data to help clients make sensible and quick decisions about purchases:

Many Pegasus ticket shopping is done through mobile devices, as most travellers are seldom able to sit in an office and book tickets. The growth consultants and experts from the aviation industry proposed social proof for the mobile web to boost the overall sales performance of Pegasus, while also providing clients with a more in-depth experience. Pegasus has been able to demonstrate the number of seats on a given flight, or regular bookings on a flight and more, through the implementation of social proof. This gave flight providers urgency and helped them determine more informedly while making bookings quicker (Kaya, 2020).

4.1.1.5 A Comparative Analysis for Logistics & Transportation Sector

AI has broad applications in many fields as a diverse range of technologies that can help people solve everyday problems. AI creates opportunities for safer, stable, effective and cleaner transportation through the analysis of traffic conditions to reduce traffic incidents and enhance sailing routes to reduce pollution. There are various applications of AI, in both advanced economies and developing markets, that prove the aids these advancing technologies can achieve to markets, thus challenges the technology creates must be managed effectively (Conde ,M.L., & Twinn, I., 2019).

When the route or weather is poor, systems equipped with intelligent automation can re-route shipping dynamically, preventing delays and rebalancing inventories as needed. For example, an application to identify and eliminate bottlenecks based on cost/benefit analysis is available through the United Parcel Service (UPS) machine learning app. For instance, if the application predicts a storm in the future, it can cost-effectively route packages away from trouble spots. Through the use of sophisticated algorithms, organizations become better prepared to fulfill client demands, improve rates of quality and navigate unpredictable incidents through agility (Chao, G., Cheung, J., Haller, K., & Lee, J., 2019).

As a result of our research for the transportation and delivery, we found that non-Turkish companies have started to apply AI in many areas, like demand forecasting, smart traffic systems, and predictive maintenance as we discussed in marine, railways, and airfreight cases. While the Turkish companies working in the same sector have applied AI in the CRM area only, and need to put more potentials in such competitive sectors.

4.1.2 Retail & E-Commerce (As an Online Retail) Sectors

Cases from worldwide are presented first followed by the cases from Turkey, then a comparative analysis is discussed at the end of this section.

4.1.2.1 Amazon's 1-Hour Deliveries

At the time anyone clicks on Amazon to "buy," Amazon's team certainly had predicted it. The Supply Chain Management Technologies department at Amazon' staff predicts worldwide demand for all Amazon sells, which underlies Amazon's entire shopping

activity. And it's essential to Amazon's pursuing of such 100 million customers shelling out for a Prime membership up to \$119 a year which guarantees two-day delivery.

Corporate executives tend to invoke creativity inside Amazon when they speak of quick delivery. They started their quickest service, Prime Now, that delivers household basics in just few hours. For AI, systems evaluate data reams, make decisions, and perform tasks that involve human intelligence generally. AI is essential to Amazon's steroid retail forecast and its effort to cut off minutes and seconds in the rush to schedule, package, and distribute. Amazon claims that this goes beyond just stating that they need a hundred piece from a certain item, but they need to be able to make a decision about how much they want their customers to purchase of that item. And then, where should they put the item so when customers press 'order' they will get it.

This method is more critical now that the competition is on for delivery through the same day and even through the same hour. Some of the retails, since they are very costly, have penetrated into such levels. And few depend too much on AI while growing to reduce costs. Analysts at the Center for the Future, claims Amazon certainly has AI integrated into every phase of an Amazon order, from the internet site to the warehouses till the physical dispatch to customer's door. Amazon labels these phases, in business terminology, "first mile," "middle mile" and "third mile."

1- Forecasting for the "first mile":

Amazon obtained the copyright for "anticipatory delivery" in 2013, with the intention of delivering customer's order as close to customer's address as possible before he actually press purchase. Amazon has since developed a vast warehousing presence throughout the world. And it has been building smaller warehouses close to city centres where Prime Now offers options for super-fast delivery. By looking at every product detail, Amazon decides what to keep in their warehouse as a stock. Of identical clothing products, as an example they take a shirt and analyses the colour, weight, sleeve weight and background of purchases, then the Amazon team extract the historical data and purchasing patterns to feed the AI system with the algorithms and mathematical models.

2- The "middle mile":

In Amazon warehouses, AI power the Kiva robots that look like big Roombas with bright yellow shelves. The robots are aware of what they need to bring and when they can get orders ready for delivery. AI systems maintain a database of all stored goods, up to one million square feet. AI frequently arranges and rearranges the shelves so that customers are nearly sure they are purchasing these items.

Amazon operation department claims that Amazon is now implementing a new efficiency boosting technology which eliminates the need for handheld scanners. The new device retrofits stations of employees with specialized cameras that can automatically scan objects been carried in the hands of the employees. AI is learning to distinguish and perceive hand movements of individuals in order to recognize when a person puts an object inside a shelf space. Simultaneously, Amazon has launched AI-powered stores that remove the need for a cashier, sparking concerns about the future of workers like these across the industry.

3- The "last mile"

One field in which AI developed a new kind of work is in deliveries. Amazon has several agreements with the courier suppliers and logistics firms, as well as Uber drivers as a side job to make super-fast deliveries in crowded towns, the application used for this is named "Flex". The process depends on AI to continuously calculate the number of drivers/vehicles required at any particular time. The software takes into account the dimensions and number of shipments to the same communities and if the shipments will be suited in the available vehicles or not. The application also suggests ordering the most effective delivery of packing containers into a vehicle.

Parking is another obstacle for the "Flex" users. The Amazon application does not instruct where to leave vehicles when dropping off an order. Timing forecasts from AI also take traffic conditions into consideration. Amazon reported that it's easy to deliver a package to family's house but it's really difficult in the case of a commercial building.

At this type of technology, every minute counts when a delivery is assigned as a one-hour task. So, deadlines that has been missed and delays get a detailed examination,

like, whether they were unable to pick the item from the warehouse shelves in time, or, if they didn't have the right number of vehicles. Or, maybe the driver forgot his key at the reception of a commercial building and had to walk a little further (Selyukh, 2020).

4.1.2.2 Walmart

For over 1 million SKU during the holiday season and 4,700 U.S. retailers selling this merchandise, the logistics required to ensure that the right products are reached at the right time in the right retailers. This is besides the fulfilling of e-commerce orders for all over the world. To do all that, artificial intelligence and machine learning has to be used to keep their operations running efficiently while maintaining customer satisfaction.

Walmart continued its growth by using one of the world's largest live datasets in 2020 while implementing machine learning. It is best to explore some of the ways Walmart uses AI both behind the scenes, in stores and elsewhere, and find out how and why Walmart uses AI.

Behind the scenes, Walmart uses sophisticated machine learning and technologies including computer vision to boost product forecasts. Walmart uses the system to optimize the supply chain and logistics, and to make sure that the goods are delivered at the lowest possible cost at the right time from suppliers in the Walmart distribution centres. It allows them to prioritize, coordinate and monitor the 60,000 trucks, custom-build pallets for specific departments in specific stores to accelerate downloading, and outlines the best routes to rapidly and cost-efficiently deliver goods to stores, while reducing environmental impact.

In Walmart's machine-learning models for example, data from the robotic shelf scanner along with a multitude of other data signals are given to enable them to monitor the stock in real time and automatically notify Walmart and Walmart suppliers when their goods are sold out so they may restock their stores faster. It interacts with the Downstock App from Walmart Associate which tells them which particular items must first be unpackaged and restored from pallets. This helps to prepare clear and effective routes around the store for its products and "pickers" of foodstuffs, enabling them to concurrently execute ten or more orders.

Many machine-learning uses involve voice-enabled shopping where the system must be able to understand whether the content and meaning of the request is part of an existing question or the start of a new one. Individualized shopping is a significant indication of machine learning, which helps Walmart to recommend products and adapt customer's buying experience and delivery preferences irrespective of whether they are shopping at stores or online. Walmart also uses machine learning and computer vision to enhance Walmart's IRL or Intelligent Retail Lab (IRL is equipped with a variety of processors, sensors and cameras to capture information about what takes place inside the shop) system store to understand how customers like to buy items, and using such information to improve their purchase experiences (Tan, 2020).

The first element this system can help the team concentrate on is the inventory and availability of the items. In brief, the team will be using actual-time information of explore efficiencies that will enable partners to know more precisely when to recover goods, ensuring that items will be available on shelves when they are required. Here is an example that the team is focusing on the coming future: Walmart needs the items that the customer buys to be available in stock, by the time customer gets in to the store as the customer goes shopping. A mixture of cameras and real-time analytics in IRL would automatically activate out-of-stock alerts to internal applications that warn associates when they need to re-stock. It means that the store will automatically:

- 1-The detection of the products on the shelf.
- 2- Recognize the actual commodity (in other words, identify the discrepancies between 1 pound of ground beef and 2 pounds of ground beef)
- 3- Compare the amounts on the shelves to the expected demand for sales.

As a result, employees won't have to continuously check the store to substitute low-run items on the shelf. When customers arrive, they should know what to take out of the stock room. With IRL technology, consumers may have confidence that the items they need will remain available throughout the duration they shop (Smith, 2020).

4.1.2.3 Carrefour

To Optimize Carrefour's Supply Chain: Carrefour was the first French company to use AI to improve inventory management and cut the excess through the integration into their supply chain of tools created by advanced SAS analytics pioneer. Carrefour supply chain has chosen the framework for an AI system developed by the advanced analytics pioneer SAS, building on the \$2 billion annual investment budget contained in the Carrefour2022 transformation plan, especially for IT and digital growth initiatives. The SAS tool has been used to gather and process information from stores, warehouses and e-commerce sites in order to boost forecasts of demand and automate supplier ordering after a trial period has been completed. More smart supply chain management will reduce both over/out stocks in stores and warehouses.

The AI technology has been incorporated into the supply chain for food goods, and shortly non-food goods, in the French retail market. The goal of this project is to build a unique physical and online ecosystem in which identified and valued customers are assured the most suitable deal all the time.

The functionality of the procurement and planning departments will also be optimized using AI system. The SAS platform would process a variety of information from the Carrefour supply chain network. It also helps employees to become more flexible by incorporating new working methods and enhancing their forecasting processes continually. Carrefour experts may also build their own customized algorithms to meet their specific requirements with the SAS open AI solution.

SAS claims that they're using their technical and business experience to support Carrefour teams, throughout the integration process of the Big-Data project which based on AI and machine learning, which will automate each step in the supply chain and improve customer satisfaction (Carrefour, 2020).

4.1.2.4 Alibaba

China is known as a rich ground for AI applications, and Alibaba continues to advance at full pace. Chinese corporation Alibaba, the world's largest e-commerce firm with a turnover of \$248 billion which is more than Amazon & eBay together. Alibaba's core business remains retail sales, but its influence and activities have increased to make Alibaba a global leader in the field of technology. In addition, Alibaba invested in

seven research laboratories that concentrate on AI, machine learning, network security, natural language processing and more.

Many of their technical innovations that helped fuel an occasion revenue last year resulted in \$25 billion in revenues, up from \$17.8 billion in sales for same day in 2016.

The AI application used were as following:

- Tmall Smart Selection: this AI-powered and deep-learning algorithm helps in recommending items to consumers then contacts the retailers to increase their stock to sustain with demand.
- Dian Xiaomi: This AI-enabled chatbot understands over 90% of Alibaba customer requests and assists over 3.5 million users daily. A new chatbot version can understand the feelings of a customer and can organize and alert the human agent to participate.
- Packing robotics and drone: over 200 robotics can handle a million cargo a day in automated warehouses. When orders being are received, the robots packs and ships the product and, in some cases, delivers it efficiently the same day. In some shipments, Alibaba also uses drones.

City Brain: AI control for cities

Alibaba expects to assist cities to operate using AI with its City Brain project. City Brain solves traffic issues, and uses a cloud-based program that gathers and processes data about the city and everyone there with AI algorithms. The project managed to reduce traffic delays by 15% by monitoring every car in the area. City Brain will be implemented in Malaysia after being popular in Hangzhou-China.

Alibaba uses AI to optimize the supply chain, produce goods and make recommendations. In addition, Alibaba aims to become the technology company that offers the cloud-based AI, which makes AI accessible via an AI-chip and will be available for anyone who has a laptop and internet access. (Marr, 2020).

4.1.2.5 Migros - Turkey

Migros makes great efforts to digital initiatives and artificial intelligence projects. Efforts and investments made in this field, increasing operational efficiency and maximizing the accuracy of the operations, ensures a better customer experience. Thanks to its deep-rooted history and leading position in the market, the company has large volumes of data that is supported by digital efforts, and big data warehouses. The company's R&D department aims to increase the use of artificial intelligence and other digital initiatives in different business units.

As per Migros' R&D department the Azure app and the image processing service allowed them to add new functionality to their current framework. The Microsoft Azure Cognitive Services and the intelligent tracking system provided by Azure, now allows Migros to instantly track the amount and stock level of fruits and vegetables on the shelves and create alerts about their condition. In addition, sell-out and automatic order issues can be easily handled.

One of the most significant advantages of the system is that operations such as adding new goods and incorporating new fruits and vegetables into the system can be simply achieved by the Migros team. The AI program, powered by Azure Cognitive Services enhances the company's digital transformation strategy by providing more valuable insights everyday as it continuously learns (Microsoft, 2020).

Thanks to the increased amount of structured data, systems are able to perform a better pattern analysis and predict ideal stock levels. The AI system predicts future stock levels more accurately. This helps Migros increase customer satisfaction by offering fresh foods without stock shortage. The company was also running a project that weighs the shelves to keep stock levels at an ideal level, thereby increasing customer satisfaction (Kansu, M., & Abu-Ltaif, S. , 2019).

4.1.2.6 TeknoSA - Turkey

Turkey's leading retail stores TeknoSA is one of the new generations, with their slogans "the most reasonable price" and "best quality of service" they sell technological products. TeknoSA has been founded in 2000, and with their 207 stores they are serving 69 provinces in Turkey. TeknoSA, is a subsidiary of Sabancı Holding

one of Turkey's leading group company. TeknoSA also has an online store that serves their customers.

The company has a huge investment in both machine learning and artificial intelligence to improve demand forecasting and minimize inventory costs. Due to their advanced capabilities in this field, they also provide consultancy services to other companies. The algorithms they use can be personalized and used by companies that perform similar activities. In the future, they have a visionary plan that will enable the company to make revenue through consultancy services they provide to other retail companies, and may change their business field from retailing to technology consulting.

According to TeknoSA executives, the retail industry is very dynamic and everything is changing rapidly. TeknoSA is aware of this situation and invests heavily in new technology. Preferring to outperform its competitors with its low-price policy, the company is now trying to transform themselves into a multi-channel structured business by making use of digital initiatives. In the field of artificial intelligence development, the company focuses primarily on data distribution and reconciliation. Using the data to take advantage of its AI capabilities, the company therefore invests heavily in improving data quality. TeknoSA focuses on their main targets which are reducing operational costs, increasing sales, and digital initiatives in artificial intelligence projects. To achieve these goals, it invests in a large artificial intelligence project that will increase demand forecast accuracy.

The company uses artificial intelligence and machine learning algorithms to forecast demand for different technology products. Using high quality historical data, these algorithms analyse the historical demand volumes and predict future sales. TeknoSA also analyses the most efficient timeframe for product display to increase demand and determines the most efficient inventory quantities through sales forecasts. By analysing the data collected from stores through heat-maps, the company tries to optimize product displays, reducing the inventory costs by keeping the optimum quantities of products in their inventory (Kansu, M., & Abu-Ltaif, S. , 2019).

4.1.2.7 OPET - Turkey

OPET, is considered as one of the market leaders in the fuel distribution sector with their high capabilities in the field of customer satisfaction, they also operate in the fields of mineral oil and jet fuel through their subsidiaries. As well as carrying out retail, commercial and sectoral sales, storage and international fuel trade activities. The number of petrol stations owned by OPET with their brand SUNPET is over 1600. With their annual storage capacity of over 1 million cubic meters, they gained a competitive advantage in the fuel industry, and is being recognized as the most digitalized and technological brand in the industry.

OPET's first priority is to offer their customers the same standard and quality in different communication channels, regardless which degree of employee performance is. The company carries out the vision of assigning more value-added tasks to the workforce by transferring non-value-added services to chatbot systems. With this vision, they aim to reduce the training costs of their employees. By improving their chatbot activities, which aimed to increase the interaction of customers with technology and create a more integrated relationship structure.

OPET, is constantly improving in terms of offering better quality and different experiences to achieve their main digitalization targets, using the new communication channels they have implemented and the changes they have made in existing communication channels. In this context, OPET, aims to facilitate the consumers buying experience with the technologies they have developed, and has implemented the “Smart Station concept”. A real-time, artificial intelligence-based chatbot system and voice shopping infrastructures were designed for customer touch-points using the Smart Dialogue System (SDS) technology.

A Turkish language collection was created using data, news feeds, magazine and book texts, subtitles and alternative sources concerning OPET customers. This system has been used in machine learning models to design automation of dialogue-based communications with SDS, with the aid of some machine learning techniques such as LSTM, CNN and Seq2Seq.

Smart Station understands and evaluates the context that customers use while actively communicating with, and creates real-time responses, creating the real feeling of human interaction. Various communication channels are also integrated into the system, and continuous system learning goes on.

What the company does with SDS technology is not only limited to improving communication with its customers. OPET also aims to provide new integrations and design new products to improve different processes with corporate customers and consumers. This will further strengthen OPET's leadership position in consumer technology and customer satisfaction (Kansu, M., & Abu-Ltaif, S. , 2019).

4.1.2.8 Hepsiburada - Turkey

Hepsiburada Call Centre claims that they receive more than 8,000 calls per day. They hired 100 full-time call-centre agents for an average call duration of 5 minutes. Handling calls manually was causing longer waiting times, increasing call duration. Hepsiburada aimed to increase self-service levels by automating the call handling processes.

Sestek-Conversational-IVR allowed users to self-serve when speaking in their usual daily life language. Sestek-Conversational-IVR is a solution integrating automatic speech recognition (ASR) with natural language processing (NLP). The system replaces complicated or ambiguous menus with simple verbal questions. The systems manage calls more efficiently and saves companies on operating expenses, saves the customer time and increases satisfaction.

Hepsiburada claimed that they desired to offer their customers a solution that would enable them to finalize their transactions by themselves without waiting. They also, aimed to increase customer satisfaction by providing faster self-service. Hepsiburada reported that the results achieved have been satisfied.

- The Results Reported by Hepsiburada were as following:

14% Increase in self-service rates

10% Decrease in ticket opening

95% Navigation accuracy

(Sestek, 2020)

4.1.2.9 A Comparative Analysis for Retail & E-Commerce (As an Online Retail) Sectors

According to Kotler: Retailing includes all the activities involved in selling goods or services to the final consumers for personal, non-business use (Kotler, P., & Keller, K. L., 2016, p. 549).

As measured in our research the retail executives in our surveyed organizations (Turkish and non-Turkish), are exploring ways to apply AI to cross-functional collaboration and integration with customers. Further processes that require more system integrations are essential for these functions. This emphasis is focused on both areas which show growth supply chain management and in-store activities for AI adoption. Supply chain involves coordination across a number of functions including supplies, distribution and transport. In the past, many of the processes associated with these functions were manual.

For this type of working environment, AI is ideally suited. Data from different operations can be obtained and digested and analyzed easily with AI-powered systems. They would then generate estimates to help retailers make decisions in real-time while designing and managing schedules, assessing tradeoffs, and achieving consensus. Retailers may use automation to perform standard tasks as they move through the process, direct workflows and implement adjustments to exceptions.

AI can also greatly benefit both retail operations and in-store services. Every city or district is distinctive, with its own geographically limited flow of people, places and activities that form customer behavior and need. A college town retail needs a wider range of items than a resort area retailer. AI will learn from the existing data to classify goods and services that meet the district's needs. This can automate stock selection for a particular retailer based on the local location characteristics and available ingredients.

Companies in the planning stages of applying AI, may expect AI to help their organizations to perform more effectively than they do now, to increase operational efficiency, improve capabilities, decrease costs and improve revenue growth. AI can help organizations achieve their objectives, but its prospective gains are more considerable than incremental improvements. Companies who already use AI have impacts that can radically alter their way of doing business, boost organizational

efficiency, increase decision efficiency and speed, and enhance client experience. The objective is less on cost reduction and more on productivity and long-term growth. Although the initial motivation for engaging with AI applications can be productivity improvements and cost savings, an even greater benefits can be achieved as capability matures.

By improving the customer experience, retailers can release exclusively new schemes to customer engagement and integration. Using AI, they will recognize the expected preferences of consumers at different times and take the right time to gain competitive advantage with the right offer. Retailers today have started using AI engines to trigger email campaigns automatically. That capability will be much more important to be added to the order process, so that consumers can make transactions freely within the campaign. And that might be the reason many of AI applications are customer focused as we have explored in the cases.

Accordingly, it's clear that both Turkish and non-Turkish companies (in almost each of the investigated sectors not only the retail sector) approved that they already in the applying phase of the AI in customer service area, which is the area most of the businesses start with.

Regarding demand management, and improving inventory productivity and operational agility, it was reported that a high level of impact on inventory productivity and operational activities was shown within the functions of supply chain management, operations and logistics. These are essential to growth. The key goal of supply chain management is to adjust supply to demand and deliver goods at the right time, to fulfill the needs and expectations of customers. Overstock can result in markdowns and understock can lead to lost sales. Any of these scenarios have an undesirable impact on inventory efficiency and revenue.

To increase inventory efficiency, retailers can employ AI and machine learning algorithms to improve planning of supply chain and demand forecasting. Because of both unforeseen and expected events, such as new product introduction or seasonal changes, the automation engine can then control the workflow to update and modify plans automatically to deal with demand spikes and slopes.

As we can see from the next and previously cases, that Turkish companies is still either in the planning or piloting phases regarding the application of AI in demand and

inventory management, while the non-Turkish companies is more advanced in this area.

For example, The Procter & Gamble Corporation, a multi-national consumer goods organization, is working to implement a demand forecasting system of the next generation to enhance its predictive accuracy globally in the near term. The aim is to improve productivity and empower planners to make better decisions in historically difficult areas, such as promotional lift predictions.

Another aspect in which AI can change the game is organizational agility which is the ability of operations to rapidly and easily adapt for change. In order to control and track goods mobility throughout the supply chain, companies are increasingly using IoT and other smart devices. AI and machine learning can apply the ability to monitor and track data for learning and reasoning. They can use this data to draw insights and establish guidance for the next best steps for coping with potentially costly obstacles and damages (Chao, G., Cheung, J., Haller, K., & Lee, J., 2019).

Another example, the Turkish retail company Migros has reported that, AI-powered product tracking and stock forecasting, Migros aims to contribute with efficient solutions to the industry 's transformation and to attract new digital talent that improves customer loyalty. An AI-powered system is established by processing data with advanced analysis-techniques. With this device, which obtains data from fitted cameras, Migros has acquired cognitive abilities such as identifying the goods in the walkway and calculating shelf occupancy levels. The main target in the use of artificial intelligence is to increase the accuracy of demand forecasts and reduce operational costs. The main focus is on optimizing demand and inventory forecasts. The company has launched a project that compares existing stock levels to expected demand metrics to reduce spoilage rates for fruits and vegetables. Robots analyses historical data to find repetitive patterns by performing inventory counting, calculating demand differences, with the use of artificial intelligence and the internet of things. After repetitive patterns are detected, artificial intelligence systems create an algorithm to predict future trends (Microsoft, 2020).

For the retail warehouse management systems and control area, as our research obtained documented-data the Turkish companies are still not into this AI applications yet, while giant retailers like Amazon, Alibaba, and Walmart has proven an advanced

approach regarding the AI applications in this area, such as smart-robotics and smart vision applications.

4.1.3 Retail Banking Sector

The European Banking Federation has reported that AI has approved advances for Security Purposes & Fraud Prevention:

AI offers great support to detect fraud and other suspicious activities which are generally linked to financial crime. Banks are historically split into the two main types of fraud: external fraud (such as money transfer-related attacks on the bank or its customers, identity theft, electronic payments, etc.) and internal fraud from employees.

The Fraud Detection System (FDS) addresses these threats through AI and adaptive learning, through collection, analysis and learning transactional data or by interaction with FDS operators. This is able to detect suspicious activity by disabling or preventing these activities and restrict any criminal activities. Once customer profiles are developed, fraud prevention becomes much more effective. These AI applications are crucial in the struggle against money laundering and other financial crimes in addition to saving funds for financial institutions (EBF, 2019).

4.1.3.1 SBI – Bank (India)

Indian banks, including state-owned SBI, have started implementing AI in a big way to boost performance, detect individual behaviour and reduce operating costs.

The State Bank of India SBI has the most sophisticated AI technologies to effectively solve the enquiries of non-resident Indian customers, similar to the enquiries of humans. SBI Intelligent Assistant (SIA) is a smart Chat Assistant built from the state-of-the-art AI technology. The chat box at the SBI's gateway offers fast answers to bank queries (Times, 2020).

4.1.3.2 Bank of America

Bank of America had launched an AI-based chatbot “Erica” to all of its clients by June 2018, after a pilot-run period inside the company. It has been claimed that Erica system can:

- Give an alert (with up to 7 days in advance) to the client when their spending habits will drive the balance to zero value, as a prediction. This is probably done through predictive analytics and is established on the average spending per month for the client, possibly the monthly purchases of the client too.
- Notify client about the regular payments and whether or not they will be billed after their due dates.
- Marking repeated payments if they are higher than anticipated. An AI-based approach detects -timely- if there is any abnormality.
- Enables the client to either lock or unlock his/her card whenever needed.

Bank of America claims that the daily users of Erica have been doubled since the launching, and it made a great contribution on how the clients manages their financial issues in a timely basis (Faggella, 2020).

4.1.3.3 Yapı Kredi Bank - Turkey

Artificial Intelligence activities have a great effect on the banking sector's business processes, strategies and operational efficiency. Yapı Kredi bank has been practicing some products and solutions that are innovative, customer-centric and value-added to increase the implementation areas of these activities.

Yapı Kredi Bank claims that of all AI systems, best solutions come from customer-based solutions. To understand it better, they put themselves in the role of the customer and concentrate on AI at main touch-points. In 2014, the applications introduced SAFIR AI to identify customers in free format by the type of transaction under a Turkish-based Natural Language Processing (NLP) and Machine Learning (ML) system. Around 4 million transactions without human interaction were made last year.

Through deep learning they are inspiring both the scope and the success rates of the project. Chatbot project is another example of their NLP strengths that was previously

published in December 2018 as a customer-service bot on WhatsApp. This company system answers both customer and non-customer interaction issues that are most frequently presented.

A newest program, FOCA is a data discovery and value development project targeting to improve the sales and financial analysis processes of organizations, digitising free-format (t-balance) documents to improve revenue expectations and automate financial assessments through a hybrid combination of NLP, pattern recognitions and ML (Kansu, M., & Abu-Ltaif, S. , 2019).

4.1.3.4 İş Bank - Turkey

İş-bank had the challenge of creating a strong virtual assistant in Turkish, who could support multi-turn use cases such as bill payment and money transfer. İş-bank made a great effort to find an innovator that could adopt to Turkish language and to give them a platform to create complex use cases with contextual understanding.

İş-bank has adopted an AI Platform called Maxi to conduct a rapid cycle of designing, building, and deploying conversational AI. Using such application, Maxi was trained to understand and respond both in written and spoken format in Turkish. Powered by advanced NLP, machine learning, and deep neural networks, the AI-based application is able to understand, recollect, and respond to unstructured, everyday human speech.

After only 6 months of building and 2 months of roll-out, the Turkish virtual assistant was deployed to all 8.2 million İş-bank mobile app users. As well as difficult personal financial management questions, the assistant, Maxi, facilitates important activities such as bill payment, money transfers, expense advice and more (Clinc, 2020).

4.1.3.5 A Comparative Analysis of Banking Sector

AI has been used by banking institutions for many years, even though it was initially limited to certain applications. AI technology for a wide range of applications in the banking services industry is rapidly being introduced today. Banks invest more in AI systems research and innovation, and technologies have played a central role in a variety of operations, from customer service to more effective compliance management. This advancement is attributed to greater access to large data sets and an improvement in capacities for data processing.

As a part of our research aiming to provide more information on the way AI is developed and used in supply chain in different sectors, banking sector is considered as a money-supply or a money-retail entity. It identifies some foundations for a meaningful discussion about the use of AI in the banking and financial services industry and focuses on its implementation in practice.

The case applications are grouped into three groups and highlight the possible areas for banking sector opportunities:

1- Increasing customer engagement and experience, for example: chatbots, voices, robo-advisor, improving customers' services, biometric approval and authentication, customer segmentation (e.g., through personalized website services), targeted customer offerings.

2- Improvement of banking process quality, e.g., automated data extraction, document analysis, loan rating, monitoring, predictive information technology maintenance, complaints management, document classification.

3- Security and risk management improvements: e.g. improved risk control, evaluation of regulation, anomaly detection, anti-money laundering, network capacity limit prediction, data quality assurance service, fraud prevention, payment transaction tracking, cyber risk prevention.

The development of new market opportunities and to generate new revenue streams is another opportunity for AI in the banking sector, i.e. personal financial management, investment analysis, asset allocation, lead output (e.g. by means of customer demand analysis, transactional analysis, customer network analysis) etc.

As a result, we found that the Turkish and non-Turkish banks almost are moving with the same speed, in applying AI in the CSM area. And both also have proven advances in applying AI in process automation/optimization, reporting, complaints handling, and document classification. While, in the areas of Anti-Money Laundering recognition and monitoring, system capacity limit prediction, fraud prevention, and cyber risk prevention Turkish banks are still in the planning stage compared with non-Turkish banks which are in the release phase.

4.2 Interviews & Questionnaire Analysis

In this section, five companies in Turkey, and nine worldwide are questioned to understand their AI applications. In addition, the impact of AI applications in subareas of SCM for different industries has been investigated and measured. The Microsoft AI maturity model has been used with some modifications to achieve the research objectives and aims.

In addition to the case studies from publicly open documentations, participating companies are represented by many sectors, most of which are owned by Retail and Producing & Resources, followed by Financial Services, then Infrastructure & Transportations, ICT & Media and the Oil & Gas.

For the Turkish companies the importance of AI alongside its digital matches also differs across the sectors. Retail, Manufacturing & Resources and Financial Services are the sectors where AI is important respectively. While the non-Turkish companies show that the Manufacturing & Resources, Retail, Oil & Gas and Professional Services respectively are the sectors where AI is important. On the whole, the Construction sector ranked AI importance by far the lowest compared to the other sectors.

4.2.1 A Maturity Model Analysis

To understand the future of AI developments in Turkey and other countries as well, it is important to understand where the AI talks are taking place at the moment as a result of the strategic importance and level of awareness of organizations.

The research showed that the AI mainly being led from a combination of technology push and business pull (with a minor deviation towards business pull).

The study resulted in that the companies are using a mixture of structured and unstructured data for AI (52% structured data vs 48% of unstructured data), and data from both internal and external sources, with depending mainly on the internal sources (79% for internal data vs 21% external data).

4.2.1.1 Participants Almost Entirely in Senior Level Positions

We surveyed and interviewed senior managers with responsibility for pushing the AI agenda at their respective businesses, to ensure that these observations and experiences are important to the executive level. With 91% of participants either in the top management or the executive board, their feedback is potentially well tailored to the overall strategic direction and general perspective of the organizations they speak for.

4.2.1.2 The Ideal Mixture of IT Push and Business Pull

The mixture of the top-to-down and down-to-top approaches, plus the approaches of IT push and business pull is most favoured for implementation of AI in the surveyed businesses. This requires the establishment of cross-functional teams of business handlers who comes with the requirements and goals, and IT professionals with the technical capability, to cooperate, recognise and implement the optimum AI solution that add value to the business.

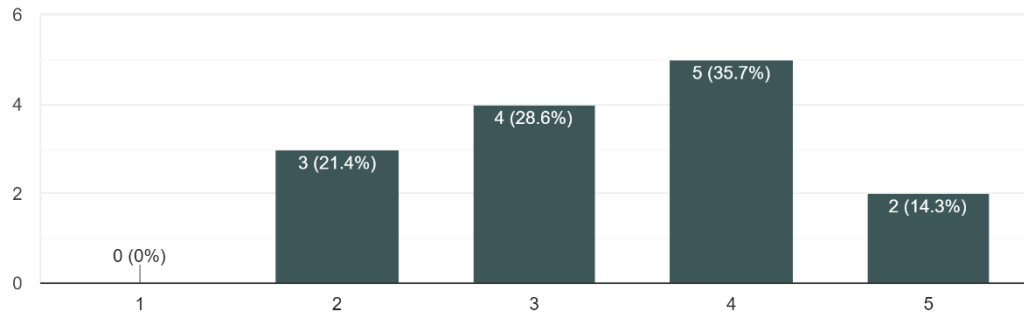
4.2.1.3 The Importance of AI Applications Relative to Company's Other Digital Priorities:

For both Turkish and non-Turkish companies, approx. 85% of surveyed companies has indicated that AI is an important-to-very important topic at the managerial level and up, regardless their degree of AI maturity. Notwithstanding the position of the participant (CEO, CFO, IT Manager ...etc), mainly their expectations from driving AI through the organization are cost savings, work efficiencies and better understanding/serving customers, it reflects the belief that AI will strongly influence the future and will become an important field in which competitors can be differentiated between them in all extents (Figure 4.2.1.3).

Figure 4.2.1.3: AI Importance relative to other digital priorities:

How important is AI relative to your company's other digital priorities?

14 responses



Source: Our Research

4.2.1.4 At Which Level/Levels in The Company the AI Is an Important Topic:

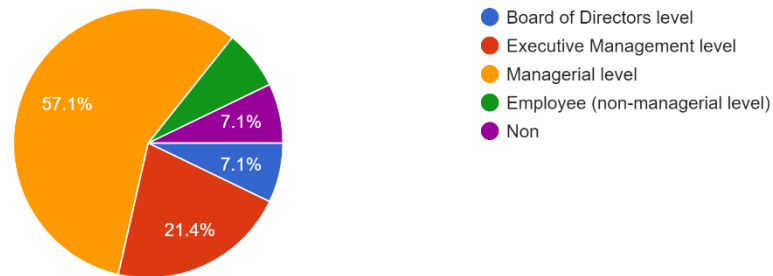
All of the Turkish companies include only managerial and top managerial levels, where the implementation essentially occur, and who are the key for bringing together the strategy from top management to the employees who will be most engaged with AI. For non-Turkish companies the non-managerial levels are actively involved in only 22% of companies, where trialling and pilot projects are occurring (Figure 4.2.1.4).

By majority of non-Turkish companies indicate that their AI initiatives are being driven using a mixture of top down and bottom up. With almost equally Business-driven vs IT-driven approaches. The Turkish companies indicated that the majority of their AI initiatives are being Business-driven approaches over the IT-driven approaches.

Figure 4.2.1.4: Where AI is being discussed inside the organization:

On what hierarchical levels in your company is AI an important topic?

14 responses



Source: Our Research

4.2.1.5 Board of Directors' Interest a Bit More Muted

AI discussions are not so far conventional at board of directors' level in the surveyed Turkish companies, with only 25% taking an attention to it. For non-Turkish companies with 33% AI discussions has been given attention at executive level in the surveyed companies. In the coming years, this will surely increase, given the level of executive involvement.

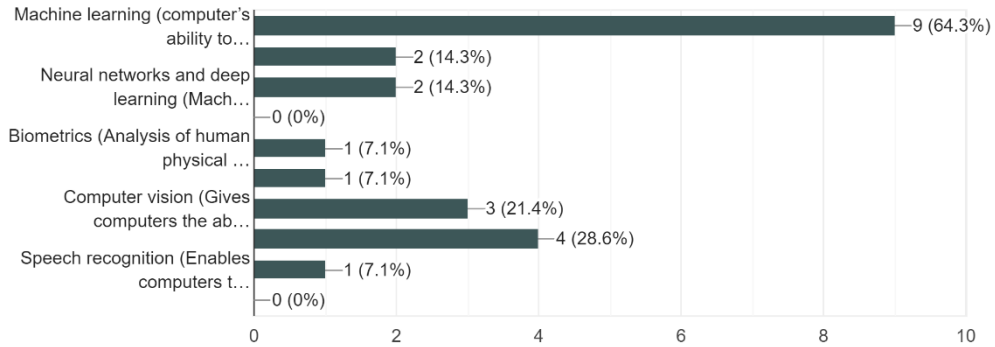
4.2.1.6 Machine learning

Machine learning is the highly popular utilized AI technology amongst the companies surveyed in Turkey, and nearly the half of the non-Turkish companies is using the machine learning. This is might be due to its broad extent of applications, which led to a diversity of uses throughout the value chain. The most popular type of machine learning is supervised machine learning, where system is being supplied with structured data and it finds models that can be used to understand and clarify new observations. While companies primarily use internal data for supervised machine learning, most have now begun exploring the possibility of combining internally and externally data in order to produce more detailed insights. The most useful was machine learning. The study does not indicate whether that is just because it is only the most solid foundation to use advanced technology, or whether it has the broadest and most significant application potential in the long term (Figure 4.2.1.6).

Figure 4.2.1.6: AI applications and their uses:

Which of the following technologies have you found to be most useful in your company's implementation of AI?

14 responses



Source: Our Research

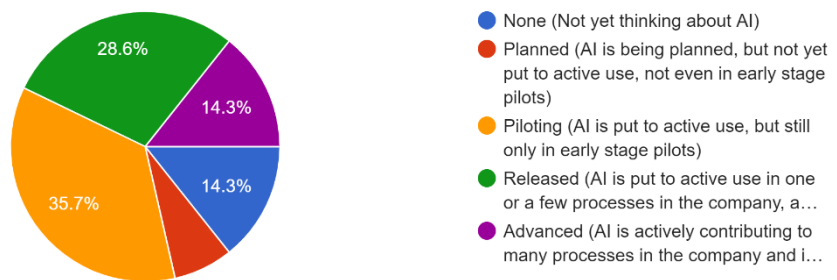
4.2.1.7 Describing the Company's General AI Maturity

Despite AI's significant impact, only a small number of companies, representing 14.3 percent of the sample, have reported that AI has been actively involved in many practices and is supporting many complex tasks these days (Figure 4.2.1.7). About 28.6% are at the 'released' stage where AI has been selectively used in one or a few business processes. The majority of companies, 42.8 percent, are still either only in AI-planning stage or early-stage pilots. 14.3% of companies are self-rated as less mature, which indicates at this stage that they do not think of AI.

Figure 4.2.1.7: Organization's general AI maturity:

How would you describe your company's general AI maturity?

14 responses



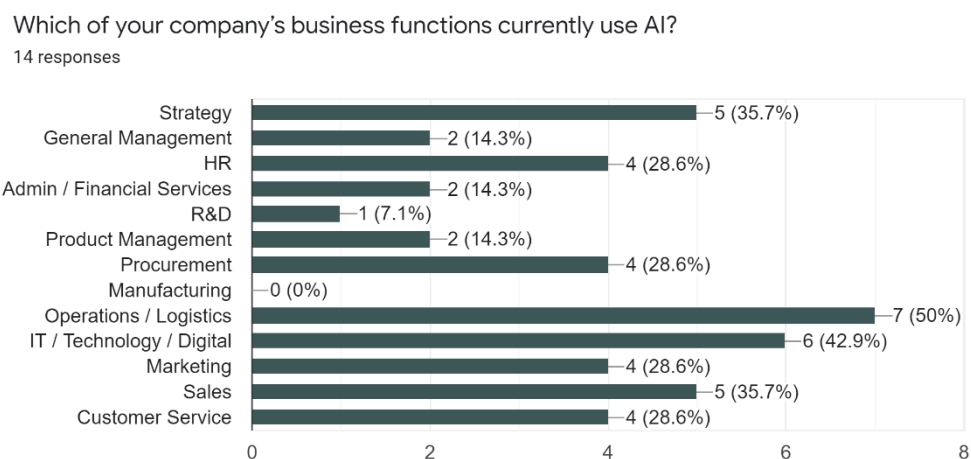
Source: Our Research

4.2.1.7.1 Investigating Company’s Business Activities Currently Use AI and Functional Diversity

The respondents represent a broad range of functions, including the classification of IT / Tech / Digital, Operations & Logistics, Management, Marketing, Sales and R&D operations. Such functional diversity enhances the research with insights into very different aspects of AI, reflecting the diversity of perspectives that affect the lens of an organization's understanding of AI (Figure 4.2.1.7.1).

The following ratios is nearly the same, and only slight differences between Turkish and non-Turkish companies. The most broadly reported implementation of AI (at 50%) was in the Operations and Logistics, followed by IT/Technology function with 42.9%, and Sales and Strategy with 35.7% for each. Then, comes the Marketing, Procurement, Customer Service, and HR with 28.6% for each. After that the R&D and Product Management come with 21.4%. Interestingly, several functions are barely using AI; as per our survey the Admin/Financial function, where only 14.3% of the companies currently use AI, and General Management with 14.3%. This is might be unexpected, due to the many uses and applicable solutions in General Management functional areas, which is not the case for the Admin/Financial functions.

Figure 4.2.1.7.1: company’s business functions currently use AI:



Source: Our Research

4.2.1.7.2 Operations Is the Field for Efficiencies

Managers in many markets are under pressures to increase productivity and efficiency in all operating sectors in difficult economic conditions – even a small percentage change could bring material tangible incentives for companies that carry large working capital financial statement. Organizations see that Operations and Logistics AI applications handle equipment and assets in a more proactive way, and improve the retail contexts in particular. AI offers deeper insights and better decisions in back and middle offices, including early success in supplier management in the non-industrial environment. Regulatory observance and risk management are early crucial points for machine learning and intelligent robotics when providing financial services.

4.2.1.7.3 Many of AI in IT/Technology Functions

As part of new technology testing and also focusing on core demands such as cyber-risk management, many early pilots focus on IT processes. AI is commonly used in R&D and Product Management (or similarly focused functions) in addition to its expected high prevalence in IT departments. This is mainly due to three factors: R&D employees are often engineers with a strong appreciation of AI, R&D and Product Management often are already focused on the experimental approach which is important to AI, and R&D often involves significant quantities of data that can be useful and lead to high promising use.

4.2.1.7.4 Some Partial Use in Group Functions

There are some ‘group functions’ where AI is low-in-use amongst the participating companies including HR, general administration and finance. Not because AI applications are not potentially useful, but because other tasks and goals are given priority.

4.2.1.7.5 Interaction with Customers Creating Front-End Data

Even heavier AI users are customer-fronting as well as business roles such as marketing, sales and customer support, which partly are motivated by their level of digitisation. Call centres, such as chatbots and robo-helper, attract new technologies

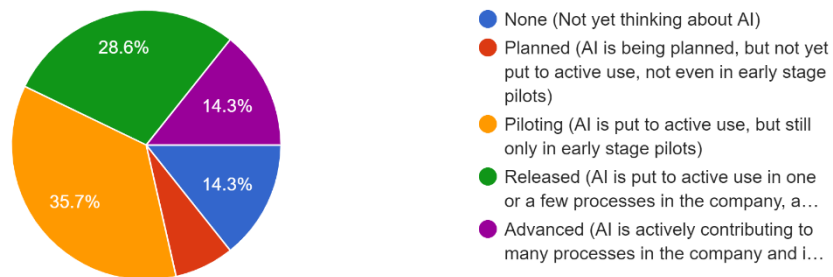
that handle customer requests and use intelligent automation to deal with outcome activity post customer interaction.

4.2.1.7.6 Interpretation of Company's General AI Maturity

The transition to AI is an ongoing journey with some organizations on their way beyond others. Most non-Turkish companies surveyed did not go beyond the early pilot stages as they were dealing with problems of early adoption. On the other hand, the majority of Turkish organizations are released, leading the early foundation stages and accelerating in the released stage, in their respective industries. And then there are these organizations that find themselves mature, since they already use AI technologies in their business. (Figure 4.2.1.7.6).

Figure 4.2.1.7.6: The degree of company's AI maturity:

How would you describe your company's general AI maturity?
14 responses



Source: Our Research

4.2.1.8 The Expected Impact from AI in the Next 5 Years:

The Turkish executives participated in the research were mostly positive about the improvements that will be made by AI (expectations ranged from moderate to high impact) within the next 5 years, with lower expectations -but still positive- for non-Turkish executives as 67% provided that the impact ranged from moderate to significant impact, will be made by AI within the next 5 years.

4.2.1.9 To What Degree Do You Expect AI Will Create Impact for Your Company Within Each of the Following Areas?

Many of the participating organizations have a wide variety of goods and services and diversified business divisions. We asked where AI expects an effect-in its core, aligned, and/or new businesses.

Impact on Core Business

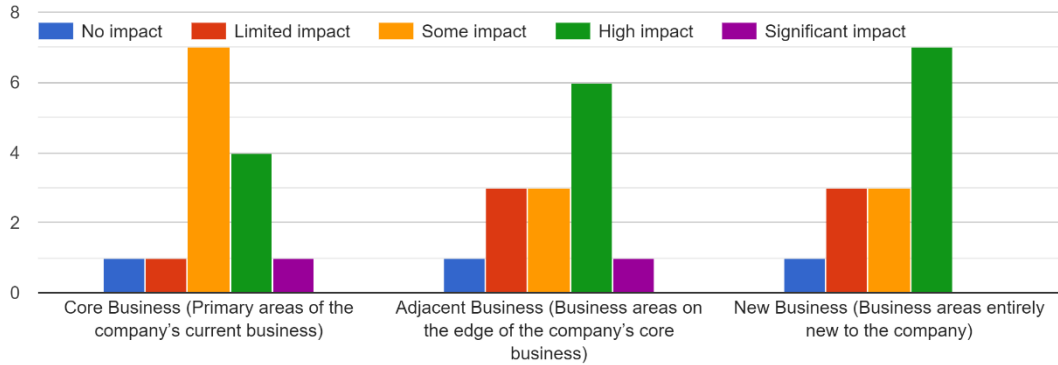
We can describe the expectations of Turkish companies for the impact of AI on core business by “moderate” with some optimistic expectations especially for the retail sector, which is one of the important indicators resulting from this research. For the majority of non-Turkish companies there are high expectations of the impact of AI on core business (Figure 4.2.1.9).

Most organizations expect AI to improve operations, deliver savings and efficiency, and implement an outstanding customer experience, which is all essential to their current business. Much is already achieved in the more digitally developed sectors, and in the next few years it is expected to expand significantly in all sectors.

The experiments on AI technologies and the learning of pilot projects offer a number of new and exciting opportunities, and the research participants are optimistic about AI's possibilities for them. The expectation is that completely new revenue flows will be unlocked when new products are split from their core submissions, and profits will be made possible by owning a greater part of value chains of the sector, and redefining them with integrated AI and digital technologies. The business community as we know it, is expected in the coming years to be unrecognizable.

Figure 4.2.1.9: The degree of impact of AI on business areas:

To what degree do you expect AI will create impact for your company within each of the following areas?



Source: Our Research

4.2.1.10 Investigating How AI Is Being Put to Use in the Company:

AI offers a wide variety of applications, widely divided between personalization, automation, prediction, prescription, and insight generation. We examined companies how relevant each was to their company, and we found some motivating perspectives on the use of AI technologies by them.

4.2.1.10.1 Prediction

From Turkish companies investigated, 40% are using some form of predictive analysis, whether to predict customer behaviour in the form of spending habits and prototypes, demand, etc, or to perform preventive maintenance to their machinery. For the 44% of the non-Turkish investigated companies, they informed that the relevant using of AI applications was in prediction activities.

4.2.1.10.2 Automation

Smart automation is acquiring more ground, and it's a popular starting point for companies who are carrying on the AI transformation processes. Automation can eliminate unnecessary activities and increase employee productivity where high-quality data occurs, as in finance and supply chain activities. In the customer service field, chatbots and rob-advisors are increasingly employed to engage customers and

cost-to-service ratios decline. For 20% of Turkish investigated companies the automation is one of the most relevant uses of AI applications, against 46% of non-Turkish companies.

4.2.1.10.3 Decision-Making Process

While 40% of the Turkish companies investigated, reported that the use of AI in decision-making processes are important. Using data, algorithms and machine learning in parallel to generate expectations that would not be accessible through usual channels, such as reporting from business intelligence, allowed AI becoming more popular and offers companies deeper insight in an array of datasets, to enhance and speed up decision-making. That was not the case for non-Turkish investigated companies, they showed no interest towards that use of AI applications.

4.2.1.10.4 Personalization

Even though both Turkish and non-Turkish investigated companies have shown no or low interest for this use, a ‘personal market reading from the researcher perspective’ see that the real situation on ground are not reflected at this point. The reason for this is that, in particular, the improved customer experience is a desired result from the application of AI technologies, especially in the retail, banking and telecommunications sectors. By the use of chatbots & personal assistants in call-centres and the adjusting of content to each interaction, these companies are aiming at obtaining insights into the customer's heart and mind in order to deliver tailor-made goods and services.

4.2.1.10.5 Prescription/Recommendation

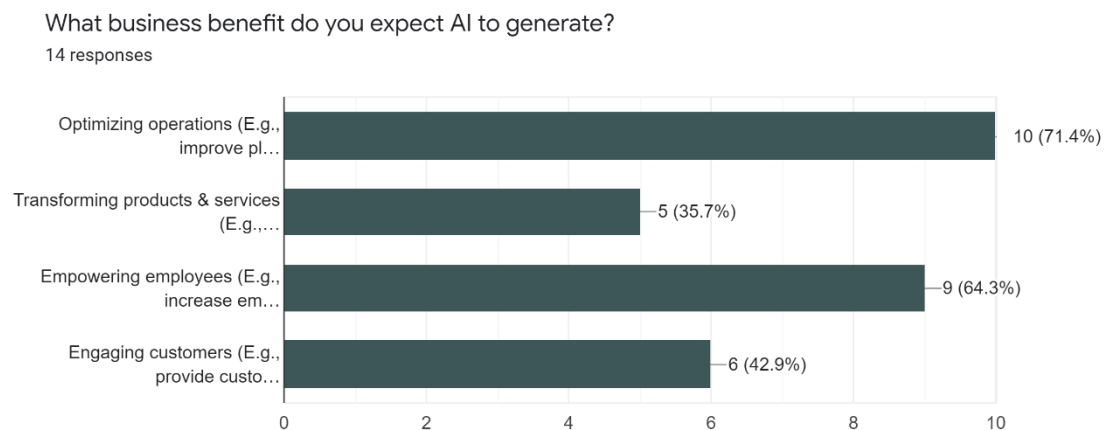
For both Turkish and non-Turkish companies a low interest has been reported for that use. Even if the recommendation to aid decision-making by using suggestion engines and recommendations, and leading employees to important insights that are essential to an optimal result, will have great benefits in the future it's not currently used by many companies. Those companies that experiment with this type of AI do so with caution, examine the outputs of the algorithms carefully, and make use of them in part. This type of AI requires the most confidence in the technology and will therefore be used slowly.

4.2.1.11 The Expected Benefits Generated By AI:

As described in the Microsoft-Digital-Transformation Framework, participating businesses -in general- expect to benefit from all four key fields: operational optimisation, customer engagement and the transformation of services and products and the enabling of employees. Each area draws on the basic AI features, the 'reasoning' of learning and conclusions with imperfect data; the 'perceptive' of data meaning including text, voice and image; and the natural 'interaction' with employees, customers and other stakeholders (Figure 4.2.1.11).

The use of AI in those fields can be transforming for a company, and ultimately changing the model of the company and its industries. The following analysis clears that benefits.

Figure 4.2.1.11: The expected benefits generated by AI:



Source: Our Research

4.2.1.11.1 Optimizing Operations Leads to Improved Production and Efficiency

60% of the Turkish companies and 78% of non-Turkish companies, have reported that optimizing operations is the expected benefit from AI. The digital transformation generally is about optimizing operations, and this is what companies consider when putting AI to action at first. It depends on some supportive technologies, such as: intelligent prediction (e.g., foreseeing non-performing products, or adaptive modelling to label corrective actions), operational efficiency (e.g., improving prediction and order-to-fulfilling streams across the value chain, or handling vast documentation

sets), deep insights (e.g., detecting fraud, or spotting new opportunity before competitors does).

4.2.1.11.2 Empowering Employees

80% of the Turkish companies and 56% of non-Turkish companies investigated in our research showed that next benefit from AI uses is enabling employees to be more capable and efficient. Several uses of AI are focused across sectors on increased productivity of employees, or on increasing human creativity and capacity to perform a specific function. In order to change the online and off-line shop layouts, conversion and sales, AI allows employees in B2C companies to extend the organizational awareness by analysing vast customer behaviour. Customers can be customized on a scale, assisted by technologies from AI that expose consumer insights in real-time, recognize the next best steps in selling opportunities and provide predictive models that provide a 360 ° view of the customer through combining customer data and attitude developing targeted offers.

4.2.1.11.3 Engaging Customers

40% of the Turkish companies and 44% of non-Turkish companies investigated in our research considering customer engagement as the realm in which to obtain most business benefits. Some well-known examples of AI applications in the customer engagement are used such as: conversational agents (e.g., chatbots offering recommendations and transactional guidance); personal assistants (e.g., leading decision-making, and reducing conversion cycles); self-service (e.g., helping customers to minimize time for determination).

4.2.1.11.4 Transforming Products and Services

20% of the Turkish companies and 44% of non-Turkish investigated companies reported that transforming products and services expect to generate future business benefits. Across R&D focused industries, where businesses see AI and advanced research as a tool to accelerate product creation and development processes, it is most important to transform goods and services, which eventually give rise to entirely new business models. In the B2C market, AI helps new services using multilingual cognitive applications, geo-location suites, behavioural analysis, cognitive robotic

advisory capabilities, personal service agencies and many other, to exceed the industry to a new extent of added-value, on a substantially greater scale and on real-time.

4.2.2 Supply Chain Management and AI

This section explores the direct effect of the application of AI on supply chain management, to understand the tangible business benefits, and to investigate the barriers, risks, and obstacles that prevent the spread of the AI technology. As demonstrated in the following subsections, we have chosen six areas of influence to measure the impact, after which a conclusion can be put. The participants to rank the impact on these areas in terms of integrating AI into their business.

4.2.2.1 The Expected Degree of Impact AI to Create on Company's Demand Management

Organizations continually need to predict the future to benefit from their competitiveness. AI enables companies to better prediction for their supply chains and develop better offers. Reliable demand forecasting is the way of using AI for digesting diverse data and adapting it to new information automatically. By which, we can distinguish trends and patterns on which we can act.

The Turkish companies investigated in our research has reflected a moderate impact of AI on demand management (which most of them responded with some-impact to high impact and one responded with limited-impact), while the non-Turkish companies has reflected a high impact of AI on demand management (as most of them responded with some-impact to significant-impact and only few responded with limited-impact). Noting that the “Don't know” has been neglected in computing the impact.

4.2.2.2 The Expected Degree of Impact AI to Create on Company's Inventory Management

Optimizing Inventory, this is where AI proves useful as it ensures that both risks of overstocking and out-of-stock are kept to a minimum secured level. An important benefit can be gained also, which is to grant access to cash whenever it is possible, so that it can be managed for other profitable activities. Another benefit of AI is it can help in assessing inventory level efficiency, AI is able to estimate the demand of

customers as well as suppliers based on the former orders with the market trend. It will result in assisting suppliers to optimize their plan and be prepared when the market gets down as they already have data about future demands through demand forecasting.

The Turkish companies investigated in our research has reflected a moderate impact of AI on inventory management (which most of them responded with some-impact and one responded with high-impact), while the non-Turkish companies has reflected a significant impact of AI on inventory management (which most of them responded with significant-impact to high-impact, and only few responded with limited-impact). Noting that the “Don’t know” has been neglected in computing the impact.

4.2.2.3 The Expected Degree of Impact AI to Create on Company’s Delivery and Transportation

In many industries, including transport, AI has been promising a dramatically increase in productivity and efficiency. AI helps to increase the safety, reliability, efficiency and cleanness of transportation.

The Turkish companies investigated in our research has reflected a moderate impact of AI on delivery and transportation (which most of them responded with some-impact and one responded with high-impact), while the non-Turkish companies has reflected a significant impact of AI on delivery and transportation (which most of them responded with significant-impact to high-impact, and only few responded with limited-impact). Noting that the “Don’t know” has been neglected in computing the impact.

4.2.2.4 The Expected Degree of Impact AI to Create on Company’s Customer Service Management

Today everything is connected, and the real-time revolution has made customers lives more comfortably, and it’s changed the way customers interact. Now, customers expect information to be available immediately. This is the very first, almost intuitive impact of AI on customer experience.

The Turkish companies investigated in our research has reflected a high impact of AI on customer service management (which most of them responded with some-impact,

and few of them responded with significant-impact to high-impact), while the non-Turkish companies has reflected a very high impact of AI on customer service management (which most of them responded with significant-impact to some-impact, and only few responded with limited-impact). Noting that the “Don’t know” has been neglected in computing the impact.

4.2.2.5 The Expected Degree of Impact AI to Create on Company’s Information Sharing and Integration

When the capacities of the company generate AI-powered insights, they have to be integrated through the business to get the benefit from. This typically involves redesigning processes to include AI insights into the workflow. This involves automation in some situations. In others, it requires the correct information to be made available to the correct staff within the company. In both cases, it is important to optimize the interface between human and machine.

The Turkish companies investigated in our research has reflected a high impact of AI on information sharing and integration (which most of them responded with high-impact, and few of them responded with some-impact to limited-impact), while the non-Turkish companies has reflected a very high impact of AI on information sharing and integration (which most of them responded with significant-impact to some-impact, and only few responded with limited-impact). Noting that the “Don’t know” has been neglected in computing the impact.

4.2.2.6 The Expected Degree of Impact AI to Create on Company’s Profitability and Overall RIO

The Turkish companies investigated in our research has reflected a moderate impact of AI on profitability and ROI (which most of them responded with some-impact to high-impact, and few responded with limited-impact), while the non-Turkish companies has reflected a moderate impact of AI on profitability and ROI (which most of them responded with significant-impact to some-impact, and few responded with limited-impact). Noting that the “Don’t know” has been neglected in computing the impact.

CHAPTER 5

CONCLUSION

It has been found that the general perception of AI and its applications in supply chain management has a positive influence. Furthermore, top management are already giving attention to learn and gaining more professional expertise in this field. They think that Turkish enterprises should be taking the initiative in adopting AI.

In our research, it has been concluded that AI is considered as one of many digital priorities, but not the most important, and only few of the Turkish organizations surveyed reported that they are "advanced" with AI. Furthermore, a noticeable potential for AI in many organizational functions has been observed.

Reliable demand forecasting, using AI for processing diverse data and adapting it to a new information automatically, helps in distinguish trends and patterns on which we can act. As investigated in our research, the Turkish companies has reflected a moderate impact of AI on demand management, while the non-Turkish companies has reflected a high impact of AI on demand management.

Optimizing Inventory, this is where AI proves useful as it ensures that the risk of out-of-stock/overstock is kept to a secured level. Whereby, it grants access to cash whenever it is possible so that it can be managed for other profitable activities. Besides the ability of assessing inventory level efficiency. As measured in our research, the Turkish companies has reflected a moderate impact of AI on inventory management, while the non-Turkish companies has reflected a significant impact of AI on inventory management.

In transportation industry, AI has been promising a dramatically increase in productivity and efficiency. AI helps to increase the safety, reliability, efficiency and cleanness of transportation. The Turkish companies investigated in our research has reflected a moderate impact of AI on delivery and transportation, while the non-Turkish companies has reflected a significant impact of AI on delivery and transportation.

Today everything is connected, and it has changed the way customers interact. Customers expect information to be available immediately. This is almost intuitive impact of AI on customer experience. The Turkish companies investigated in our research has proven a high impact of AI on customer service management and is considered the field that is most widely using AI applications, while the non-Turkish companies has reflected a very high impact of AI on customer service management.

The optimization of the interface between human and machine, and delivering the correct information to be made available to the correct staff within the company, both are considered one of the powerful benefits of the AI applications in the information sharing and integration. The Turkish companies investigated in our research has reflected a high impact of AI on information sharing and integration, while the non-Turkish companies has reflected a very high impact of AI on information sharing and integration.

To apply AI in an organization, as a part of the digital transformation process for any company, requires a huge capital investment. In addition, both Turkish and non-Turkish companies investigated in our research has reflected a moderate impact of AI on profitability and ROI. These factors explain why the transformation towards applying AI is still in its early stages, and why many companies are still in the piloting stages.

The AI applications are considered - generally - in Turkey in the planning phase, and they are not widely applied. But it has been observed that they have been applied mostly in CRM modules. One of the main reasons is that the investments are noticeably high for applying AI.

It's clear that both Turkish and non-Turkish companies, in almost each of the investigated sectors not only the retail sector, approved that they already in the applying phase of the AI in customer service area, which is the area most of the businesses start with.

Turkish companies are still either in the planning or piloting phases regarding the application of AI in demand and inventory management, while the non-Turkish companies are more advanced in this area.

For the retail warehouse management systems and control area, as our research obtained documented-data the Turkish companies are still not into this AI applications yet, while giant retailers like Amazon, Alibaba, and Walmart has proven an advanced approach regarding the AI applications in this area, such as smart-robotics and smart vision applications.

As a result of our research for the transportation and delivery, we found that non-Turkish companies have started to apply AI in many areas, like demand forecasting, smart traffic systems, and predictive maintenance as we discussed in maritime, railways, and airfreight cases. While the Turkish companies working in the same sector have applied AI in the CRM area only, and need to put more potentials in such competitive sectors.

As concluded, we found that the Turkish and non-Turkish banks almost are moving with the same speed, in applying AI in the customer service area. And both also have proven advances in applying AI in process automation/optimization, reporting, complaints handling, and document classification. While, in the areas of Anti-Money Laundering recognition and monitoring, system capacity limit prediction, fraud prevention, and cyber risk prevention Turkish banks are still in the planning stage compared with non-Turkish banks which they are in the release phase.

For the future research on artificial intelligence in Turkey, despite some limitations to this kind of researches, the conclusions are generally confirming the above-mentioned studies held by Microsoft & IBM. Furthermore, some potentials for the upcoming studies for example, a focused study on a pilot implementation of AI application(s) in demand management for different sectors in Turkey. Or, an investigation for how AI can affect and be applied in marine/airfreight sector in Turkey.

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APPENDIX

1. Name *
2. Company's name ...? *
3. Location? *
4. Your role as an employee at the company *
5. What industry do you work in? *

Mark only one oval.

- Retail (Consumer Products & Retail)
- Manufacturing & Resources (Manufacturing, Materials, Equipment)
- ICT & Media (Technology, Media/Entertainment & Telecom)
- Health (Pharmaceutical, Healthcare, Biotech)
- Infrastructure & Transport (Transportation, Energy, Construction, Real Estate)
- Financial Services (Banking, Insurance, Investments)
- Professional Services (Professional Services, Hospitality, Public Services, Membership Organization, Government Departments)
- Other:.....

Section II: Strategy and AI

6. Are you currently using unstructured or structured data types in your AI process?

Are you currently using internal or external data sources in your AI process? *

Check all that apply.

	Internal	External
Unstructured	<input type="checkbox"/>	<input type="checkbox"/>
Structured	<input type="checkbox"/>	<input type="checkbox"/>

7. Which of the following technologies have you found to be most useful in your company's implementation of AI? *

Check all that apply.

- Machine learning (computer's ability to 'learn' from data)
- Smart robotics (The combination of AI and robots to perform advanced tasks compared to traditional robots)
- Neural networks and deep learning (Machines imitating the human brain, enabling AI models to learn like humans)
- Virtual agents (Computer-generated virtual characters that can be used to interact with people)
- Biometrics (Analysis of human physical and emotional characteristics)
- Natural language processing (Computer interpretation, understanding, and generation of written natural human language)
- Computer vision (Gives computers the ability to "see" images similar to how humans see)
- Text analysis (Computational analysis of texts, making it readable by other AI or computer systems)
- Speech recognition (Enables computers to interpret spoken language and to transform it into written text or to treat it as commands for a computer)
- Don't Know
- Other:.....

8. On what hierarchical levels in your company is AI an important topic? *

Mark only one oval.

- Board of Directors level
- Executive Management level
- Managerial level
- Employee (non-managerial level)
- Other:.....

9. How important is AI relative to your company's other digital priorities? *

Mark only one oval.

	1	2	3	4	5	
Not Important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very Important

10. How would you characterize the way AI is being managed in your company?

How would you characterize the way AI is being deployed in your company? *

Check all that apply.

	Business Driven	IT Driven
Top-to- Down	<input type="checkbox"/>	<input type="checkbox"/>
Down-to-Top	<input type="checkbox"/>	<input type="checkbox"/>

11. How would you describe your company's general AI maturity? *

Mark only one oval.

- None (Not yet thinking about AI)
- Planned (AI is being planned, but not yet put to active use, not even in early stage)
- Piloting (AI is put to active use, but still only in early stage pilots)
- Released (AI is put to active use in one or a few processes in the company, and/or not supporting advanced tasks)
- Advanced (AI is actively contributing to many processes in the company and is supporting advanced tasks)

12. Which of your company's business functions currently use AI? *

Check all that apply.

- Strategy
- General Management
- HR
- Admin / Financial Services
- R&D
- Product Management
- Procurement
- Manufacturing
- Operations / Logistics
- IT / Technology / Digital
- Marketing
- Sales
- Customer Service

13. How much impact do you expect AI will have on your industry/company within the next 5 years? *

Mark only one oval per row.

	Don't Know	No impact	Limited impact	Some impact	High impact	Significant impact
Impact Degree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. To what degree do you expect AI will create impact for your company within each of the following areas? *

Mark only one oval per row.

	No impact	Limited impact	Some impact	High impact	Significant impact
Core Business (Primary areas of the company's current business)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adjacent Business (Business areas on the edge of the company's core business)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New Business (Business areas entirely new to the company)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. What are the relevant uses of AI in your company? *

Check all that apply

- To predict (Anticipate events and outcomes)
- To automate (Handle tasks without human intervention)
- To generate insights (Identify and understand patterns and trends)
- To personalize (Tailor content and user-experience)
- To prescribe (Suggest solutions to defined problems)

16. What business benefit do you expect AI to generate? *

Check all that apply.

- Optimizing operations (E.g., improve planning and reduce costs through intelligent prediction, operational efficiency, and deep insights, predictive maintenance)
- Transforming products & services (E.g., speed up product innovation cycles, enable new value add services, and provide real time support)
- Empowering employees (E.g., increase employee efficiency through predictions, enabled support, and automation of repetitive tasks)
- Engaging customers (E.g., provide customers advice, shorten conversion cycles, and reduce time to resolution)

Section III: Supply Chain and AI

17. To what degree do you expect AI to create an impact on your company's

Mark only one oval per row.

	Don't Know	No impact	Limited impact	Some impact	High impact	Significant impact
Demand Management (demand forecasting, order management ,... etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inventory Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delivery and Transportation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customer Service Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information sharing and Integration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Profitability and overall RIO	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. What are the main reasons that prevent the wide implementation of AI in the supply chain areas (Demand – Supply – CS)? *