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Master in Business Administration

Postgraduate Dissertation

The Role of Artificial Intelligence and Big Data in Digital
Transformation

Stylianos Glyniadakis

Supervisor: Dimitrios Karlis

Patras, Greece, May 2026

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The Role of Artificial Intelligence and Big Data in Digital Transformation

Stylianos Glyniadakis

Supervising Committee

Supervisor:
Dimitrios Karlis
Professor

Co-Supervisor:
Emmanouil Mamatzakis
Professor

Patras, Greece, May 2026

To my wife Charoula, my daughter Zoi, and my son Michael

Abstract

This dissertation examines the role of Digital Transformation in modern business activity, emphasising especially on Artificial Intelligent and Big Data. The adoption of Digital Transformation aims in the creation of economic value, which is the primary goal for the organizations. The research clearly mentions that the transition to digital transformation is not just a technological advance but demands the creation of the proper culture in modern economy. In the first stages, it develops theoretical framework, to a substantial extent, of Digital Transformation, Big Data and Artificial Intelligence. Also, describes the connection between these factors from the very beginning until today and the contribution in modern business administration and decision-making process. In addition, it examines the change that the digital transformation creates, the perception of big data as a resource, and the capability that artificial intelligence provides information analysis and decision-making. The theoretical discussion contributes significantly, because it is regarded as a necessary precondition for every organization to understand both the importance and the ways of implying it. The empirical part, that follows, contributes in a qualitative methodological approach via the analysis of two case studies, Amazon and Maersk. These two organizations operate in different economic environments, but the similarities and differences are clearly presented. Amazon is a modern company which operates in e-commerce, computing cloud and digital applications, while Maersk is a more traditional company, which has invested in infrastructure and capital equipment, such as ships. Comparative analysis gives the opportunity to investigate the way that digital transformation can be implemented in different sectors and business models, following similar steps. Amazon has invested in digital transformation and can predict the consuming demand and behaviour, while also developing personalized models for each customer. Maersk implies the digital transformation in order to achieve reduction in bunkers consumption, finding the best routes and the precise prediction in maintenance of its invaluable capital equipment. Finally, the dissertation concludes that digital transformation is necessary for modern businesses and that its successful implementation can lead any firm to an improved economic position, otherwise, it may face difficulties and possibly even failure.

Keywords

Digital Transformation, Artificial Intelligence, Big Data, Economics, Business Administration

Ο Ρόλος της Τεχνητής Νοημοσύνης και των Μεγάλων Δεδομένων στον Ψηφιακό Μετασχηματισμό

Στυλιανός Γλυνιαδάκης

Περίληψη

Η παρούσα διπλωματική εξετάζει τον ρόλο του ψηφιακού μετασχηματισμού στην σύγχρονη επιχειρηματική δραστηριότητα, δίνοντας ιδιαίτερη έμφαση στη συμβολή των μεγάλων δεδομένων και της τεχνητής νοημοσύνης. Η υιοθέτηση του ψηφιακού μετασχηματισμού στοχεύει στη δημιουργία οικονομικής αξίας και τη βελτίωση της λειτουργικής αποδοτικότητας. Η έρευνα καθιστά σαφές πως η μετάβαση στον ψηφιακό μετασχηματισμό δεν αποτελεί μια τεχνολογική εξέλιξη, αλλά απαιτεί τη διαμόρφωση μιας κουλτούρας στη σύγχρονη οικονομία. Αρχικά ακόμα αναπτύσσεται σε ικανό βαθμό το θεωρητικό πλαίσιο του ψηφιακού μετασχηματισμού, των μεγάλων δεδομένων και της τεχνητής νοημοσύνης εξάγοντας βασικές έννοιες. Και αναλύοντας τη μεταξύ τους σύνδεση, καθώς και τη σημασία στη σύγχρονη διοίκηση και τη στρατηγική λήψη αποφάσεων. Ειδικότερα, διερευνά την οργανωτική αλλαγή που δημιουργεί ο ψηφιακός μετασχηματισμός, την αντίληψη των δεδομένων ως παραγωγικός πόρος, καθώς και την εξαιρετική ικανότητα που προσδίδει η τεχνητή νοημοσύνη στην ανάλυση πληροφοριών και στη λήψη αποφάσεων. Η θεωρητική αυτή συζήτηση συμβάλλει σημαντικά, καθώς θεωρείται προαπαιτούμενη από κάθε επιχείρηση προκειμένου να αντιληφθεί τη σημαντικότητα του και τους τρόπους εφαρμογή του. Το εμπειρικό μέρος, το οποίο αναπτύσσεται στη συνέχεια, συμβάλλει στην ποιοτική μεθοδολογική προσέγγιση μέσω της ανάλυσης δυο περιπτώσεων μελέτης, της Amazon και της Maersk. Οι επιχειρήσεις αυτές λειτουργούν σε δυο διαφορετικά οικονομικά περιβάλλοντα, παρόλα αυτά οι ομοιότητες στην υιοθέτηση του ψηφιακού μετασχηματισμού είναι εμφανής. Η Amazon είναι μια σύγχρονη εταιρεία που δραστηριοποιείται στο ψηφιακό εμπόριο, το υπολογιστικό νέφος και τις ψηφιακές υπηρεσίες, ενώ η Maersk είναι μια παραδοσιακή επιχείρηση, με ιδιαίτερα μεγάλο κεφάλαιο επενδεδυμένο κυρίως στις υποδομές και τον κεφαλαιουχικό εξοπλισμό, όπως τα πλοία. Η συγκριτική ανάλυση δίνει

τη δυνατότητα για διερεύνηση του τρόπου με τον οποίο ψηφιακός μετασχηματισμός μπορεί να εφαρμοστεί σε διαφορετικούς κλάδους και επιχειρηματικά μοντέλα, ακολουθώντας αντίστοιχα βήματα. Η Amazon Έχει επενδύσει στον ψηφιακό μετασχηματισμό προκειμένου να μπορεί να προβλέπει την καταναλωτική ζήτηση και συμπεριφορά, καθώς επίσης και να δημιουργεί μοντέλα εξατομικευμένα για κάθε καταναλωτή. Η Maersk εφαρμόζει τον ψηφιακό μετασχηματισμό προκειμένου να πετύχει τη μείωση στην κατανάλωση καυσίμων, Την εύρεση καλύτερων διαδρομών και την καλύτερη πρόβλεψη συντήρησης του ακριβού κεφαλαιουχικού τους εξοπλισμού. Τέλος, η εργασία καταλήγει στο συμπέρασμα πως ο ψηφιακός μετασχηματισμός αποτελεί ανάγκη για τις σύγχρονες επιχειρήσεις και πως η επιτυχημένη εφαρμογή του μπορεί να οδηγήσει κάθε επιχείρηση σε βελτίωση της οικονομικής της θέσης, διαφορετικά θα αντιμετωπίσει δυσκολίες ίσως και αποτυχία.

Λέξεις – Κλειδιά

Τεχνητή Νοημοσύνη, Μεγάλα Δεδομένα, Ψηφιακός Μετασχηματισμός, Οικονομική Επιστήμη, Διοίκηση Επιχειρήσεων.

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List of Abbreviations & Acronyms

AI — Artificial Intelligence

AWS — Amazon Web Services

Big Data — Big Data

CEO — Chief Executive Officer

DESI — Digital Economy and Society Index

ERP — Enterprise Resource Planning

GDP — Gross Domestic Product

IaaS — Infrastructure as a Service

IMF — International Monetary Fund

IoT — Internet of Things

IT — Information Technology

OECD — Organization for Economic Co-operation and Development

PaaS — Platform as a Service

RAM — Random Access Memory

ROM — Read-Only Memory

SAN — Storage Area Network

SQL — Structured Query Language

SSD — Solid-State Drive

SSRN — Social Science Research Network

1. Introduction

Digital transformation is one of the most important factors that affect both business environment and society. For many scientists, digital transformation represents the next step of evolution following the industrial revolutions of 18th and 19th centuries, because its concept reconsiders the way that organizations operate. We have plenty of examples to conclude that organizations failing in adoption of digital transformation and modern technologies will face significant risks of marginalization or even collapse. We have numerous examples of large and well-established companies which fail to involve and respond in digital era, collapsed.

According to the literature Sibel (2019), digital transformation is the result of combination of four pillars: Big Data, Artificial Intelligence, Computing Cloud and Internet of Things. The purpose of the dissertation is to investigate and answer questions such as: What is Digital transformation? Why is considered so critical for modern business? What steps and strategies should be taken to achieve it? What are the ethical and social affections and implications from the use of Big Data, Algorithms and Artificial Intelligence in decision-making?

As it is mentioned before, Digital Transformation is a result of four pillars. This Thesis focusses mainly on the contribution of Big Data and Artificial Intelligence and the important role they play in modern business activity, which is evolving rapidly. References in the rest components, Computing Cloud and Internet of Things, are made in an attempt to provide the whole picture and understanding of their contribution in digital transformation framework.

This Thesis provides an extent analysis of two internationally recognised organisations: Amazon, which operates in the retail sector and Maersk, in maritime and shipping industry. The two companies can be considered as representative examples for within their industries, as they pioneer in digital transformation adoption. The economic and financial result evident their decision to implement the transformation into their operations and culture. Amazon Web Services (AWS) provides unlimited computing and storage capabilities, creating new paths since 2000s for the collection, stores, processing and analysing data at low cost, high security and extreme speed. The revolutionary procedure provides minimum infrastructure investment for any company, because no servers required

for running the business. Also, the actual needs of companies in computing force and storage lower the cost and gives the possibility to anyone to operate. Amazon is a global leader in retail sector, where the adoption of digital transformation provides the efficient inventory management and improves customer service. On the other hand, Maersk is the world's leading company in shipping. It has invested in advance technology and data analytics that offer an effective management of supply chain. Valuable insights into both benefits and challenges are connected to digital transformation.

Furthermore, the research contributes to understanding the level of Digital transformation in our country, Greece. Both in business and public sectors. We will see that the results are not predicted.

The Dissertation begins with the historical events of digital transformation, which origins go back several centuries ago. It examines the first challenges in recording and managing of data and the methods that we found to anticipate in these challenges. Starting with recording in clays by the ancient Sumerians to today's unlimited cloud of storage capacities of AWS and other providers. The evolution of information management is extremely fascinating. The analysis continues with the Artificial Intelligence back story the training of the machine learning from solving complex problems to decision – making using Big Data.

Except from the benefits of the Digital Transformation, challenges, risks and drawbacks also emerged. The increasing use of data, algorithms and automated systems concerns part of society. Also, Artificial intelligence's intense use in decision – making concerns, creating scenarios in substitution for human judgement or reproduce biases embedded in their training data.

Digital transformation may generate challenges within company and cultural changes, because it requires new skills different roles and changes in traditional processes. At the same time, the automation of specific processes may create challenges regarding employment and the role of human factor in organizations. It becomes evident that digital transformation is a strategic process in organizations with social implementations which requires planning, responsible management and evaluation of every step. Companies must decline the concept of technological advance, because as we can see below, digital transformation is way too more than that.

Although the topic of the thesis primarily is associated with the fields of information technology and computer science, it is closely connected to business administration science.

Digital Transformation can contribute to a substantially extent in improving management of every type of operations. Furthermore, it can enhance the effectiveness of managerial decision-making and reduce the risk of mistaken human made. After reading of this Thesis, everyone can understand what Digital Transformation, Big Data and Artificial Intelligence really are, how they connected and why they are considered crucial factors of present and future organizations.

2. Theoretical Framework

2.1 Artificial Intelligence (AI)

Artificial Intelligence is one of the most advanced technological developments in a vast area of applications. It reshaped the term of digital transformation and refers to the ability of computers to perform tasks that traditionally need human interference and action. Machine learning through data, problem solving, predictions and decision-making process are among them in business fields. Artificial Intelligence has evolved from a scientific concept to one of the most crucial factors of economic value creation in the modern business environment.

Artificial Intelligence first emerged in the mid-twenty century, when scientists began to think of developing machines that could replicate human tasks, such as thinking (Agrawaal, Gans and Goldfarb, 2022). Early approaches to AI focused on rule-based systems via algorithms, which attempted to code human commands in a form that computer machine could understand and process. This process was clearly inspired by the first desktops, that replicated a real office. The first limitations were the lack of sufficient computer force, storage, the absence of proper volumes of data and the incapability of machines to process modern and realistic situations. The emerge or revival of modern AI was a combination of three factors. First, the rising power of computing power, mainly in processing of data and cloud, which allowed the development of complex models. Second, the increase of storage of great volumes of data, that we call today Big Data and third, the advances in algorithmic designs, like machine learning, which make it possible to extract and process data from large data bases with accuracy and velocity. In this Thesis, Artificial Intelligent should no be considered as an advanced technological tool, but a technological example that redefines how organizations operate, coordinate activities and make decisions.

In business, AI is based on its ability to solve complex problems and make decisions in an environment of uncertainty and low possibilities and only in copy of human intelligence. AI systems support organizations to make faster, well informed and more accurate decisions.

One of the most important matters of Artificial Intelligence is its role in the reduction of cost of prediction. Agrawaal, Gans and Goldfarb (2022) argue that the economic value from AI increases a lot from its capabilities of generating accurate predictions at low cost.

As predictive accuracy increases, economies of scale decrease the marginal cost of predictions. Organizations can reconsider the decision-making process. In other words, GPS, which use AI to predict the best route for you, cost almost nothing nowadays in contrast to previous years. This change has serious implications for companies' structures, resource finding, and distribution in labor between humans and computers. When predictions become cheaper and more reliable, companies are fond of adopting AI in an automatic or semi-automatic manner and make their decision-makers focus on judgement that require understanding, ethical consideration and strategic insights.

It is pointless to say that artificial intelligence eliminates human factors, instead, it enhances it by reducing the mistakes and providing more efficient time. In other words, it changes the environment of human work.

Artificial intelligence has evolved through many applications. The most well-known is machine learning. Machine learning is a category of artificial intelligence and refers to computational techniques that develop systems to learn from data without being programmed for every possible result using patterns from historical and present data, instead of predetermined rules as previous times (Agrawaal, Gans and Goldfarb, 2022). Modern models of machine learning are continuously fed with new volumes of data, and their performance tends to improve, allowing them to become faster and more accurate in their predictions. The change from models, which used strict rules to perform tasks to machine learning, is the real evolution of Artificial Intelligence. Traditional models required programmers to codify every step, to give specific orders in advance and to extract results faster. The concept of machine learning is the creation of code by the computer itself, identifying and using the proper data sets. This enables organizations to respond easily to variability by updating predictive models as new data becomes available. This capability has made machine learning invaluable in business functions. Applications forecast demand and supply, pricing adjustments, credit risk assessment, customer segmentation, fraud detection and supply chain optimization. As a result, machine learning has become a pillar of data driven decision making process.

Artificial intelligence, through machine learning and all the other applications, is not just a technological challenge. The digital transformation literature highlights that AI can provide sufficient results, in business, when the organization adopts the proper structure and strategic framework, as it is widely reported culture. This culture is created by alignment of managerial capabilities in implementing AI technology and lead the employees to be taught

and follow, data quality and strategic framework. Only then does AI the organization has the possibility to adopt it and lead to measurable performance improvements. Organizations that adopt artificial intelligence in a more supportive way often cannot achieve remarkable results. Artificial intelligence must not be used as a tool which aims to make the project or work faster, but to increase the strength and capabilities of the current resources and strategic goals. To achieve full potential of AI the organization must understand that this technology must be a main component of daily procedures and decisions.

The development of technology has given to business world the evolution of machine learning and neural networks. Neural networks are sophisticated models, inspired by human brain networks. There are the widest known parts of AI working systems. Following the structure and functioning of human nerve system, they consist of interconnected artificial intelligence neurons organized in layers, where each of them processes inputs and extract outputs, transmitting them to the next layer. Traditional models, as is written above, operate with predefined coding, but neural networks learn directly from data. As an example, when it is needed to train the machine to recognize a cat, countless photos are given. Every stance, every color, every type, all parameters. As a result, the machine, through these layers, can understand and identify a cat. We presume that the cat is only the slightest problem. When we feed the machine with human data, we create an auto drive car, which can protect pedestrians.

In business, the adoption of neural networks provides a revolutionary strategy in decision-making. Now, we anticipate automated decisions and are not supportive. Traditionally, the organizations were based their strategies on statistical models. These models often require strong, or better significantly strong, assumptions about data distribution and causality to provide predictions. These assumptions are not always possible to be provided in uncertain business environments. Neural networks process historical and present data in a way that patterns, unknown to humans, can support crucial strategic aims such as customer behavior analysis, demand forecasting, risk management and pricing policy.

Exploiting the raw computing power, we possess today and large scales of data set, scientists made one more step further, deep learning. Deep learning is neural networks, which consist of many more layers, capable of performing even more complex tasks. These deeper systems allow us to process information at multiple levels of abstraction, making them more effective in processing unstructured ‘‘messy’’ data, like photos, audio, image

and video. In business, deep learning plays a major role in the evolution of AI technology, as it caused several changes in a wide range of applications. This revealed the real capabilities of AI in organizations. AI solutions, including speech recognition systems, computer vision applications, natural language processing tools and advanced recommendations engines. The companies use widely these technologies to serve customers, manage their operations, and deliver products and services in a more individual way. Deep learning lies on the abilities of organizations to expand their capabilities not only to improve business performance.

Deep learning opened paths that allow firms to extend analytical insights into areas that previously did not have access to traditional data analysis techniques. According to Siebel (2019), deep learning plays an important role in digital transformation initiatives, because it allows to transform raw data into knowledge. In modern organizations, which have already adopted digital transformation, data are not only stored to be used somehow in the future but are actively analyzed in real time to support predictions and ultimately decisions. Deep learning is a great weapon in the hands of managers, which support this transformation by processing historical and present data and generating results that are very useful to extract information for operation functions. Despite these benefits. The adoption of neural networks and deep learning systems introduces important challenges that organisations must attend. The managers sometimes cannot understand how specific results or predictions have come. Due to models' operative complex systems. This difficult or lack of understanding can create barriers and decline of acceptance of AI, especially when decisions are connected to the most important economic components, such as financial, human resources, operations etc., ethical or legal matters. For this reason, organizations must balance the results of AI for accountability, validation and accuracy. Another consideration is the organizational capabilities of adoption of AI. Successful implementations require high quality data bases, experts to process them and the collaboration between scientists and managers to encounter the challenges and increase the economic value. Businesses that neglect to anticipate the necessity of using the proper steps in managing and science often fail to produce economic value, risking investment in technology. Testing and creating pilot projects step by step provide possibilities for success. Neural networks and deep learning should be understood as new technologies, which must be fully implemented in business functions and integrated into organizational processes and not as simple solutions for daily problems.

As artificial intelligence technologies continue to involve and adopted by organisations, their role goes beyond predictive analytics into more advanced forms of operational contribution. In recent year, the concept of Agentic AI emerged. Agentic AI is an AT system, which possess the capability to plan and execute actions on specific objectives, rather than creating recommendations and predictions (Stryker - IBM, 2025) . Unlike the traditional systems that could work only as advisors and rely on human support, agentic AI can proceed in semi-autonomous solutions, acting like agents. These systems can monitor and manage tasks. Interacting with companies, information systems and executing operational actions within fixed constraints. AI participates actively in modern business, not just as advisors but as process agents who help personnel in execution of business operations. Agentic AI expands the capabilities of AI across business beyond predictions to an operational factor that can influence how work is performed daily. This change has important implications for organizational design, control systems and managerial responsibility.

As AI becomes to play an important role in modern business activities questions arise, that are related to accountability, governance and human understanding. Research shows not all organizations successfully integrate AI and turn its capabilities into economic value. Companies that adopted successfully AI into their business operations achieve better performance than those in early or experimental stages. The difference in performance level can be easily seen in productivity, quality in decisions, operational efficiency and managerial agility. To create economic value by implementing AI does not automatically, it takes time to create the environment to build this new world and bring it to the organization. It needs strong managerial will and capabilities, effective governance of data, cross collaboration among departments and new strategies to lead.

At macroeconomic level, artificial intelligence has also contributed to global economy. It has been considered as a potential leader in productivity growth, innovation and long-term expansion. It is expected to influence global economic growth over the coming decade, as various studies estimate. Because of the extensive adoption of artificial intelligence, economies can increase their GDP, primarily through efficiency gains, process automation, creation of new jobs, products, services and business models. The global GDP is already increasing from new technology adoption. Artificial intelligence adoption will enable organizations, on a global scale, to use their resources more efficiently, to reduce operational errors made by human and old procedures, to anticipate in new challenges and

to create new sources of value. The creation of economic value for every company is supporting the theory of global GDP increasing.

Despite the benefits and the gains of artificial intelligence, there are several challenges and limits that organizations and economies must anticipate, as they increase. There are big differences in adoption of technology across companies and nations. They have not equal access to new technology. The lack of skilled labor, scientists and expertise is another difference and barriers of bigger organizations to maintain all the gains through AI can limit other companies' entry in digital era. The benefits of Artificial Intelligence may be distributed in a less equal way, raising concerns related to economic inequality and labor market disturbances.

These challenges require organizations, policy makers and educational institutions to collaborate and work together to increase the digital sources and make sustainable the equal transition to a digital reality for every company and country.

The strategic integration of artificial intelligence within organizations goes beyond using advanced algorithms and data infrastructures. Technology is the protagonist of artificial intelligence but is not only that. Is not sufficient to achieve the wanted economic value. It needs to be embedded in the core of organizations operations and functions. Organizations that use artificial intelligence as an auxiliary analytical tool often fail to seize its full potential. On the other hand, organizations that redesign their workflows, decision making systems a culture to adopt artificial intelligence and the gains that will offer, limiting the challenges, it is more likely that to achieve increase in margin revenues and reduction of cost. This strengthens the view that artificial intelligence should be understood as an organizational capability, a holistic change in how the leadership, managers and employees think and work, and not as a technological solution.

Except from operational efficiency, artificial intelligence can increase the comparative advantage of the organization. Faster and more accurate predictions by artificial intelligence, the firms can respond more effectively in market changes, estimate customer behavior and optimize production according to demand. The comparative advantage will come as the organization will develop key capabilities, that are different for competitors to replicate. However, such advantages depend on continuous learning and investment to adopt artificial intelligence, as it evolves rapidly.

The integration of artificial intelligence also generates important challenges, as AI systems affect decisions and actions within organizations. The need for dynamic

government frameworks becomes more important, these mechanisms can prevent issues in domains such as data quality, model validation and ethical challenges. Organizations must establish clear rules regarding the responsibilities of human decisions makers versus artificial intelligence systems.

Ethical issues also require the attention of any organization and nation, since artificial intelligence may affect privacy, fairness and bias, particularly when the decisions made by AI uses personal data and judged by humans, individuals or groups. Organizations must ensure that the applications of artificial intelligence they use respect the societal norms, legislation and human values. It is fully understood that new departments must be introduced, within organizations which occupy themselves with these matters.

The effective use of artificial intelligence needs the management to understand how the results of machines must be interpreted by every employee and not only by expertise. The managers must enhance subordinates' insights about judging predictions and decisions, limitations and ethical issues. The managerial perception of this is very important and highlights the need for new skills and continuous training. The most important is to cultivate the proper culture in the organization to fully succeed in artificial intelligence integration. These collaborations between technical and managerial partners are, perhaps, the most important factor to lead in AI era. The limitations of adoption of artificial intelligence within the company are, at first, the resistance of the managers themselves, as following the former practices and techniques for many years is very difficult for them to abandon their experience and skills for something new. Also, persuading their subordinates to proceed in change is even tougher.

Artificial intelligence is most effective when combined with significant investments in data infrastructure, process design, applications and cultural change (Agrawaal, Gans and Goldfarb, 2022). This is the final form of digital transformation, which is based on strategic change and not only in technological advance. Artificial intelligence will boost the transition in digital transformation and sustain benefits. Each company must define the current level of digital transformation and the future one, depending on what are its needs and how much the economic value can increase through this process. Differences in maturity, resources availability, environment and competition can affect the level of digital transformation can be achieved. AS a result, organizations must adopt a more defined and framed approach to AI strategy, adjusting their efforts in implementation to their specific needs and priorities.

In conclusion, artificial intelligence is one of the most important pillar in transition to digital transformation. Its value lies not only in technology and trend, but in something deeper. The strategic integration of processes, functions, operations, decisions, structures and governance frameworks. The evolution of artificial intelligence from machine learning to neural networks, deep learning and agentic AI is a signal that is embedded into companies, and its affection goes beyond predictions to active participants.

2.2 Big Data

The development of computing power and the capability of collecting, storing, processing and analyzing large scales of data sets changed fundamentally not only the way we technological frameworks and digital systems, but our picture of the world. Patterns of everyday life, such as knowledge and behaviors have been influenced by data use. Historically, societies are based on data and collect information to increase economic value. Nowadays, this perspective has not changed a lot, because the goal is the same. The changes from these eras are in speed, scale, accuracy and the organized process of exploiting data, the strategies.

Historical evolution of data provides sufficient evidence on how important ever was for humans to record information, either for memory or for future processing and analysis. This recording goes back to prehistoric periods. From the earliest stages of human history, societies developed many possible ways to gather information, even before language invention. This was to preserve knowledge from the past, to support decisions to coordinate economic data. The first forms of data were the symbols on clays, stones and bones, for transactions, administrative, and religious purposes. In the ancient civilizations of Mesopotamia, Egypt and China, data recorded evolved even more with the development of written systems. Written systems were invented and used for this reason, to record speaking data. Archeologists discovered ancient Sumerian clays, which served as instruments to record economic data, demographic counts, trade transactions and debts, enabling more effective management of these early societies. These data records were primitive, but the systematic collection of information remained unchanged over time. The Industrial Revolution constituted a revolution in data collection, leading the way to modern data science, through the creation of first statistical models (Mayer-Schönberger, V., & Cukier, K., 2013). Since industrialization and urbanization emerged, the need of collecting data to

control increased production, handle the workers' performances and consumption. This era was significant for data analysis. After that, the twentieth century and the appearance of the first electronic computers increase our ability to collect, store and process data and acquire information. Data began to be stored, processed and analyzed at radical rates, allowing vast volumes to be collected and the need of Big Data emerged. The final step to what we called today Big Data was the invention of the internet in the early twenty-first century, which led to mobile phones, social media and anything we use today (Mayer-Schönberger, V., & Cukier, K., 2013). And the world was never the same. For the first time in human history, organizations were confronted by high velocity and variety and not just large scales of data. Data now are considered as assets and resources, which pioneer in new strategies and not just a scientific tool.

The concept of Big Data extends beyond large scales of information and constitutes the bridge for modern companies to collect, store and analyze them to enhance their decision-making systems, to correct human error and ultimately to proceed in digital transformation. The historical evolution of data recording proves that despite the technological changes and the stages that performed, the central role was ever the same, as a tool for organizations and societies to control and forecast.

Historically the ability to collect and store data was very limited, due to insufficient computing, mainly power and storage. Although, theoretical knowledge and methodologies emerged. We managed to extract interpretations from data through mathematical models and statistics. From a large population, scientists succeeded in predictions by using smaller samples, minimizing the errors. In the contemporary era, data processing reached a level that reshaped the role of statistics. Modern data scientists and engineers no longer focus on sample analysis but aim to process population level datasets. The concept of $n = \text{all}$ has become more common and widespread, as allows for the substantial reduction, or even eliminating the error, that statistics should consider in their models. This can lead to safer, more accurate and faster predictions. This change has a direct impact on modern business.

Data are used largely by economists in modern economies to predict several economic phenomena, such as fluctuation in prices, stock return, demand and supply patterns, and other financial indicators. This precision and accuracy can improve our perspective for global economy and to aim countries to prevent crisis and economic disorders (Mayer-Schönberger, V., & Cukier, K., 2013).

Data is generated and collected in several forms, for example audio, video, excel, images, sensor-based measurements and texts. It is reasonable to expect insufficiency, error, inedible form, and missing value. The importance of data is that any data can be found, despite the form is invaluable and we can extract information from this. This is the concept of data, even in ‘messy’ condition (Mayer-Schönberger, V., & Cukier, K., 2013). Scientists and organizations tend to prefer large data sets even in this condition. The objective is to collect data and process them effectively in imperfect conditions. With the term of Big Data, someone would understand very large, or even unlimited set of data. But it does not work like this. Big Data, indeed, are very large in scale and continuously generated in complex forms. They are collected from multiple forms and sources and are structured and unstructured. Their management constitutes technical challenges, data loss, and uncertain quality and quantity. Without appropriate techniques and tools, Big Data can become misleading, dysfunctional and rendering useful storage. So, without the advance of technological expertise Big Data cannot be processed efficiently. The solution is to distribute the analysis in several computing systems and analyzed in parallel, instead of processing all by a central computer. This procedure decreases the time needed and makes the analysis of large scales of data more feasible. Technologies such as Hadoop and Apache Spark are created and developed for this reason, enabling organizations to use data that is unusable. Storage is the other main pillar for collecting and analyzing data. Traditional systems are gradually replaced by clouds for actual storage and databases such as NoSQL and data pools, which offer adaptability and processing capabilities. These systems have the computing power to store data in row form, even when it is not fully structured (messy) or have any kind of forms (audio, image, video, text, etc.), enabling cleaning and analyzing at later stages.

The ability of using technologies from employees with companies is another challenge, like artificial intelligence. Even though the modern machines can perform several multitasking procedures, the process from common users is still problematic. Employees should be trained properly to anticipate in big data environments and to ensure that using data will be a familiar and comprehensive task. Still SQL remains the most practical and well used language for analyzing Big Data. Many modern systems support the execution of language, which is similar to SQL on distributed databases, making the technological gap even smaller. Organizations accept the fact that Big Data are often incomplete, insufficient and

unstructured and attempt to filter and analyze them to give them a form, through proper tools to extract meaningful information.

One definition of great importance in statistics that would probably change in Big Data world is correlation. Correlation is the connection between data variables. Correlation is evident when the data sets are limited, like a sample. A strong correlation between two or more variables means that the change in figures of one affects the others. For example, smoking is correlated with cancer or heart problems. Statistically, the more a smoker consumes cigarettes, the probability of anticipating such health problems is increasing. The point is that even though this statement is statistically significant and the probability strong, it is only a possibility. Not all smokers have health problems. The concept of Big Data does not consider correlation. The data are strong and there is no need for possibilities. There is so much data that in future there will be several reasons for health problems that we cannot connect them logically. In Big Data world correlation is often treated as sufficient evidence for extracting conclusion without the need to explain why a phenomenon occurs anyway, opening a whole new thinking in humanity, which tries to explain the correlated variable with logic. This does not mean that causality becomes irrelevant, but in business that would be a dangerous mistake. Many business predictions and actions matter more, without the need for full explanation of every relationship. This constitutes the revolution that Big Data brings to our world, the lack of causality. This is a tremendous concept, if we think that, science as definition, tries to explain the reason for something.

When we proceed in understanding the science of Big Data, we must understand the difference between digitization and datafication as Agrawal, Gans and Goldfarb (2022) argue. Every handmade manual that is transferred to computer is an example of digitization. However, the fact that content from handwritten is transferred to digital form is not useful data for analyzing procedure. Datafication is a term that refers to the transformation of raw, unstructured information or even messy into data that can be analyzed. Google scans every document and book in digital form. This does not happen for reading books from our mobiles, everywhere. It uses all this material by gathering words, grammatical phrases and patterns to train its translation systems and become more genuine across multiple languages. GPS systems also collect and evaluate data to propose more efficient (economical or faster) routes for the drivers. Our smartphones are the sensors, which transmit data in real time regarding the traffic. Also, our smartphones provide data, which are transformed into information regarding our trends, behaviors and demands. Social networking applications

and digital services produce, also, enormous volume of content. Personal preferences, social relationships, emotional states and interactions, all are data that are to be transformed into information.

From the experience regarding Big Data theory and application in every aspect, from organizations, societies or even economies, we conclude that data can be reused countless times and they are never useless. Data can be used by several types of scientists or organizations to extract different information. The same data from the mobiles inform us about the time we need to reach our destination or the consumption of fuel or the traffic. This characteristic gives data great economic significant and enables several forms of value creation, because data can be sold and purchased from many types of organizations. Also, data is never useless. Even the slightest bit of information that can be extracted from data can be very helpful. Google, for example, gathers information from incomplete or mistaken search results to improve its search engines. Repeated mistakes and poorly formulated queries constitute valuable learning material for its algorithm, contributing to the development of features such as autocomplete and improving user's experience. Furthermore, the residuals of data, called data exhaust, are very important sources of information for business. To understand what this category of data is, we can examine an example of Amazon, which uses its learning machine to estimate how much time the users spend searching for a product, or how many times this product was searched or occurred by chance. This historical data generates a strong competitive advantage for organizations, which possess this and constitute barriers to any possible competitor. It requires extremely managerial and technical capabilities on valuation of this data.

The value of possessing large databases is obviously invaluable, as this thesis argues, even though it is not considered as intangible assets. Based on the above, Big Data is characterized by large volumes, reusability and the ability to generate value in multiple ways. Data can be sold from many organizations, creating economic value even in this manner. There are organizations which possess databases, but they don't use them for own purposes, because they have not the technology to do so, or the mindset to put them in operation. Other companies do not have the proper data for predictions or analytics but have the tools to do it. These companies use data from others or occupy to analyze data for profit. There is one more category of organizations, which has developed the mindset. The ability to foresee the value of data and to understand that exploitation can affect their margin profits. This is exactly the point and the most important argument of Big Data. Only the

mindset counts. When the company adopts the proper mindset and realizes how important the role of data is in its function, there are several ways to acquire data and the technical tools for analyzing. This strategic willingness makes the difference in modern business activities. The managers must understand the importance of the matter and pass this mindset on to their subordinates, in order to create economic value. This third category may prove to be the most significant, since strategic vision and managerial culture are often more decisive than technology itself.

Wide use of Big Data raises challenges regarding ethical and legal concerns. The collection, storage, process and analyzing of personal data may lead in construction of individual profiles, without, of course, the consent of the individual, for commercial, administrative and even security reasons. Decisions are made, based on predictions through the power of data analysis, regarding crime prevention. Some police departments in U.S.A, for example, use data analysis to prevent crimes, creating individual profiles of suspects, based on statistics. There are cases where they were right, but others were wrong. The central issue is that processing of personal data may goes beyond the original purpose for which those collected and that affect the privacy matters. Within European Union, data protection regulations are applied and accompanied by severe penalties for violations. Data governance remains of the most important challenges of modern times, because the multiple usability and reuse of it make protection very complex.

Another benefit of Big Data analysis applies in society and goes beyond technical ethical matters. Data is not used only for business purposes, but the effects can be returned to improve our lives (Mayer-Schönberger, V., & Cukier, K., 2013). A common example is Google, collects data from every user interaction, such as searches and geographic locations to provide extended and detailed maps, accurate navigation and real-time traffic information. These services, obviously, are benefits for our society and our lives from this secondary use of data.

Claude Shannon introduced the concept of information and not only proved its existence but managed, through mathematical models, to count it. The bit represents the smallest possible unit of information, which reduces the uncertainty. The operational logic behind computers is based on Shannon's theory, as computational processes rely on the binary method. While the bit refers to a very small and theoretical side of information, the byte is used in practice as a unit of storage for measuring data volume in digital systems. In Big Data theory volume is measured in bytes, but the real value is the information and

knowledge is extracted. Storage is very critical in management procedure of Data, as it affects not only the speed of processing and reliability but its very existence and the capability of utilization. Historically a very large range of storage capabilities have been created for this reason. RAM is the most common and is created and used for temporary storage of data, for fast speed in analytics. ROM supports a more permanent type of storage, and it is essential of operational instruction. SSD is the common hard drive disk, either internal or external and offers faster read and write capabilities, than the previous forms of hard drive disks. This storage type is very suitable for Big Data applications, which require rapid access to large databases. NAS systems provide centralized storage connected to the network, while SAN systems provide faster storage access for large companies and data centers, when the demand is extremely high. The latest and most sophisticated tools that provide almost unlimited storage is Cloud. Cloud services use internet to remotely store data everywhere. Cloud services don't require a real object to store data in, but offer flexibility, scalability and the capability to create applications through the system for managing the data. This revolutionary technology is provided by colossal companies, such as Amazon, at very low price, allowing every organization to handle large volumes of data, without investing in physical infrastructure. Cloud computing has become the dominant solution, as it supported both large-scale data storage and distributed data processing on a global level. Amazon, as it was mentioned above, succeeded in the exploitation of such infrastructure, which in an effort to improve its internal functions, created the first cloud application in early 2000s. The infrastructure evolved and led to the creation of Amazon Web Services in 2006. The impact was so high that the CEO Jeff Bezos became one of the richest people until today. Amazon Web Services (AWS) provides storage and computational services to millions of users and organizations worldwide at highly competitive cost. The increasing speed in process and the unlimited storage capacity enabled by such infrastructures were the first big steps of Digital Transformation. Large companies found the way to manage Big Data through, cloud and similar applications in order to foresee the benefits of Digital Transformation and increase their economic value.

In conclusion, Big Data constitute one of the most important pillar of modern business activities, as the benefits are countless. From the historical evolution of information recording to the limitless capacity of cloud, data was ever massively generated and created value. As the technology thrives even more information can benefit businesses and societies in a more actionable way. Even if the technology support the collection, store, processing

and analysing data and advanced analytical tools and infrastructure, it is profound that the cultivation of the proper mindset and culture can lead in perfect exploitation. Big Data functions as a critical catalyst for informed decision-making and the creation of sustainable competitive advantage, forming the foundation upon which advanced technologies, such as artificial intelligence, are developed.

2.3 Digital Transformation

Digital Transformation is not a simple sequence of technological developments. It constitutes a deeper change of thinking and culture in decision making process and organizational functions, using the technology in the main core. It affects business operations and society, in general. As is already mentioned above, Digital Transformation is a result, based on four pillars: Big Data, Artificial Intelligence, Internet of Things and Computing Cloud (Siebel, 2019). The main object of Digital Transformation is to create economic value for the organizations, to expand their business and develop their activities. It must not be considered as a trend, because it demands a tremendous cost for its application. Also, the adoption of technological methods does not constitute a transition in Digital Transformation, but it must be embedded into the core of actions, functions and activities of the organization to achieve its full potential in decision making process and efficiency.

The evolution of Internet is clearly one of the most important events of the modern era, because it has reshaped the ways that data are being generated, exchanging and applying. The beginning of internet goes back to the late 1960's, with the creation of ARPANET, a researching tool, which it developed for safer and reliable transfer communications between computers. In the next decades, communications protocols, such as TCP/IP allowed the connection between individual networks to a global system. The development of the world wide web in the late 1990's is considered as a great change, because it gave the chance to any individual to have access to the internet, extracting it from the exclusive use of academic and researching societies.

The introduction of graphics interface of the users and the easy operating systems contributed to the rapid adoption and expansion of the internet. One major factor of this expansion is, without a doubt, the spread of personal computers in 1980. Before the mass

expansion of personal computers, computing systems occupied entire rooms, because their dimensions were enormous. Also, they were used by a small community of people, such as researchers, academics and business personnel who wanted to perform basic arithmetic calculations faster.

The mass expansion of personal computers changed the life of each person, contributing to the introduction of them in our lives, affecting and enhancing our capabilities in programming, decision making and business controlling. The new technologies from typing digitally, managing files and graphic designing increased the managerial functions for even faster and safer decisions.

These changes led scientists to think about a concept with more computing independence, Artificial Intelligence. A concept of how we can train our machines to process the given data and extract useful information. Also, the development of search engines allowed us to acquire access to information and knowledge and the instant communication through e-mails and digital applications for instant exchange of messages, shifted our way of thinking. Organizations adopted gradually digital technologies aiming in improvement of operational efficiency and functional effectiveness (Siebel, 2019; Westerman et al., 2014). A characteristic example of digital technology adoption is the banks, which have already proceeded in digital transformation through provision of digital applications in services. Physical transactions and great delays have significantly decreased as the majority of transactions are performed by digital applications, allowing faster transparency and the security of money. Also, the investment management platforms and digital banks emerged, enabling financial transactions without the direct involvement of traditional brokerage institutions. Increased competition within the financial sector is expected to lead to more flexible products and more favorable conditions for consumers.

It is most necessary to separate the terms of digitization and digital transformation, as the two concepts are often confused despite referring to different levels of organizational change. Digitization has offered important improvement in business efficiency, allowing the automation of functions and operations and management of information. Digitization refers to the whole transition of analog procedures and methods, such as the use of written documents into digital forms, and the enhancement of existing workflows through technology, without changing the core of the business model. Dion Hinchcliffe noted that digitization involves using digital tools to automate and improve the existing way of

working without fundamentally altering it. Consequently, digitization constitutes the first and necessary, but not enough, step for the transition in digital transformation. The increasing of economic value and the general development of any organization demand not only focus on digitization, but the adoption of proper business culture, the innovation in strategic model and operations. However, the cost of innovation and investment in digital technologies involves a high level of uncertainty and risk, particularly for those that have been operating within a specific industry for a long period of time and have invested substantial resources in established processes and technologies. There are organizations, like Mearsk which will be analyzed later that managed to gain advantage through digital transformation, despite the risks and uncertainties. Others, like Nokia, which was the leader in mobile industry these times, encountered significant difficulties in abandoning years of research and investment based on a different product philosophy. When the concept of the smartphone was eventually adopted, by Apple, the market had already changed, making the transition extremely challenging. This example illustrates how the incapability to adapt strategically in a timely manner can lead even dominant firms to a loss of competitive advantage.

On the other hand, companies such as Amazon, Tesla, Netflix, and Alibaba leveraged the capabilities of digital transformation from early stages and today are considered among the greatest organizations worldwide, in terms of market capitalization. This fact highlights the significant role of strategic technology utilization in long-term economic value.

Digital transformation continues to expand across modern markets and has become a central concern for many organizations. Although full implementation remains a distant goal, it is highly evident that the lack of participation in digital transformation represents a significant strategic risk. The global economy is growing at a fast rate to fourth industrial revolution, through digital transformation, in a manner that humans do not only learn the machines to perform tasks faster and more efficiently, but to trust them in adjustment and making decisions for them. In these terms digital transformation affects the business world to the core in a more decisive way. For example, in the pharmaceutical sector, the transformation extends to the creation of smart medications equipped with embedded sensors that collect real-time data regarding their impact on patient and not only for new drugs. This example leads to two critical conclusions: first, the firm that innovates first is likely to receive the largest share of the market; and second, such a transition is challenging

for established firms that are required to fundamentally reconsider their investments and organizational structures, turning toward transformation. Empirical studies confirm that organizations that adopted substantially digital transformation, achieved higher scores in business performance and enhanced competitiveness. According to literature (Siebel, 2019), digitally mature organizations present higher productivity, stronger revenue growth, and greater durability compared to firms with low levels of digital maturity. Digital transformation affects human resources management, as it seems that in digitally matured organizations the salaries tend to be higher for skilled and experienced personnel, instead of those organizations that are immature digitally.

Macroeconomic effects are expected to be positive. The international literature comes together with the view that the wide adoption of artificial intelligence and digital technologies can increase global GDP through productivity innovation. However, these benefits require investments in skills, infrastructure, and appropriate policies.

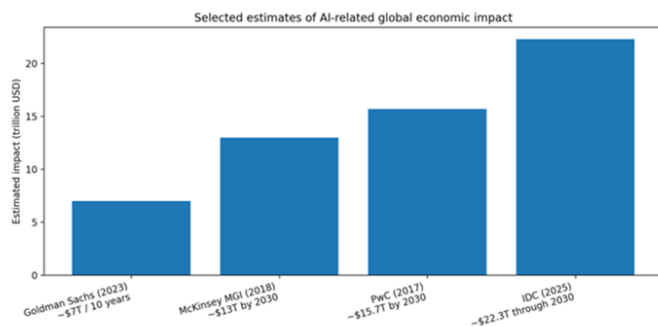


Figure X. Selected estimates of AI-related global economic impact (trillion USD).

Source: Goldman Sachs (2023); McKinsey Global Institute (2018); PwC (2017); IDC (2025).

Note: Estimates are not directly comparable due to differences in methodologies and time horizons.

There are many sectors where digital transformation can affect significantly economic growth and social development. 3D printing is expected to change manufacturing, enhancing the production of complex products at low cost, faster and more efficient! In medicine sector, data and algorithms will provide better and more reliable diagnoses and predictions of human health, helping more people to prevent and treat health issues. In logistics, the development of automated vehicles is expected to decrease accidents, by preventing human errors and increasing security in roads.

One crucial aspect that has risen is the role of human factors in this evolving environment. As per our knowledge, this question has already been answered, as the development of technology has made many professions perish, but it has created new ones! For example, the shoe repairing professions seem to be abandoned, but data science professions seem to be one of the most well paid! In any case, learning and training for lifetime is expected to be crucial.

At this point, it is appropriate to examine the two remaining key factors of digital transformation to form a more comprehensive understanding: Cloud Computing and the Internet of Things.

Computing Cloud

It is unrealistic to believe that Amazon's CEO Jeff Bezos is so wealthy and has the capability to send himself to outer space, by only selling books, in e-commerce. In reality, a substantial part of its economic success comes from Amazon Web Services (AWS), which provides what has become a fundamental requirement for modern enterprises: computing power and data storage capacity. Through cloud computing, vast storage resources and high computational performance are offered at remarkably low cost. This development played a decisive role in the emergence and establishment of the start-up ecosystem, enabling new and innovative firms to operate without investing in expensive physical servers, instead relying on powerful and cost-efficient cloud infrastructures.

Today, many organizations either lack the ability or choose not to invest in data storage and processing infrastructures, as the management of large-scale data requires increasing amounts of hardware resources. By contrast, companies such as Amazon have systematically invested in storing and processing data at large scale. Beyond storage, server, and networking services, these firms develop integrated software solutions that enable organizations to manage their entire infrastructure while optimizing critical business functions. Cloud computing therefore functions as a foundational enabler of digital transformation, since it lowers entry barriers, increases flexibility, and supports the scalable use of digital technologies.

Internet of Things (IoT)

The Internet of Things is a network of objects equipped with sensors, which have the capability to collect, exchange, and process data through the Internet without direct human intervention. These devices range from simple sensors and smart home appliances to industrial equipment, vehicles, and urban infrastructure. IoT is significant for real-time data generation. Through continuous data sending from connected devices, organizations gain enhanced visibility into their operations, improve process control, and strengthen decision-making capabilities. Within the context of Big Data, IoT constitutes one of the most important sources of high-velocity and high-variety data, intensifying the need for advanced storage and analytical systems. At the organizational level, IoT supports applications such as predictive maintenance, supply chain optimization, smart energy management, and the automation of production processes. Consequently, it functions as a critical link between the physical and digital worlds, accelerating digital transformation and reinforcing the creation of both business and social values.

Therefore, it becomes evident that Big Data, Artificial Intelligence, Cloud Computing, and the Internet of Things do not operate in isolation. Rather, they collectively shape the framework within which organizations can digitize their operations and advance toward full digital transformation. An analysis of these four factors largely corresponds to an analysis of the very concept of digital transformation itself.

3. Research Methodology

This chapter analyzes the methodological approach adopted to examine the role of digital transformation in modern business, especially on the use of big data and artificial intelligence. The analysis focuses on understanding how firms use digital technologies to improve their efficiency, develop new business models, and strengthen their strategic position in international markets.

The methodology selected for this study is case study analysis. This approach is widely used in academic literature on business administration and information systems because it enables a deeper examination of complex phenomena within their real business environment (Yin, 2018). Unlike purely quantitative approaches, which are often limited to the analysis of numerical data, the case study method allows for a more comprehensive understanding of the processes through which organizations adopt and integrate new technologies into their strategies and operations, with the aim of developing a culture of digital transformation. In addition, this method can generate useful conclusions regarding how highly successful companies have managed to embrace this culture of digital transformation and how other organizations may follow similar practices in order to improve their own performance. The selection of this methodology is considered particularly appropriate for the analysis of digital transformation, as this phenomenon is too complex and includes technological, organizational, and strategic dimensions (Yin, 2018; Flyvbjerg, 2006). Through the examination of real business examples, it becomes possible to explore how firms utilize digital technologies to create economic value and enhance their competitiveness.

Within the context of the present study, two international companies, Amazon and Maersk, were selected as case studies. These companies constitute characteristic examples of organizations that have invested significantly in digital transformation and data utilization. The analysis of these two cases makes it possible to investigate different approaches to digital transformation, as the two companies operate in different sectors of the economy and follow different business models.

3.1 Research Approach: Case Study Analysis

The present research is based primarily on the qualitative methodological approach of case study analysis. However, selected quantitative indicators and performance outcomes from the two companies are also referenced in order to further support the research analysis. This approach is frequently used in the social sciences and in business administration for the examination of complex organizational phenomena, particularly when the research subject is related to contemporary business practices and strategic decision-making (Yin, 2018). The case study method allows researchers to investigate real organizations within their natural environment and provides the opportunity to understand the processes through which firms adopt and exploit new technologies (Yin, 2018).

In the case of digital transformation, this approach is especially useful because technological change is not limited to the adoption of new tools and innovations, but also affects the overall structure of the firm, its decision-making processes, and its strategic position. Case study analysis also enables the connection between theoretical concepts and real business examples. In the present dissertation, the theoretical discussion surrounding digital transformation and data-driven technologies is linked to the practical implementation of these technologies in two major international organizations.

The selection of more than one case study increases the chances for a comparative analysis of different business environments (Eisenhardt, 1989; Yin, 2018). The comparison of these two companies makes it possible to define both similarities and differences in the way organizations use digital technologies to create competitive advantage and economic value, which is the central objective of this adoption. Amazon is an example of an organization which operates in the digital economy, relying on data and digital platforms. On the other hand, Maersk represents a more traditional company operating in the shipping and supply chain sector, which has made significant investments in digital transformation in order to improve the efficiency of its operations. The comparative analysis of these two cases is very valuable because it highlights that digital transformation is not confined to technology-intensive firms alone. But, it can also be implemented successfully in more traditional industries, provided that organizations develop the necessary strategies, technological infrastructure, and organizational capabilities. Therefore, both organizations, Amazon and Maersk, in the present study shows a broader and more balanced perspective on how digital transformation can be applied across different industrial contexts. Specifically, the case study supports the objectives of this dissertation in three important ways. First, it allows for

an in-depth understanding of each company's transformation path and not only limiting the analysis to generalized assumptions. Second, it establishes the examination of the relationship between digital technologies and business strategy, making it possible to understand how technologies such as big data analytics and artificial intelligence contribute to operational improvement and strategic renewal. Third, it provides the opportunity to compare different organizational types to digital transformation and to identify patterns, best practices, and critical success factors (Eisenhardt, 1989).

Overall, the case study method is considered particularly suitable for the purposes of this research, since it offers both analytical depth and practical relevance. By focusing on Amazon and Maersk, this dissertation seeks to provide a clearer understanding of the role that big data and artificial intelligence play in the digital transformation of modern firms, while also illustrating how organizations from different sectors can leverage digital capabilities to achieve innovation, resilience, and long-term competitive advantage.

3.2 Case Study Selection Criteria

The selection of the companies examined as case studies in the present research was based on specific criteria related to their importance in the international economy, their degree of adoption of digital transformation, and the opportunity they provide for analyzing different approaches to digital transformation (Eisenhardt, 1989; Yin, 2018). These two companies are also highly representative of their respective sectors in terms of their position and progress in digital transformation.

The first key selection criterion was the international significance of the companies. Amazon is one of the largest firms in the global digital economy and is considered among the most important organizations in the field of e-commerce. The company has developed a particularly powerful digital ecosystem that connects millions of consumers, businesses, and suppliers worldwide. Similarly, Maersk is one of the largest organizations in the global shipping and supply chain industry. The company manages an extensive network of maritime transport and logistics operations through various types of vessels, serving many businesses and markets at the international level.

A second important criterion concerns the degree to which the companies have adopted digital methods and technologies. Amazon has extensively integrated technologies for the storage, processing, and analysis of big data, as well as artificial intelligence, into its business operations. Using big data, the company is able to analyze consumer behavior,

personalize product recommendations, and optimize supply chain processes. In a similar way, Maersk has also made significant investments in digital transformation, using data-driven technologies to improve supply chain management. The use of digital platforms and data analysis supports the company to increase supply chain visibility and make more effective operational decisions.

A further criterion for selection was the existence of different business models. Amazon operates primarily in a digital business environment, where technological platforms and data constitute fundamental components of its business model. By contrast, Maersk operates in a more traditional sector, where physical infrastructure and transportation activities in its operational model. This distinction makes the comparison between the two organizations especially valuable, as it allows the study to explore how digital transformation can be applied not only in digitally native companies, but also in more traditional, asset-intensive industries.

The comparison of these two companies therefore provides the opportunity to investigate how digital transformation may be implemented in both digital and traditional business contexts. It also enables a wider understanding of the role of data and artificial intelligence in different industries, showing that digital transformation is relevant beyond the boundaries of pure technological firms. As a result, the selected case studies offer a balanced and meaningful basis for examining the diverse ways in which organizations pursue innovation, improve operational performance, and build competitive advantage through digital capabilities.

3.3 Case Study Analysis Process

The case analysis process was supported in the collection and processing of secondary data (Bowen, 2009). The data were taken from academic journal articles, business reports, corporate financial statements, and analyses published by international organizations. The use of secondary data was appropriate for the purposes of this research, as it allows for the examination of a wide range of information regarding the case studies, including their strategies, operational structure, technological investments, and performance outcomes (Bowen, 2009).

The analysis was conducted in three main stages:

In the first stage, information was collected regarding the strategic orientation, business operations, and financial condition of the two companies. Emphasis was placed on the ways in which these organizations use technologies to support their transition toward digital transformation, including big data, artificial intelligence, and digital data analysis systems. This stage was essential in establishing the broader organizational and strategic context within which digital transformation takes place. In the second stage, the operational practices of the two companies were analyzed with the aim of understanding how technological capabilities affect efficiency and decision-making. More specifically, the analysis focused on how each company adopts digital technologies into its business activities, as well as how these technologies support process optimization, customer service improvement, and strategic adaptation to changing market conditions. This stage helped identify the practical role of data and artificial intelligence in the development of more agile and competitive business models. In the third stage, a comparative analysis of the two companies was undertaken in order to identify both common elements and important differences in the way digital transformation is implemented across different sectors of the economy (Eisenhardt, 1989; Yin, 2018). This comparative perspective was particularly useful because it allowed the research to highlight how sectoral characteristics, business models, and organizational structures affect the form and intensity of digital transformation initiatives. At the same time, it enabled the study to identify broader patterns concerning the strategic use of digital technologies in modern organizations.

This process makes it possible to form a comprehensive view regarding the role of big data and artificial intelligence in the digital transformation of contemporary business activity. It also contributes to a deeper understanding of the ways in which organizations can use data and artificial intelligence to create competitive advantages and generate economic value. Therefore, the case analysis process not only supports the empirical dimension of the dissertation but also strengthens its theoretical contribution by linking conceptual discussions on digital transformation with real-world business applications.

The following diagram expresses the path of the research:



Figure Y. Research Methodology

Source: Authors' Design

3.4 Research Limitations

Despite the advantages of the methodological approach followed in the present study, it is important to emphasize that the research is also subject to certain limitations. The recognition of limitations is a fundamental element of scientific methodology, as it contributes to a more balanced understanding of the findings and enhances the credibility of the conclusions.

One major limitation concerns the use of secondary data. The data used in this research were derived primarily from published business reports, academic articles, financial statements, analyses by international organizations, and books. Although these sources are generally considered reliable and are widely accepted in academic literature, the study is not based on primary data such as interviews with executives or direct field research, although the study also refers to executive statements published in company articles and official websites (Bowen, 2009). As a result, the analysis relies mainly on published information and interpretations that have already been presented in existing sources. A second limitation relates to the number of case studies included in the research. The present study focuses on two large organizations, Amazon and Maersk. Although these companies are characteristic examples of firms that have adopted a culture of digital transformation and have made substantial progress in this area, the findings of the research cannot be fully generalized to all sectors of the economy. The selection of a limited number of cases allows

for in-depth analysis, but at the same time restricts the generalizability of the results (Flyvbjerg, 2006; Yin, 2018). Clearly, the examination of a larger number of case studies would provide a broader picture of how contemporary businesses pursue digital transformation and the different ways in which they implement it. In addition, the two companies operate in different sectors of the economy and adopt different business models. Amazon is a leading company that operates mainly in the field of the digital economy and e-commerce, whereas Maersk operates in a more traditional and capital-intensive sector, namely shipping and logistics. Although this comparison offers interesting research insights, the differences between the two sectors may influence the way in which digital transformation is ultimately implemented. For this reason, sector-specific characteristics should be taken into account when interpreting the findings of the comparative analysis. Finally, it should be noted that digital transformation is a dynamic and continuously evolving process. Technological developments, particularly in the fields of artificial intelligence and big data analytics, are advancing at a very rapid pace. Consequently, the business models and strategies of the two companies examined in this study, as well as those of many other firms, may change significantly in the coming years. This means that some of the conclusions drawn from the present analysis may need to be reassessed in light of future technological and strategic developments.

Despite these limitations, the analysis of the two cases, namely Amazon and Maersk, provides important insights into the role of big data and artificial intelligence in the development of a digital transformation culture and, ultimately, in the use of digital transformation for the creation of economic value and competitive advantage. Therefore, although the findings should be interpreted with appropriate caution, the study still offers a meaningful contribution to the understanding of how digital technologies reshape contemporary business activity across different organizational contexts.

4. Analysis and Presentation of Case Studies

4.1 Case Study 1: Multinational Retail Company – Amazon

1. Industry and Competitive Environment

Amazon operates in a very competitive and evolving digital environment that occupies multiple sectors, including electronic commerce, cloud computing, digital services, and supply chain management (Amazon.com, Inc., 2024; Jassy, 2025). These sectors are characterized by intense competition, particularly in service speed, operational efficiency, and low cost. Rapid technological innovation and development are growing customer expectations for speed and quality and pushing the company to invest in the personalization of consumer needs and in the continuous improvement of the services. Amazon does not compete only with traditional retail businesses, but also with digital firms that use technology as a driver of profitability and expansion. Within such an environment, the ability to possess, store, process, and analyze large volumes of data in real time is considered a critical condition for success (Siebel, 2019). The academic literature on digital transformation mentions clearly that firms operating in digitally intensive industries are required to develop constantly, technological capabilities that allow them to analyze data effectively while maintaining a sustainable competitive advantage in a dynamic and rapidly changing market (Siebel, 2019; Westerman et al., 2014). Amazon's competitive advantage is linked to this ability to administrate big data and artificial intelligence across all its operations (Jassy, 2025). Through this capability, the company can generate continuous streams of data, learn from them, and improve its processes on an ongoing basis. Therefore, Amazon's position in the market is not based solely on traditional price competition or on product differentiation in the conventional sense, but rather on its ability to convert data into strategic knowledge. In this respect, its market strength derives from the capacity to translate information into faster decisions, more accurate forecasting, improved customer targeting, and higher operational efficiency. This feature differentiates Amazon from many of its competitors and places data-driven decision-making at the center of its business model.

2. The Strategic Background of Amazon's Digital Transformation

Amazon's digital strategy has long been based on two key pillars: operational efficiency and the creation of long-term economic value (Jassy, 2025). From the early stages of its development, the company invested heavily in data collection systems, and artificial intelligence tools to support decision-making (Jassy, 2025). Technology was the central determinant of the company's strategy (Jassy, 2025). This strategic approach constitutes a characteristic example of digital transformation, since digitally mature organizations tend to integrate technology into the core of their strategic orientation rather than applying it in fragmented or isolated ways (Siebel, 2019; Westerman et al., 2014). This approach is closely related to the creation of a digital transformation culture. Amazon gives strong emphasis on experimentation, the use of performance indicators to measure the results, and the development of a mindset that is oriented to continuous learning and improvement (Jassy, 2025). As already discussed in the theoretical framework of this dissertation, the development of such a mindset forms one of the most important pillars of digital transformation. The organization must also develop an internal process and management to support innovation and learning from data, and not only just adopt digital tools. An important element of Amazon's strategy is its procedures of data as a strategic asset and not only an invisible tool. Decisions regarding pricing, portfolio development, supply chain management, and the overall customer experience are based on quantitative evidence, instead of relying exclusively on managerial intuition or executive judgment (Jassy, 2025). This approach allows the company to adapt its business model easily and quickly and to expand into new markets. An example is Amazon Web Services (AWS), which represents one of the most significant strategic expansions of the company beyond e-commerce. AWS, established in 2006, is now one of the largest cloud computing providers in the world (Amazon Web Services, n.d.). It provides a wide range of services, including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), (Siebel, 2019) and an extensive portfolio of artificial intelligence, machine learning, data analytics, and cybersecurity tools (Amazon Web Services, n.d.). Through AWS, Amazon provides digital infrastructure, storage capabilities, and computing power to businesses at relatively low cost and with a high level of security (Amazon Web Services, n.d.). Although the development of AWS as a separate business organization would itself require extensive analysis, given its innovative role in

digital transformation, the present study does not allow for a full examination of this dimension.

3. Applications of Big Data and Artificial Intelligence at Amazon

3.1 Customer Analytics and Personalization

One of the most successful applications of artificial intelligence at Amazon is its product recommendation system (McKinsey & Company, 2013). The company analyzes vast amounts of data related to customer behavior, purchase history, search queries, and product reviews. These data are processed by machine learning algorithms that identify patterns of selection and opinions and predict user preferences (McKinsey & Company, 2013). Personalization represents a change from mass retailing to a model of individualized customer interaction. Amazon has driven the customers from selves, even of e-commerce, to purchases that are tailored to their needs. Relevant literature suggests that personalization systems respond to increasing customer demand for tailored experiences and strengthen this transition by cultivating a relationship of individualized trust between the company and the consumer (McKinsey & Company, 2013). For Amazon, personalized recommendations are not merely a promotional tool, but a central mechanism for revenue generation and market share expansion (McKinsey & Company, 2013). At the managerial level, this reflects a transformation in the way economic value is created. Amazon's digital store is dynamically adjusted on the basis of real-time data analysis, demonstrating that artificial intelligence enables the development of a flexible and customer-oriented business model.

3.2 Supply Chain Optimization and Demand Forecasting

In addition to applications related to the end customer, Amazon also utilizes big data and artificial intelligence in the management of its supply chain (Jassy, 2025). Through predictive systems, the company forecasts demand by geographical region and by product category. These forecasts support optimal inventory management, reducing both stock shortages and excess inventory. AI-driven demand forecasting enables the supply chain to operate more efficiently on a large scale by coordinating warehouses, distribution centers, and transportation networks. This approach is consistent with academic literature that

highlights the role of analytical tools in redefining operational processes and strengthening organizational agility (Siebel, 2019; Westerman et al., 2014). From a strategic perspective, supply chain analytics allows Amazon to remain highly competitive and reliable by achieving fast and responsive delivery performance. At the managerial level, this reflects a transition from traditional operating models toward predictive and data-driven systems. Rather than responding to demand only after it is asked, Amazon seeks to predict market needs and to allocate resources in advance (Jassy, 2025). This predictive strategy is one of the main ways in which digital transformation reshapes the internal procedure of the organization. In this context, data is not used merely to record past activity, but to support future-oriented planning and improve the coordination of complex business operations.

3.3 Automation, Robotics, and Operational Intelligence

Amazon has also integrated artificial intelligence into warehouse automation using robots (Amazon, 2023; Amazon, 2025). Intelligent systems coordinate the movement of robots and optimize product segmentation to satisfy the demand (Amazon, 2025). These systems rely on continuous flows of data and machine learning algorithms, which gradually improve performance over time. The adoption of artificial intelligence for automation reflects a broader transition toward digitally enhanced operations. Rather than fully replacing human labor, Amazon's approach is based on the combination of human and machine intelligence with the aim of increasing productivity. This combination shows the effort that is required between human resources and technological systems for a successful transition to digital transformation. In practice, this means that the company does not just introduce advanced technologies into its facilities but redesigns its culture in a way that allows people and machines to operate together and more effectively. Such a model illustrates that digital transformation does not depend only on technological investment but also involves organizational adaptation and the redefinition of work practices.

4. Interim Analytical Assessment

Amazon utilizes big data and artificial intelligence for both strategic decision-making and operational execution (Jassy, 2025). The capabilities of data use are deeply

embedded in the company's strategy as well as in the everyday implementation of its business activities. Amazon's high level of digital maturity enables continuous learning and adaptation, thereby strengthening its competitiveness in markets characterized by uncertainty and constant change while also allowing the long-term evolution of its processes. This places Amazon among the leading firms in the field of digital transformation. This observation is consistent with academic theories that approach digital transformation as an evolving process rather than as a single project with a clear beginning and end (Siebel, 2019; Westerman et al., 2014). Amazon therefore represents a characteristic example of a business in which big data and artificial intelligence function as dynamic capabilities, supporting strategic flexibility and sustainable operational performance. Its transformation is the systematic integration of digital capabilities into the company's broader strategic and organizational logic.

5. Organizational and Cultural Implications of the Adoption of Artificial Intelligence and Big Data

The extensive use of data and artificial intelligence at Amazon has substantially affected its structure, managerial roles, and organizational culture (Jassy, 2025). Digital transformation theory emphasizes that technological change must be accompanied by organizational adjustment to generate economic value, and this principle is clearly reflected in Amazon's case (Siebel, 2019; Westerman et al., 2014). The company has developed a culture centered on the use and analysis of large volumes of data. Its performance indicators and experimentation guide both strategic and operational decisions (Jassy, 2025). Managers are encouraged to rely on data and measurable outcomes when making decisions, while also trusting artificial intelligence forecasts and analytical results. These decisions are continuously tested and revised. Such a culture strengthens the learning capacity of both managers and machines, which in turn establishes the company as a digitally mature organization. In other words, Amazon's transformation is supported by a managerial philosophy that values adaptability and constant improvement and not just technological advance. Furthermore, the integration of artificial intelligence and big data has led to the emergence of new roles and new skill requirements. Data scientists, machine learning engineers, software developers, and analytics specialists work closely with managers and

decision-makers. This collaboration reduces organizational silos and facilitates the conversion of analytical findings into reliable and timely decisions and, ultimately, into strategic action. At the same time, however, this transformation is accompanied by managerial challenges. The growing dependence on automated decision-support systems may reduce managerial autonomy and increase dependence on algorithms. As a result, managers are required to develop new capabilities, such as the ability to supervise algorithmic systems and critically evaluate AI-generated outcomes rather than simply adopting them without reflection. Therefore, Amazon's case demonstrates that digital transformation is not solely a matter of technological adoption, but also a matter of organizational redesign, skill development, and cultural change. The successful use of artificial intelligence and big data requires an environment in which technological systems are aligned with human judgment, managerial responsibility, and strategic intent.

6. Managerial Challenges, Risks, and Limitations

Despite its success, Amazon's transition toward digital transformation is not without risks and limitations. One of the main issues concerns the management of complex artificial intelligence systems. As algorithms become increasingly sophisticated, the logic behind decision-making becomes less transparent, thereby increasing the risk of unintended consequences and bias (Siebel, 2019). From a strategic perspective, excessive dependence on data may also limit the exploration capacity that the human factor contributes. Artificial intelligence systems tend to optimize based on past data, a condition that may constrain imagination and reduce the potential for more creative or unconventional forms of strategic thinking (Agrawal, Gans, & Goldfarb, 2022). For this reason, management must balance the computational dimension of decision-making with strategic judgment and human creativity. Ethical considerations are also an important area of challenge. The collection and use of data by the company raises issues related to privacy protection and information security. The relevant literature emphasizes that trust and institutional validity require critical judgment for the maintenance of competitive advantage over the long term (Siebel, 2019). Consequently, Amazon must continuously invest in administrative and technological security ways that ensure the responsible and ethical use of data. In this context, digital transformation is a matter of accountability and governance, efficiency and innovation. In addition, the effects on the workforce create a critical managerial issue. Although artificial

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intelligence can enhance productivity, it may also generate concerns regarding job security and lead to resistance to transformation. Employees may insist on current stance as a threat to established roles and responsibilities, especially when organizational communication is unclear or when reskilling efforts are insufficient. As a result, effective management changes and clear internal communication become essential in order to preserve organizational cohesion and maintain the stability of structures and processes during periods of technological transition. Therefore, Amazon's experience shows that the success of digital transformation depends not only on technological capability, but also on the organization's ability to manage the social, ethical, and managerial implications that accompany such a transition. The company must continuously ensure that the benefits of artificial intelligence and big data are not undermined by governance weaknesses, cultural resistance, or strategic overreliance on algorithmic systems.

7. Strategic Link with Digital Transformation Theory

Amazon's digital transformation model is largely aligned with academic models and clearly highlights the importance of creating the necessary transformation culture, organizational flexibility, improved decision-making processes, and the ability to capitalize on opportunities arising from the digital marketplace (Siebel, 2019; Westerman et al., 2014). The company continuously reconfigures its resources using big data and artificial intelligence. These two factors function not merely as tools for improving operational efficiency, but as strategic creators of the organization's development and competitive direction. Amazon's investment in digital infrastructure allows the adaptation of its business model and supports experimentation, accelerating innovation (Jassy, 2025). This reinforces the argument that digital transformation should be understood as a dynamic strategic process rather than as a single and static tool or initiative. The company's experience illustrates that technological capability alone is not sufficient. Rather, Amazon's success is based on the combination of technology, organizational culture, and strategic leadership. It is this link among technological assets, managerial intent, and cultural readiness that allows digital transformation to create the most wanted economic value. In theoretical terms, Amazon can be interpreted as an example of a firm that has developed dynamic capabilities through its digital infrastructure and data systems. The company's ability to sense and seize opportunities and alter internal resources in response to market changes corresponds closely

to the core principles of digital transformation theory. In this sense, big data and artificial intelligence enable strategic agility and the renewal of its competitive position in a rapidly changing business environment.

8. Case Study Summary and Key Conclusions

In summary, the case of Amazon demonstrates that big data and artificial intelligence can function as major drivers of digital transformation when they are dynamically integrated into the strategy and operations of an organization. Amazon's experience shows that digital transformation requires continuous learning, collaboration among all organization's parties, and the development of an alternative managerial mindset that is more adaptive, analytical, and innovation oriented. The company's example shows that digital transformation extends to the redesign of organizational logic and value creation processes. The main lesson for managers is that artificial intelligence and big data should be viewed as strategic factors that play a central role in increasing economic value. Their importance becomes evident when organizations invest in technology, human resources, and processes, ensuring that digital capabilities are aligned with long-term strategic objectives. Therefore, the case of Amazon confirms that sustainable competitive advantage in the digital era depends on the effective integration of technological innovation, managerial capability, and organizational transformation.

Amazon: Executive Testimonies and Interpretive Commentary

The case of Amazon demonstrates that digital transformation is not limited to the adoption of new technologies but rather constitutes a comprehensive organizational strategy that affects operations and customer experience. Andy Jassy, former SVP and CEO of AWS, has emphasized that generative AI is expected to “transform virtually every customer experience,” while Amazon is developing hundreds, if not more than a thousand, artificial intelligence applications across areas such as customer service, search, operational workflows, and advertising (Jassy, 2025). This statement indicates that the company treats artificial intelligence and big data as strategic assets that enhance both efficiency and differentiation. At the same time, Doug Herrington, as CEO of Worldwide Amazon Stores, connects Amazon's operational evolution with the logic of continuous improvement, stressing that the company's teams are encouraged to challenge established processes,

identify weaknesses, and constantly seek better ways to serve the customer (Amazon, 2023). This testimony is very important because it reveals that digital transformation at Amazon is based on a culture of organizational learning and continuous redesign. From the perspective of technological leadership, Swami Sivasubramanian, Vice President of Agent AI at AWS, emphasizes that the value of artificial intelligence emerges when a company succeeds in moving from experimentation to productive implementation by addressing practical issues such as data integration, model reliability, and operational deployment at scale (AWS, 2025). This perspective supports the argument that the success of digital transformation depends on the organization's ability to transform innovation into tangible business outcomes. Overall, the testimonies of Amazon's executives show that the company's digital transformation is grounded in three main pillars: a) the extensive use of artificial intelligence, b) the continuous improvement of internal processes, and c) an absolute focus on customer experience. Therefore, Amazon constitutes a characteristic example of a firm in which big data and artificial intelligence do not function merely as supportive tools, but as central mechanisms of organizational transformation and sustainable competitive advantage.

4.2 Case Study 2: Shipping Business – Maersk

1. Industry and Competitive Environment

Maersk is one of the most characteristic examples of a company that has advanced in digital transformation while operating in a traditional and capital-intensive sector (A.P. Moller - Maersk, 2024). The company is active in the global shipping and supply chain industry and faces high levels of operational complexity, strong cost pressures, legal and regulatory constraints, as well as substantial exposure to geopolitical and environmental uncertainty (A.P. Moller - Maersk, 2024). In response to these challenges, Maersk has adopted, to a significant extent, the collection, storage, and processing of big data, together with artificial intelligence, as strategic drivers for enhancing efficiency, resilience, and long-term competitiveness (A.P. Moller - Maersk, 2024). The shipping and supply chain industry is characterized by high capital investment requirements, low profit margins, cyclical demand, and strong sensitivity to fluctuations in international trade. Firms operating in this sector are required to manage highly complex and multilayered supply chains involving multiple factors, such as ports, customs authorities, and logistics partners. Traditionally,

competitive advantage in this industry was based on fleet size, cost reduction, and route optimization. However, increasing customer expectations for integrated and immediate services have placed substantial pressure on the traditional business models of shipping companies. At the same time, stricter environmental regulations and the broader push toward sustainability have made it imperative for firms to improve energy efficiency and reduce emissions. In this uncertain and continuously evolving environment, Maersk recognized that decision-making supported by artificial intelligence, big data, and digital technologies had become essential not only for maintaining competitiveness, but also for ensuring long-term viability (A.P. Moller - Maersk, 2024). From the perspective of digital transformation, shipping represents a particularly demanding sector because of its dependence on physical assets and legacy information systems. The relevant literature emphasizes that, in such industries, transformation must be gradual and strategically guided rather than abrupt (Siebel, 2019; Westerman et al., 2014). As in all cases, however, the existence of a culture that supports digital transformation remains the most critical success factor.

2. Strategic Background of Digital Transformation

The evolution of Maersk's digital transformation is based on a strategic decision to move from a traditional shipping company toward an integrated, digitally enabled supply chain organization (A.P. Moller - Maersk, 2024). The company has realized that the creation of economic value in an dynamic sector, which evolves constantly, depends on the acquisition and use of data, as well as on the cooperation of processes, in a simpler way, throughout the entire supply chain (A.P. Moller - Maersk, 2024). Maersk do not use technology as an isolated tool but has adopted digitalization into its long-term strategy (A.P. Moller - Maersk, 2024). Its investments in data storage, processing, and analyzing try to be integrated in the entire supply chain, from port operations and public authorities to destination delivery. This strategy is aligned with theoretical models of digital transformation, which emphasize not only the adoption of technology but also the integration of a digital transformation culture into the long-term strategic orientation of firms (Siebel, 2019; Westerman et al., 2014). At the same time, the company considers the constraints, which are associated with legacy systems and organizational complexity. As a result, its transformation initiatives focus more on strengthening and upgrading existing processes through technological tools and automation, rather than on the complete

replacement of core operational structures, at least for the time being. This fact does not align with the literature for digital transformation, that implies the whole transition into a new technological change in culture but seems that helps their perspective. To support this difference, we can assume that shipping industry is always fond of changes in technology. Vessels are equipped with sophisticated technologies, which are evolving all the time. It is a sector in which digital data and other technologies are embedded always in its core.

3. Applications of Big Data and Artificial Intelligence

Maersk generates enormous volumes of structured and unstructured data from a wide range of sources, including vessel operations, container movements, port activities, weather conditions, fuel consumption, customer interactions, and maintenance systems (Maersk, 2025). These data are collected across multiple geographical areas and operating conditions and are analyzed through artificial intelligence tools, supporting decision-making at both operational and strategic levels (Maersk, 2025). One of the most important applications concerns predictive maintenance. Machine learning algorithms analyze historical and real-time data to predict mechanical failures. In this way, maintenance activities can be scheduled in advance, reducing unplanned malfunctions and extending the lifespan of highly valuable assets, such as vessels. This preventive strategy has the potential to reduce company costs significantly and improve profit margins and enhance safety, especially for personnel working on board vessels, for cargo, and of course, the ships themselves. Even the workload for the crew can be decreased, as they must only monitor their vessel's condition and report back the results, as data for the headquarters. Artificial intelligence is also applied to route optimization and voyage planning (Maersk, 2025). By utilizing data processed through AI systems, Maersk can generate more accurate forecasts regarding fuel prices, weather conditions, port service capacity, and vessel performance, to determine optimal routes (Maersk, 2025). Through these capabilities, the company reduces fuel consumption, limits emissions, and improves operational reliability. Also, the use of artificial intelligence and big data plays a role in cargo delivery. The company can monitor the movement of its vessels in real time and to predict delivery times to customers with greater accuracy (Maersk, 2025). This capability is important for Maersk because it continuously feeds its systems with new data, supporting them to learn and produce even

more secure and reliable predictions over time. This data-driven learning function represents a component of enormous strategic importance for the company, as it strengthens both its service quality and its broader digital transformation capabilities.

4. Effects on the Digital Transformation of the Business Model

The integration of big data and artificial intelligence has had a great effect on Maersk's business model. The company can no longer be viewed merely as a traditional shipping firm, but as a digital player within the supply chain, coordinating complex networks using big data and artificial intelligence (A.P. Moller - Maersk, 2024). Data analytics has reduced difficulties that emerge within operational processes and has improved decision-making on a global scale. Artificial Intelligence has redefined activities in ports and cargo management, increasing efficiency, reducing costs, and limiting excessive bureaucracy. This development highlights the importance of designing new processes shaped by digital transformation and by the real-time use of big data. In this case, the need to adopt the appropriate transformation culture remains too important. Managers have been required to understand the concept of digital transformation, to become familiar with new technologies, to acquire new skills, to change their way of working, and to transfer this knowledge to their subordinates. In addition, the company attracts specialists such as data scientists, analysts, and IT professionals to support data analysis and digital integration. These specialists work closely with managers, strengthening the already established organizational culture and keeping the company closer with the logic of digital transformation. Therefore, the effect of digital transformation on Maersk's business model is not limited to process improvement. It also involves a broader repositioning of the company within the value chain. Maersk increasingly operates as an integrated logistics partner that offers visibility, coordination, and digital control across the full supply chain (A.P. Moller - Maersk, 2024). This shift reflects the strategic importance of digital capabilities in redefining how value is created and delivered in traditional industries.

5. Managerial Challenges and Organizational Implications

Despite the progress achieved and the benefits generated, Maersk also faces significant challenges. The extraction and integration of data from older and diverse systems constitutes a serious issue that must be addressed, since data complexity requires even greater critical capacity in relation to AI-based predictions (Siebel, 2019; Westerman et al., 2014). Data originating from unstructured environments must first be organized into structured forms to be exploited effectively. This is clearly an issue that requires time, and substantial managerial efforts. Change management also is a central factor. The transition to an environment within artificial intelligence and big data has changed traditional roles and may generate resistance within the organization (Siebel, 2019). Consequently, investments in training and managerial persistence are required. Employees and managers must adapt to new tools, different responsibilities, and revised processes regarding decision making. Without this adaptation, technological investment alone would be insufficient to support organizational transformation. At the same time, issues of cybersecurity and data protection are becoming increasingly important (Maersk, 2025). In a sector like shipping, trust and the safeguarding of personal and professional data are prerequisites for long-term viability. For this reason, Maersk must ensure that its digital transformation strategy is supported by strong cybersecurity policies, and a robust framework for data responsibility.

6. Strategic Link with Digital Transformation Theory

Maersk's experience is consistent with theoretical models that emphasize the importance of operational efficiency, managerial transformation, and the gradual development of digital capabilities (Siebel, 2019; Westerman et al., 2014). Unlike native digital enterprises, Maersk is a traditional company with established structures and an organizational function of a traditional firm. It is not a startup in which technology adoption is considered the original reason for creation and market participation. This is also what makes the transition toward digital transformation more difficult and, at the same time, more interesting for analysis. Big data and artificial intelligence provide the company with the ability to detect risks, predict disruptions, and improve processes. Transformation, however, does not emerge instantly. It develops gradually as the process of strategic adaptation increases. This observation is important from a theoretical perspective, because it supports

the view that digital transformation in traditional industries often depends on change in organizational learning and long-term capability building rather than radical redesign. In this sense, Maersk confirms that digital transformation must be adopted as a strategic process in which technology, culture, leadership, and organizational structure evolve together. The company's progress demonstrates that the successful use of big data and artificial intelligence requires not only systems and infrastructure, but also strategic patience, internal alignment, and a clear long-term direction.

7. Case Study Summary

The case of Maersk shows that big data and artificial intelligence can serve as mechanisms of substantial digital transformation even in traditional and capital-intensive sectors. By using artificial intelligence and big data into its operations, Maersk has strengthened its efficiency, resilience, and economic value, repositioning itself as a leading player in the global shipping and logistics sector. For managers, the main lesson is that digital transformation requires a structured approach that combines technology, organizational change, and strategic purpose. When these elements come together effectively, big data and artificial intelligence can support competitive advantage and economic value creation, through their integration into the company's digital transformation strategy. Maersk's experience demonstrates that digital transformation is not reserved for digitally native organizations only, but can also be achieved by traditional organizations that are willing to invest in data capabilities, technological upgrading, and organizational adaptation.

Maersk: Executive Testimonies and Interpretive Commentary

The case of Maersk demonstrates that digital transformation in the supply chain sector is not limited to the simple digitization of individual functions, but it constitutes a strategic choice aimed at data integration and improved visibility across supply networks. The company itself describes digital transformation as a process of automating and digitizing supply chain operations to achieve efficiency by making better data management (Maersk, 2025). In its annual report, Maersk also emphasizes that its strategy is based on

the modernization of core applications, the standardization of processes, the automation of workflows, and the interconnection of modern platforms in order to ensure a seamless flow of data (A.P. Moller - Maersk, 2024). Particularly indicative is the statement by Lars

Kastrup, Chief Executive Officer of Pacific International Lines (Pte) Ltd, who notes that genuine digital transformation does not simply mean digitizing existing processes, but rather combining data from across the entire enterprise so that supply chain planning takes into account the relationship between demand, supply, and inventory. Within the same context, Maersk explains that it utilizes data analytics technologies based on artificial intelligence, machine learning, and agentic AI to transform large volumes of data into actionable insights for decision-making (Maersk, 2025). This testimony shows that the company does not perceive data as a passive stock of information, but as an operational mechanism for forecasting, coordination, and faster response. Similarly, Karsten Kildahl, Chief Commercial Officer at Maersk, reports that in an increasingly complex and uncertain environment, the key challenge is not whether companies will face disruptions in their supply chains, but how they will manage them effectively and continuously. For this reason, Maersk invested in the development of the Logistics Trend Map. This Map was based on data analysis, expert interviews, and more than 500 interviews with logistics executives worldwide, using AI-driven analytics to process academic studies, patents, earnings calls, and startup activity (Maersk, 2025). This approach demonstrates that the company integrates the use of data and analytical tools not only into its operations, but also into its strategic planning itself. Furthermore, the leadership dimension of Maersk's digital transformation is also reflected in the profile of its executives. Vincent Clerc, before becoming CEO, had led an enterprise-wide transformation initiative aimed at turning Maersk into an integrator of container logistics (A.P. Moller - Maersk, 2024), while Navneet Kapoor, as Chief Technology and Information Officer, is directly linked to the company's transformation and technology agenda (Maersk, n.d.). Maersk's annual report emphasizes that technology and data is the key instruments for "connecting and simplifying supply chains". Also, artificial intelligence is viewed as a major opportunity for increasing productivity, improving employee experience, strengthening profitability, and accelerating the company's transformation (A.P. Moller - Maersk, 2024). Overall, Maersk represents a characteristic example of a company in which digital transformation is built on three interrelated pillars: a) the integration and use of data across the entire supply chain, b) the adoption of digital

platforms and artificial intelligence tools, and c) the strategic pursuit of greater resilience and visibility for the customer. Therefore, in the case of Maersk as well, big data and artificial intelligence do not function merely as supportive technologies, but as fundamental catalysts of organizational transformation and business model reconfiguration.

4.3 Economic Impact of Digital Transformation for Amazon and Maersk

The effects of digital transformation become evident, considering the economic and financial data for both companies. According to the annual report of Amazon, total sales increased from 575 billion \$ in 2023 to 638 billion \$ in 2024 (Jassy, 2025). An increase of approximately 10%. According to McKinsey and the Harvard Business Review, 30 – 35 % of these sales generated from algorithmic product recommendation system, which can be evidence of the importance of digital transformation capabilities (McKinsey & Company, 2013). In 2025 shareholders letter, Amazon reported further increase of total revenue reached at 717 billion \$, while AWS revenue rose to 129 billion \$, confirming the strategic role of cloud, data analysis and AI supported services (Jassy, 2026). Also, Amazon stated that in 2024 delivered over 9 billion packaged items daily, expanding the “same day” delivery sites in the United States by more than 60%, while reduced the reaching distance for clients at 10% in the first six months of 2024, through machine learning, data driven logistics and redesign of its inventory (Jassy, 2025). These figures support the claim that big data and AI contributed to developing and expanding of Amazon’s ecosystem.

Digital transformation affected Maersk in the same way. This can be stated clearly considering company’s financial data, too. According to the official annual report of the company in 2024, Maersk’s revenue was 55,55 billion \$, EBITDA 12,1 billion \$ and EBIT 6,5 billion \$., while management described this year as one of the strongest financial performances (A.P. Moller - Maersk, 2024). In 2025, respectively, revenue recorded at 54 billion \$, EBITDA 9,5 billion \$ and EBIT 3,5 billion \$ (A.P. Moller - Maersk, 2025). This performance sustained the company at high levels. The AI powered platform, called StarConnect, analyses over 2,5 billion data annually, taken from over 700 vessels, exploiting machine learning capabilities to predict bunker consumption, condition of the vessels, route planning in real time (Maersk, 2025). This has led to a reduction of fuel consumption and operating cost of up to 10 – 15 %. All these effects placed Maersk in leading position in the

global transportation market. The figures show that digital transformation is very connected with measurement developments in control, efficiency and business performance. Finally, the following diagram illustrates the components of digital transformation and the way in which they lead to economic value and comparative advantage:

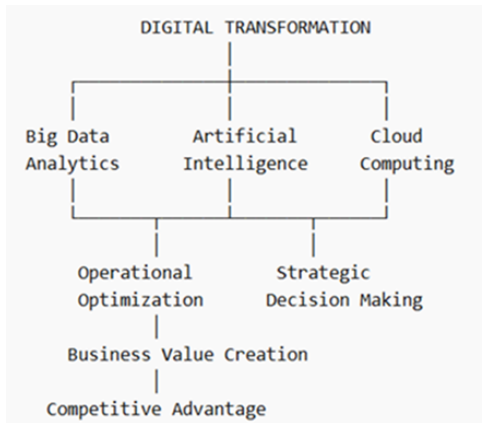


Figure Z. Components of digital transformation

Source: Author's Design

5. Conclusions and Discussion

5.1 Discussion of Findings

The analysis of these two case studies, Amazon and Maersk demonstrated the significant role of Digital Transformation in modern business activity and how it reshapes the strategies of the organizations in order to adopt it successfully. Even though these companies operate in different industries and follow different strategic ways, they implement the same steps in how they utilize digital technologies, especially Big Data and Artificial Intelligence, while they cultivate the same culture to support and develop these technologies.

First, both companies embrace data as an invaluable resource, which is used in increasing production and alter their strategies. Amazon case showed that it implements the process of real time data to understand customers' behavior, personalize their needs, optimize the prices to be charged and manage ultimately the supply chain. At the same time, Maersk uses data to find better routes for their vessels and improve its services through supply chain, also to control the emissions and reduce the bunker cost, which constitutes the most expensive expenses, strengthening its economic and operational efficiency.

Data is treated as a critical input, which can help them in decision-making, production improvement and efficiency of their functions. They don't handle it as one more information that supports business. In digital era, data is a major pillar, which can open path, that companies need to achieve highly competitive advantage and create economic value.

Also, despite their similar steps to Digital Transformation, there are many differences as the research detected. Amazon is a company that designed from the beginning to operate in the digital economy. This allows it to adopt innovative solutions and highly sophisticated technological methods more easily and to develop dynamic and modern business models with greater speed and flexibility. On the other hand, Maersk is a traditional company with capital- intense infrastructures, which make Digital Transformation harder to be integrated. The transition must be gradual and staged and not radical, considering the long-term investments in physical infrastructures, such as vessels, buildings and organizational complexity and resistance. Despite the difficulties, Maersk achieved a high level of transformation, proving the point that even large and well-established companies

can proceed by embracing the culture.

Another important finding is the role of Artificial Intelligence in improving economic efficiency. In the case of Amazon, artificial intelligence is used to support the customer and maximize sales through personalized recommendations, intelligent search and automatization. In contrast, Maersk uses A.I to optimize transportations routes, minimize operational costs and predictive maintenance to support the extremely expensive assets. This thesis demonstrates that the two companies integrated Digital Transformation for the same reason, the creation of economic value and the increase of competitive advantage, but they implement it in different ways and rate. Amazon's value creation depends heavily on customer's interaction, digital engagement and sales conversion. In Maersk's case, value creation depends on operational coordination, reliability, cost efficiency and effective management of highly complex logistics networks. These findings approve the theoretical approach that was implied in previous chapters, according to which Digital Transformation is not only a technological advance, but a wider transformation of business models within a new economic era. Both companies have redesigned their organizational logic, redefined the economic value process to achieve Digital Transformation and strengthen their position in market and competitiveness. The essence of Digital Transformation lies in the new and robust strategies these two companies applied. In addition, the analysis supports the argument that the managers' involvement in implementation of Digital Transformation is very crucial, because their abilities and willingness lead their subordinates and all company. Executives in Maersk and Amazon testified their vision of new ideas, willing to be trained and equally willing to train their personnel in the development of this new organizational culture. In other words, leadership plays a decisive role in ensuring that technology adoption becomes a meaningful strategic and organizational process than a supportive tool or trend.

5.2 Theoretical Implications

The present study contributes to the theoretical understanding of how Big Data and Artificial Intelligence leads to the integration of Digital Transformation, as they are considered as two of the four pillars, reshaping modern business activities. The findings of the analysis confirm and support the existing theoretical implications and literature, while at the same time highlight the similarities and the differences of Digital Transformation

adoption in characteristics of different sectors of economy. The results reinforce the theory of dynamic capabilities, as organizations must develop the abilities to understand opportunities, seize them and transform their resources in ways that allow them to imply new strategies. In the case of Amazon, the use of Big Data and Artificial Intelligence, developed algorithms, which are capable of understand the consumer's needs and behaviors, personalizing each of them and ultimately manipulating their purchases, according to in available staff in inventory. Maersk, on the other hand, uses digital technology to improve efficiency of its operations and respond to the demands of an unstable international trade environment. Influenced by geopolitical conditions. In both cases, it is obvious that robust changes in strategies and adjustments in organizational processes lead to the embracement of Digital Transformation and ultimately to the efficiency of their functions, competitive advantages against others and to economic value. The analysis findings highlight, also, that Digital Transformation is not the development of technological supportive tools, but a change in the very culture within the organizations. The two-case studies analysis approve the technological involvement to the heart of procedures, functions, decision-making systems and culture, first from the executives, according to their testimonies and the sum of all employees.

5.3 Managerial Implications

The findings of the present studies highlight the impact of Digital Transformation on executives and decision makers to achieve competitiveness and profits for their companies. The analysis of the cases of Amazon and Maersk provides useful insight in how these companies can collect, store and analyze data to train their machines effectively and utilize artificial intelligence for benefit. A first and foremost conclusion is the importance of integrating digital technologies should not be treated as supportive and operational tools, but to involve them in the broader business strategies. These technologies must be considered as fundamental parts of the wider and holist change in the core of the organization. Amazon is a characteristic example of organization, which has integrated data and artificial intelligence into the core of its functions, operations and strategies. Maersk, similarly, that a non-digital company with high investments infrastructure and capital can pioneer and gain sufficiently from digital technology. A second important conclusion is that the transition in Digital Transformation presupposes the existence of skilled human capital,

such as data scientists, software engineers and data analysts. The role of managers and executives is even more important, as they must understand the need for investment in this type of human capital. They must train themselves to understand, anticipate, estimate and judge correctly the results of machines. Also, they need to support their subordinates to embrace the new way of working and to pass their knowledge to them. Leadership is the first and foremost substance of success. They must acquire the ability to interpret analytical methods outputs and incorporate them into strategies and decisions.

The use of real time data enables business to make faster and more reliable decisions, which will strengthen their competitiveness. Amazon, for example, adjusts their offerings, depending on consumer's behaviour, while Maersk uses data to optimize its supply chains and improve risk management. A very important ability of managers is the judgment of predictions or decisions made by machines. Managers must understand the output, judge them accordingly and make the right decisions. Organizational structure, processes and working practices are also a very interesting issue, as sometimes executives or staff are not fond of changes, without resistance. They consider digital transformation act of modernism and decline its adoption. Effectively acceptance of new technology from all parties is the first and most important step. It requires communication, training and active involvement of workforce.

Ethical and legal issues have arrived from the beginning of exploiting large volumes of data and put them on the machine. Personal data protection, information security and the proper and respectful use of artificial intelligence are important considerations that any manager must attend and take them into account. The development of appropriate governance mechanisms is therefore essential in order to ensure the reliability and long-term sustainability of digital initiatives.

Finally, the analysis concluded that digital transformation is not a single investment how applies only once, but a dynamic and continuous progress, which evolves over time. Firms that wish to maintain their competitive advantage and ultimately ensure their survival must invest in technologies, skills and innovation on a continuous basis. Successful integration depends on the abilities of organizations to exploit Big Data and Artificial Intelligence in a manner consistent to their aim, the creation of economic value.

5.4 Future Research

The findings of this study contribute to the present literature of what Digital Transformation is and how Big Data and Artificial Intelligence constitute important factors in its establishment, but there are several directions for future research, which will could offer a better understanding of Digital Transformation and its effects on firms and economy. Digital Transformation remains a relatively new concept. Lots of organizations still cannot understand its beneficial effects, and even they did, it is hard for them to know or to follow the proper steps to succeed. Also, the differences across different sectors of economy create severe incapacibilities in defining the right way to follow. Another factor is the fact that gathering, collecting, storing to analyse data is a procedure that requires time, before can be considered as adequate for training intelligent systems effectively. In other words, we have a big picture about how and how much Digital Transformation can benefit organizations and societies but we still lack of sufficient data for evidence.

A good start in future research may expand the analysis in more than two areas of economy, including more organizations. This will be very beneficial, because examine more firms, even smaller companies from less digitized environment could offer a more comprehensive pictures of challenges and opportunities are connected to Digital Transformation. This Thesis examines two of the largest companies worldwide, Amazon and Maersk, which are characteristic examples of how organizations can embrace transformation for their own benefit. Such a future analysis would provide significant information of how Digital Transformation differs according to companies' size, organizational structure and the level of digital maturity.

In addition, future research would use primary data, instead of secondary. Primary data, such as interviews of executive of several companies or surveys to employees. This would be particularly useful for understanding how managers and their subordinates accept or decline the concept of Digital Transformation, what is important for them to change, and which are the organizational and cultural factors that influence the success or failure of Digital Transformation integration.

Another field for research is the long-term effects in labour and workforce skills. Even though, this thesis highlights the benefits of Digital Transformation in efficiency in

performance, further investigation could explore in technological changes, artificial intelligence and big data lead to job redesign or abandonment or if new jobs are required to emerge in order to sustain digital transformation existence. Also, how these new jobs will be supported by executives and what are willing to offer for that matter.

Digital transformation and environmental sustainability is one more idea for future research. As this thesis deeply examined, the use of digital technologies can contribute to the reduction of climate change by organizations, through better energy management, route optimization and more efficient resource allocation. The quantification of these effect in environment could also contribute a reason for future research.

Finally, interesting research would be the investigation of risks associated with the adoption of Digital Transformation regarding the use of digital technologies and artificial intelligence in more sensitive issues, such as private data. Research to examine what measurements must be taken, regarding legislation, bias, rules and general frameworks would be considered very helpful.

5.5 Conclusion

The main objective of the present study is to investigate how Digital Transformation affects modern business activity, and in particular the role of Artificial Intelligence and Big Data contribute the most, as main pillars in its integration. Through the analysis of two case studies, Amazon and Maersk, it became possible to understand how organizations combine digital technologies with the human factor to create the proper culture in proceeding to Digital Transformation, increase the competitiveness and improve the economic value.

The findings demonstrate that organizations must not treat Digital Transformation as a technological tool, which is going to improve some functions, like a new machine. But, it must be considered as a revolutionary procedure that will change their organizational structure and strategic vision. Companies, which succeed in Digital Transformation are not necessarily those that adopted more technologies, but those that managed to ingrate them in their culture. Of course, technology is very important for the transition, and its absence makes the transformation impossible.

The study of the two case studies, Amazon and Maersk demonstrated that Digital Transformation can be implemented and in very large organizations, that operates in digital economy or in more traditional, capital-intensive sectors. Amazon is an example of

company, which can easier adopt Digital Transformation, because from its very beginning was built in using Big Data and Artificial Intelligence, while Maersk is a large organization with strong physical capital and infrastructure, which could absorb Digital Transformation by altering its functions and business model through digitalization and considering the benefits from such a revolution, like Big Data and Artificial Intelligence. These findings are very important as they prove that Digital Transformation is not restricted to highly technological firms but also can also be implemented and benefit more traditional.

One of the important conclusions of this dissertation is that data can form one of the most important resources of organizations. The ability to collect, store, process and analyse data in real time helps the companies to understand their environment more effectively, make better decisions and form efficient strategies. On the other hand, Artificial Intelligence constitute a very important weapon to help analysing those data and support advanced predictions and decisions. It is clear that Big Data and Artificial Intelligence together provide firms the capabilities to adjust their strategies in a more corrected and profit oriented way.

This thesis argues that all benefits generated from the transition of organization to Digital Transformation do not come without cost. Very important challenges and issues emerge. Within organizations the develop of new skills, data protection and ethical use of Artificial Intelligence are factor, which influence the success and the creation of value. Firms must adopt strategies, technological methods and cultures that will transform them in general, because the success of Digital Transformation depends on the ability to align those factors in the modern digital era.

Overall, the present dissertation confirms that Digital Transformation is a major driver of growth and economic value in modern economic environment. Organizations that can dare redesigning their methods, strategies and creating a revolutionary culture to proceed in adoption of Digital Transformation will respond to the future challenges effectively. By contrast, those organizations that fail to adapt will face severe consequences in a relentless and continuously evolving market. Finally, Digital Transformation is not simply an option, but a necessity. In an environment, which is changing constantly in technology and competition, the ability to adapt and innovate will determine their position in global market.

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