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Application of Information Communication Technologies on Management

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ABSTRACT

The development of Information Technologies brought about a revolution in traditional communication models, leading to global integration on internet networks. The observed changes reflected themselves in commercial operations, leading to the emergence of digital marketing methods alongside traditional marketing practices. In the era of information technologies, businesses must not only focus on innovation but also ensure efficient organization of their production, marketing, and accounting departments.

Consequently, globalization and technological advancements are causing shifts in competition at both domestic and global levels. The production areas of enterprises encompass not only a single country but also the entire globe. The primary factor behind the global reach of international competition is the rapid dissemination of information facilitated by technological advancements. When examined from this standpoint, it becomes evident that technological advancements have a significant impact on the organizational framework and marketing endeavors at both domestic and global levels.

Mere observation of the transformative impact of information technology on the competitive landscape is sufficient to comprehend the vital and irreplaceable role technology assumes in businesses. The research examines the necessity for national economies to adjust to the transformations brought about by the Information Technologies Age on the global stage and the consequences of these changes on them. The discussion of the emergence and historical progression of marketing includes an acknowledgment of the significance of modern technologies for overall management.

The primary intent of the study is to determine the influence of Information and Communication Technologies on economic behaviors, particularly focusing on the patterns of managerial behaviors. This research specifically examined several independent variables, including the level of digital transformation in companies, overall research and development spending, the utilization of big data and analytics, and the adoption of new marketing methods by manufacturing enterprises. The dependent variable analyzed was the global competitiveness ranking. The objective is to investigate the relationship between these variables. The study centers on primary data sourced from raw unprocessed database of Eurostat and IMD Competiveness Report, which plays an essential role for ensuring the accuracy and usefulness of the study's findings.

Keywords: information and communication technology, digital marketing, manegement, competitiveness, innovation

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1. INTRODUCTION

1.1 Background of the study

Explaining the complex relationship between technology, global inventions, new concepts, and the primary function of human beings in today's world is challenging, especially after considering the Earth's age. The reason our era is referred to as the age of information and telecommunication technologies is not a coincidence. Developments in the economic, social, and technological sectors have laid the way for the expansion of free market economies on both the international and local levels. This has led to increased globalization, the establishment of international competition, and the emergence of new economic structures. The emergence of a significant number of organizations specializing in computer technologies is not a coincidence at all. Less than a century ago, humankind was unable to imagine the possibility of a computer being small enough to fit in a pocket. Looking back even further, technologies that we might consider unsuitable for use in our current era had the potential to be celebrated as extraordinary achievements. Currently, it is a reality that a typical mobile phone has the ability to carry out multiple tasks simultaneously, exceeding the capabilities of computers, which were once considered cutting-edge technology. The widespread implementation of information technologies is fundamentally transforming the daily lives of numerous people. These changes had a significant impact on both the domestic politics of different countries and the relationships between these countries, international organizations, social movements, financial groups, criminal organizations, and the global system. Comprehending modern management in theory is not feasible without considering the significance of new information technologies. The utilization of information technology is essential for the efficient management of various social organizations and systems. Management is the process of making and carrying out decisions based on information about the state of a system and its environment. It involves preparing, adopting, and implementing these decisions. Information technology is commonly defined as the process of exchanging messages between systems that send and receive information, resulting in a transformation of the recipient's state. Information technologies can be regarded as a component and mechanism of the information society, with the purpose of overseeing, sustaining, and enhancing the management system of the emerging network society. In the past, information and knowledge were traditionally passed down through rules, customs, traditions, cultural patterns, and stereotypes. However, nowadays, technology plays a primary role in this process. Information technologies facilitate the transmission of information on a worldwide, regional, and local basis. They have a crucial influence on the technostructure,

promoting the importance of education, and actively participating in various aspects of socio-political and cultural life, such as domestic affairs, entertainment, and leisure activities.

Technology is crucial for enabling businesses in particular sectors to achieve economies of scale and concentrating on globalization. Global enterprises depend on technology to enhance their efficiency. Technology is both a consequence and a significant driver of globalization. The impact of advancements in information technology and telecommunications on the competitive landscape, as well as the significant transformation in global business practices by individuals and organizations, clearly highlights the importance of this issue (Fatima, 2017).

Science and technology have been the driving force of major changes and developments in the world so far. In recent years, advanced technologies that fascinate and frighten individuals and societies are emerging with a brand new dimension in the political, economic and military fields. A great race, competition and technological war continues among industrial countries in this field of advanced technologies, which constitute the building blocks of the third industrial revolution. One of the most frequently encountered elements in market relations is the ever-increasing competitive conditions. In today's world where this competitive environment, also called destructive or destructive competition, prevails, industrialized countries are confident that none of the developing countries can compete with them at the cutting edge of science and in the fields of advanced technology (Mashelkar, 2017)

Businesses often seek high technology as a medium to enhance their competitive advantage. Therefore, businesses can effectively fulfill consumer demands in a timely manner and deliver superior quality products, thereby gaining a larger market share. Technology provides an extra competitive edge through the introduction of innovative goods and manufacturing methods (Dereli, 2017).

The integration of information technologies and telecommunications is fundamentally changing the competitive landscape for companies. Historically, substantial financial resources have been allocated towards technological advancements in order to reinforce competitive strategies. Subsequently, this pattern persisted and businesses emerged as substantial consumers of telecommunications (John Diebold, 1986).

Within the framework of market dynamics, a crucial objective in both macroeconomic and microeconomic domains is to examine and address the theoretical and methodological challenges of contemporary management. Every component requires management to some extent. Management is the skill of effectively guiding individuals' actions and shaping their conduct to

accomplish objectives. It is a universal concept that can be utilized in various domains of human endeavor. Alterations in market dynamics fundamentally transform the characteristics of the economic system and consequently induce modifications in overall management relationships. The shift in management relations signifies the enhancement and advancement of management within the context of new market dynamics. The significance of this topic is also defined by the fact that the foundation for enhancing and advancing management lies in the examination of management theories and concepts, as well as their integration with the continuous advancement of technology. Hence, it is essential to first delve into contemporary management theories and concepts, as they hold significant theoretical and practical significance. The text explores the establishment of management science, the development of different management schools, and their defining features. It also investigates the primary functions of contemporary management, the application of strategic management in the modern economy, the enhancement of labor productivity, the factors influencing it, and the analysis of technology's role in this context.

1.2 Problem Statement

The primary focus of management and its significant enhancement, to adapt to contemporary circumstances, involved the widespread utilization of advanced information and communication technology, along with its establishment on the foundation of highly efficient information management technologies. Technological tools and methods are utilized in the management process. Information technology-driven advancements require modifications in management's organizational structures, regulations, human resources, documentation systems, and information recording and delivery methods. The implementation of information management is particularly important as it greatly enhances companies' ability to utilize information resources. The advancement of information management, the structuring of the information and knowledge processing system, and the formulation of scientifically sound proposals and recommendations within comprehensive automated management systems that encompass all levels of production and management, both vertically and horizontally, holds significant significance.

1.3 Aim and Objective of the Study

Within the scope of this research, the primary objective of this study is to analyze the utilization, enhancement, and advancement of information technologies in the management process. Additionally, it aims to investigate the evolution of management from its inception to the present day. Regarding these matters, we discussed topics such as the fundamental nature, principles, and functions of the management process, as well as the utilization of information technologies in

management. The main objectives of the research include investigating the origins of management as a scientific discipline, analyzing different management schools and their developmental traits, identifying the key functions of contemporary management, examining strategic management in the economy, enhancing labor productivity and identifying the factors that influence it, exploring the factors that impact productivity and competition in management, and determining the role of information and communication technologies in these factors.

1.4 Research hypothesis

The research hypotheses are proposed as follows:

H1: The use of big data and analytics significantly affects the Business efficiency ranking and the use of big data and analytics.

H2: Digital transformations in companies significantly influence the competitiveness level in the countries of the companies.

1.5 Significance of the Study

The constant development of technology has had an enormous impact on multiple fields, including healthcare, education, economy, and engineering. The influence in question was not dismissed in management, as it is directly connected to each of these fields. Hence, considering the various aspects of modern management, the significance of the research lies in the utilization of management theories and perspectives in the management process across different domains, along with the provision of practical recommendations. This study explores the practical implications of implementing management strategies at both the macro and micro levels. It specifically focuses on the role of information and communication technologies in global management processes, strategic management, crisis management, corporate management, and improving labor productivity.

1.6 Limitations of the Study

Considering the broad definition of the field of management, it has the potential that particular management issues and the influence of information and communication technologies may not be addressed in the dissertation. However, the dissertation did not adequately address the presented issues with the same great detail and comprehensiveness.

1.7 Structure of the thesis

Once this research is finished, it will be presented as a dissertation. The utilization of the dissertation as a means to present the findings enables future researchers to employ the data for the advancement of their study in the realm of information and communication technologies and its impacts. The dissertation will be structured sequentially, with each chapter outlined as follows. This study consists of four primary chapters:

Chapter 1 (Introduction): This chapter encompasses the contextual information of the study, the statement of the problem, the goals and objectives, and the organization of the research. Chapter 2 (Literature Evaluation): This chapter presents an extensive and analytical review of the literature regarding the scientific nature of management, information communication technologies, and their interconnected effects. Consequently, it will be constructed based on articles and other literary pieces authored by other writers. Chapter 3: (Research Methodology provides an overview of the data and methodology employed in this study. Additionally, it presents the findings of the empirical analysis. Chapter 5 (Conclusions): This chapter presents the final outcomes based on findings.

2. LITERATURE REVIEW

2.1 The evolution of management theories and principles

2.1.1 The emergence of management science

The history of management practice is extensive. Nevertheless, the management practices of the past were significantly distinct from those of the present. Although management has a lengthy history, it is a relatively new field of study in the realms of science, economics, and research. Management emerged as a discipline and field of study during the late nineteenth and early twentieth centuries. Archaeological findings have demonstrated that even in the early stages of human civilization, individuals formed organized collectives and engaged in shared endeavors, often under some type of governance (Perewari & Otimi, 2024).

Thus, in order to acquire a deeper understanding of the evolution of management as a scientific discipline, it is beneficial to concentrate on the domains it influences and the manner in which it molds societies. The Agricultural Revolution and the Industrial Revolution play a significant role in the economic advancement of societies. The transition from a lifestyle of hunting and gathering to a settled way of life occurred during the Agricultural Revolution. Given the opportunity with a growing population, early humans actively searched for additional resources. To address the requirement for nutrition, they engaged in the practice of cultivating the land and domesticating animals. A reduced activity level has altered the composition of migratory human societies. Following the agricultural revolution, land became the primary asset for human communities that began to settle in villages located near bodies of water. Surplus product acquisition led to the launch of exchange activities and the emergence of new occupations beyond agriculture. Over time, the birth of city states had an impact on the change. Political organizations were established to form city states. The division of society is linked to the Agricultural Revolution. As ancient societies emerged, the concept of privilege became relevant. The ruling class of the Ancient Age collaborated consistently with various social classes during historical developments. This collaboration is efficient in guiding individuals' future (Everett E. Hagen, 1963).

During the transition to the Industrial Revolution, agricultural societies dependent on manual labor had to adapt to a new societal structure characterized by the dominance of machines. The advent of steam engines in the 18th century marked the commencement of the Industrial Revolution. The growing accessibility of information has accelerated the rate of societal progress. Information is a crucial factor that drives change and promotes progress. The era of Information Technologies is influenced by the presence and utilization of information.

The profound transformations that occurred in the world following the Industrial Revolution have had a significant influence on the shift towards the Information Technologies Age. The global economy experienced fluctuations but overall expansion from the 1850s until the outbreak of the First World War. The Industrial Revolution played a significant role in shaping the economic history of the world through its technological advancements. The repercussions of the First and Second World Wars compelled societies to allocate greater resources towards the advancement of science and technology. In this emerging period, known as the Information Age, information has transformed into the fundamental resource of economies (Feng Cao, 2021).

Prior to the twentieth century, organizations were not approached with a scientific and systematic management perspective, despite their historical presence. Due to the distinct characteristics of each era's development and ownership structures, the perception and approach towards organizations and their management have differed (Marshev, 2021).

2.1.2 The primary functions of modern management

Management is the process of influencing many types of systems used to reach the ultimate goal of a business while preserving its integrity and structural coherence. Management cannot be done without an object (organization, enterprise, or corporation). The existence of management is linked to the existence of organizations. That is, if an organization exists, so does management, and vice versa.

Management is an ongoing, dynamic activity. The proper organization and solution of this process necessitates the organization and implementation of all work done in the direction of reaching the desired outcome in the form of discrete functions (Cunningham, 1979):

Modern management primarily involves:

- Planning
- Organization
- Coordination
- Motivation (execution)
- Supervision

Planning function.

The planning process is a technique for organizing concepts relevant to decision-making and implementation, which includes:

Resource Allocation - This process involves allocating restricted resources like as finances, managerial personnel, capital, and technological skills.

External environment adaptation entails taking steps to improve the organization's relationship with its surroundings. Each organization must adjust to both favorable possibilities and potential dangers from the external environment. For this, the firm must identify important scenarios and ensure that its strategy is adaptable to the environment.

Internal coordination - is the coordination of actions that address both the organization's weak and strong points in order to achieve effective integration in intra-firm operations.

Organizational strategic foresight - For the organization's survival and efficient operation, leveraging past strategic decisions by managers, anticipating and implementing scientific and technological innovations in real time means ensuring the enterprise's regular and dynamic growth (Miller et al., 2004).

Information technologies are applicable in all aspects of management, including planning, organizing, directing, coordination, and control. Primarily, it offers significant advantages during the initial planning phase, which is the fundamental and primary stage of managerial operations. At this level, it oversees the strategic process of gathering, organizing, manipulating, and evaluating data. Hence, in order accurately determine the objectives of the institution and effectively carry out other procedures, it is crucial to methodically gather information and make it practical. Given the similarity in the fundamental purpose of information technologies, it becomes more straightforward for assessing their impact on managerial tasks. Information technologies play a crucial role in implementing strategies and assessing the progress towards reaching desired outcomes (Hasan Kürşat Güleş, 2003).

The utilization of computers and the rapid growth of internet networks are integral components of the Information Technologies Age. In the era of Information Technologies, the composition of societies is undergoing transformation, necessitating acknowledgment of the emergence of novel social, cultural, economic, political, and technological frameworks. The current era has revolutionized the way management functions are strategized and implemented, with digital technologies playing a crucial role in handling data, engaging with customers, and enhancing overall organizational effectiveness. Effective digital marketing strategies are now crucial in management, particularly as information communication technologies are increasingly utilized for business purposes. The incorporation of digital tools enables effortless communication and transaction capabilities, rendering geographical and temporal constraints progressively insignificant. This change requires the implementation of novel marketing strategies to effectively engage with a worldwide audience (Janković et al., 2018).

Organizing is another crucial aspect of management. The purpose here is to ensure the successful execution of the adopted work plan. The organizational function involves conducting necessary work for the implementation of the activity. The organizing function is the stage in which the activity shifts from the planning phase to the implementation phase. The organization recruits and strategically places the essential components required to initiate the task, ensures their cooperation for future collaborative endeavors (Sims, 2002).

Utilizing information technology in the process of planning and forecasting enables organizations to promptly anticipate and adopt scientific and technological advancements. Technological advancements have a significant impact on societies, both in terms of their economic and social-cultural aspects. The utilization of advanced analytics and digital tools enables the organization to anticipate and plan for future challenges and opportunities in a highly competitive and rapidly changing marketplace, thereby ensuring its continued existence and expansion.
The complexity and arrangement of overseeing both managing and managed systems have a significant impact on coordinated management. This underscores the importance of employing systematic methods to handle events and processes, such as crisis communication and maintaining effective organizational communication (Saleem et al., 2020).

2.2 History and Development of Information and Communication Technologies

The transition to the information society has required firms to adopt a new mindset, especially as communication and information technology have progressed and worldwide competition has increased. The new strategy centers on perceiving the organization's output as "information" and the technology derived from it, rather than as physical objects. It also involves investigating how organizations will adjust to increased competition driven by information.
Currently, the value added by information output surpasses that of physical output. For instance, the profit obtained from manufacturing and selling a machine is lower compared to the profit generated by selling the expertise and design necessary to create similar gadgets. Consequently, organizations engaged in physical manufacturing will continuously rely on companies involved in technology and information production. This viewpoint from the corporate level can also be extended to the national level, and it is possible to contend that countries whose businesses are involved in physical manufacturing using a restricted range of technologies will inevitably rely on countries whose businesses are engaged in the production of information technology. Companies

are beginning to explore strategies for adapting to this novel situation. During this process, new organizational structures and business practices have emerged (Sümeyra Alpaslan, 2014).

The shift from a hunter-gatherer lifestyle to more structured social systems influenced the development of land-based lifestyles that involved manual movement using hands and arms. Although the Agricultural Revolution was seen as a significant advancement for humanity, the subsequent Industrial Revolution brought about a profound and transformative shift. Computers are a crucial tool in the widespread adoption of information technologies. Computers and internet networks enable the gathering, processing, preservation, and sharing of information (Hill et al., 2011)

In today's period of Information Technologies, significant transformations are occurring. The shift from existing social frameworks to the information society is a significant aspect of this transformation. Change is a process of transformation that results in alterations to the fundamental operations of marketing. It is observed that individuals consistently require information as a result of their inherent inclination towards growth and adaptation. (Stone et al., 2007) states that change is the most evident outcome of knowledge. Change, which also influences commercial activities, results in the expansion of human needs. This applies to both the promotion of ideas and the promotion of goods and services. The impact of change on marketing is an indisputable reality. In the present era of technology, societies that rely on information require diverse strategies and approaches in the field of marketing. An information society is a social phenomenon that is characterized by the widespread use and reliance on information and communication technologies.

Discussing the wide distribution of knowledge in all areas within this social framework is imperative. Knowledge encompasses a wide range of subjects, including social, political, technological, and economic fields. Due to its multidimensional nature, it spans across various areas. An important factor to consider in information societies is the proper utilization of information technologies. Ineffective and inefficient utilization of information technologies impairs their ability to meet expectations. The production of information is essential for the functioning of the information society. Data that can be generated, stored, utilized, and exchanged is advantageous for society. In the present era, computers and the internet are widely utilized. The post-industrial developments have given rise to an information society that is influenced by both information and technology. A crucial aspect of information technologies is their capacity to capture, safeguard, and reprocess data, as well as facilitate its sharing (Sidanius & Pratto, 2004)

Technological developments such as software innovations including new hardware and inventory procedures significantly contribute to the rise in productivity. While technological advancements

are the primary cause of long-term output growth, it has been discovered that long-term economic development may be disturbed in the absence of continual technological improvement (Cameron et al., 2005). Technological advancements result in increased number, quality, and differentiation of products and services, as well as a reduction in physical and technical hurdles in corporate life. Technological advancements that expand the range of new products and manufacturing methods promote human and economic progress (Mohamed et al., 2022).

In the early 2000s, technology advances at a dizzying pace, with new inventions and ideas popping up all over the world, and the it should be mention that the human factor is at the center of all these events is a difficult scenario to explain, given the planet's age. (Hossein Karbasi Yazdi*, 2013) this situation wasn't until the end of the twentieth century that people discovered themselves, realized the importance of their knowledge, and were able to apply it. Classical production variables such as capital, labor, and natural resources have now faded into the background, with knowledge and technology emerging as human beings' most valuable assets.

Technological capabilities promote the development of new technologies and makes optimal use of imported technology. Technological competence encompasses research and development activities related to the transformation and advancement of imported technology, as well as novel R&D applications (Sosa, 2009).

2.2.1 Management Information Systems

Management information systems (MIS) are a type of management support system that facilitate the creation and delivery of regular, clarified reports. These reports facilitate in the planning and monitoring of a company's ongoing operations, as well as in forecasting its future performance. Management information systems primarily prioritize internal company activities and provide assistance for planning, control, and decision-making tasks at the management level, rather than focusing on external and environmental activities. Management information systems typically rely on business transaction systems to obtain the necessary data. Managers can utilize Management Information Systems (MIS) to track various types of information at their preferred level and access this information on computer screens. Managers can maintain constant control over the companies they are accountable for managing. The latest advancements in information technology, such as computer hardware, software, and communication tools, allow for the rapid, precise, cost-effective, and adaptable collecting, transmission, recording, processing, access, and display of data (Rodríguez Torres et al., 2022)

To enhance the understanding of the subject and analyze the influence of technology on the process of globalization, it is beneficial to focus on the domain known as information and communication technologies. Information communication technologies have facilitated easier access to visual, audio, written, and unwritten information. According to (Abbott & Coenen, 2008) it is a comprehensive process that encompasses all advancements in technology that make it easier to access, gather, store, and process information. It is accurate to state that globalization plays a significant role in creating the global network that encompasses the world. The internet, which originated in the United States during the 1960s, was a result of the rapid transmission of messages over long distances. Subsequently, as the Internet became universally available, it became integral to the establishment of social networks, encompassing social media platforms. This extensive network has spearheaded the globalization of the world, effectively turning it into a global village. After the discussion of the ongoing advancement of technology, which is continuously progressing due to the influential power of information. To delve deeper into the topic, it may prove essential to analyze the extent to which technology is integrated into globalization.

2.3 The technological aspect of globalization

Globalization encompasses various dimensions, including the economic, social, political, cultural, and technological aspects. Technology, as a significant factor in globalization, has permeated society due to advancements in information and communication technologies since 1980.
Eliminating the perception of time, space, and distance is of utmost importance. Technology is the catalyst that both exposes and expedites the process of globalization.

Essentially, technology is not a necessary component of globalization, but rather a dimension that must be incorporated. The advancements in information and communication technologies, particularly in the industry, have led to an increase in production capacity. This has resulted in reduced costs and wider accessibility of technology to society, thereby accelerating the process of globalization. Specifically, the incorporation of integrated circuits and microprocessors into computers, along with the emergence of the internet in the 1990s, took on a global scale due to the elimination of borders in the process of globalization. This resulted in the creation of a worldwide network (Skare & Riberio Soriano, 2021).

The economy was the initial domain impacted by technology within the framework of globalization. The growing division of labor and specialization, along with the emergence of new professions, have played a significant role in the shift of the economic sphere towards the social

sphere. (Goos, 2018) describes these nascent professional groups subsequently engaged in a power struggle and became involved in the political sphere. Culture is the final domain where all these fields and technology are manifested. Culture is a relatively stable component that undergoes minimal changes over extended periods. This is why it is characterized by the occurrence known as culture the delay.

2.4 The era of Industry 4.0 and technological innovations

The term Industry 4.0 was officially established in 2011. This emerging industrial movement originated in response to the advancements occurring in Germany. The prevailing sentiment of the Industry 4.0 era is influenced by intelligent technology, sustainability, and the utilization of novel energy sources (Bai et al., 2020)

To comprehend the connection between globalization and technology, it is crucial to initially analyze the developments that have been achieved in various fields of industry. The industrial revolution, which originated in the 18th century, was set off by the utilization of water and steam power in mechanical manufacturing processes. Subsequently, during the early 20th century, the second industrial revolution occurred. The utilization of electrical energy in the industrial sector resulted in the implementation of the assembly line, which facilitated mass production. During the third industrial revolution, which occurred after the 1970s, the utilization of electronics and information communication technologies played a significant role in achieving the highest levels of production automation. Significant advancements in the production process have been achieved through the establishment of a digital connection between cyber and physical production, facilitated by the fourth industrial revolution (Pietrobelli & Puppato, 2016)

This concept encompasses more than just a process that corresponds to the design and automation of the value chain system. Conversely, it demonstrates an integration among all currently functioning elements. The coordination process is an effective industrial process that utilizes advanced digital technology. These devices are fast, high-quality, and equipped with intelligent and self-managing capabilities. They additionally have the ability to communicate in real-time without any interruptions. Today, there have been occurrences of both favorable and unfavorable outcomes, including severe weather phenomena, acts of terrorism, and instances of data manipulation (Birkel et al., 2019).

Given the rapid advancements in computer and internet technology, it is undoubtedly that every device connected to the network faces significant vulnerabilities and potential risks. The resolution of privacy concerns and the cyber attacks on the internet requires effective management.

Additional threats arise from the integration of the industry with digital, biological, and physical technologies, resulting in the emergence of novel challenges. There has been a rise in industrial turns it down, degradation in the labor market, and a growing belief that technological innovations may have negative consequences. Today, the remarkable and rapid transformation in production, accessibility, energy market, and other systems has sparked certain movements in various areas, including job opportunities, social issues, and geopolitical positions. The escalation of this situation implies that it will entail certain potential risks. Essentially, it appears unavoidable that technology will drive out specific fields while simultaneously generating new ones (Friedewald & Pohoryles, 2013)

This recent revolution in the industrial sector has had a significant impact, distinguishing it from other advancements. Industry 4.0 has brought numerous innovations into our lives. The advancements in data processing and storage capabilities, along with the unrestricted access to information, are highly significant progressions. Particularly, the advancement of artificial intelligence technology, three-dimensional printing technology, quantum computer technology, and energy storage are crucial technological developments for improving the well-being of humanity. The industrial revolution brought beneficial outcomes in terms of economic expansion and societal progress, particularly when accompanied by effective governance. The ongoing advancements in emerging innovations are leading to the continuous development of network technologies that are equipped with internet infrastructure and databases known as Big Data (Saniuk et al., 2020)

The launch of Big Data has led to a significant increase in the speed and volume of information. Nevertheless, it is challenging to manage this vast quantity of information. The solution involves extracting and accessing the desired data using techniques such as data mining and cloud technology. Subsequently, expanding technology has advanced the field of robotics with the assistance of the industry. The growing fascination with robotics and automation technology has driven the advancement of this field. It enhances productivity, fosters competition, and facilitates job creation. The implementation of artificial intelligence in this field has significantly enhanced productivity, regenerated labor markets, and facilitated seamless integration between humans and computers. Nevertheless, robots have significantly reduced the necessity for human involvement and have consequently introduced numerous challenges, particularly in the form of unemployment (Saniuk et al., 2020).

In today's world, huge corporations can develop R&D-based growth strategies using their own resources. However, there is a greater need for states to contribute and regulate in order to increase the R&D capacities of SMEs, which account for a significant portion of the economy. It is evident that in nations such as South Korea and China, which have recently witnessed fast growth, these R&D-based growth strategies are specifically intended for SMEs (Seo & Cho, 2020).

However, the ongoing progress of information and communication technologies promotes enhanced competitiveness in integrated countries. Adapting to constantly evolving technologies, monitoring advances, and harmonizing production processes based on technology advancements. Small and medium-sized enterprises contribute to economic progress by adjusting to quick changes through flexible production systems. New substances developed as a result of technical advancements, such as new types of plastics, ceramics, and metal alloys, are widely employed, particularly in electronics, communications, spacecraft, vehicles, and medicine. All of these advancements have resulted in an information explosion, which has accelerated the transition to an information society.

With the advancement of technology, traditional business processes have been replaced by aspects such as created information technologies, client base, the product and service quality. As a result, instead of easy-to-measure and manual components, aspects that are less tangible or abstract and more difficult to measure and modify have evolved. The usage of computers and the growth of internet networks are key components of the information technology age. In the age of information technologies, the structure of societies is changing, and new social, cultural, economic, political, sociological, and technological frameworks have emerged. In this new process known as the age of information technologies, it is evident that new structures are being attempted to explain using diverse notions. Digital technologies play a vital role in the information technology age. Data can be recorded, processed, archived, and disseminated using information technology.

According to (Suganya & Shanthi, 2014) the discovery of microchip technology, the creation of the internet, and the application of nanotechnologies in industry are all key elements of technological advancement. With the broad adoption of the Internet, the combination of numerous elements has resulted in a significant shift in traditional marketing approaches.

Consumer habits have shifted as a result of the commercial use of internet technologies. The internet, which allows for continuous connection between businesses and consumers, supports simultaneous and two-way communication. This enables customers to shop from virtual storefronts despite time and space constraints. While traditional marketing approaches evolve into digital channels, businesses and consumers connect on digital platforms. These advancements,

which allow worldwide marketplaces to converge, necessitate the development of new marketing tactics. It is critical to employ digital channels for digital marketing operations because digital marketing has a broad range of influence and allows for mutual connection(Deniz Zeren, 2020).

Interest in the Internet grew in the 1990s, particularly as the user-friendly World Wide Web became more widely available. Tim Berners-Lee, a physicist at Switzerland's Cern, created the web in 1980. The Web, which began as an electronic library for physicists, has now evolved into the international market (Erik P. Bucy, 2014).

The global adoption of internet networks has prompted the development of new marketing methods. These networks have caused shifts in customer behaviors, aspirations, and demands, necessitating the adaptation of marketing strategies. Businesses use a variety of tools to interact with customers in real time and bidirectionally through digital channels, such as social media, websites, and email apps. While digital marketing has benefits, it also has drawbacks, emphasizing the necessity for continual research and adaption. The rapid expansion of information technologies has important ramifications for commercial activity, changing the competitive landscape and allowing enterprises to reach customers via virtual platforms. In addition to product and service marketing, these venues are ideal for concept promotion. However, remaining competitive in this dynamic market necessitates ongoing work from firms, as technological improvements affect economic, social, and cultural dimensions. While technology improves communication and allows for more targeted marketing techniques, it also results in higher investment costs and cost structure changes. Nonetheless, information technologies improve efficient communication, allow for the tracking of client preferences and habits, and provide chances for individualized marketing methods, which optimize resource usage and increase customer engagement (Wibowo et al., 2020).

The Internet and the World Wide Web distinguish firms' approaches to customers and connections with them. The Internet has impacted firms' market potential, information technology, and network infrastructure. At the same time, it has highlighted organizations' business models, new market opportunities, and the need to redefine notions like customer interactions. While the speed of competition between companies has increased due to technological advancements, businesses that stay local and traditional have suffered as a result of globalization. The advancement of technology has led to increased competition among companies worldwide, as they seek to produce high-quality products and enhance customer satisfaction. The process by which companies adapt to new global trends is referred to as global competition (Sugandi & Kurniawan, 2018).

Marketing communication involves two-way communication. Marketing communication facilitates the flow of knowledge and experiences in both directions. New technical innovations, in particular, provide up new avenues for this kind of communication. Creating a database and utilizing it in decision-making opens up several potential for marketing communication. Research attempts to determine the consequences of communication and consumer inclinations. As a result, consumers become the primary source of marketing communication. The information acquired reveals fresh marketing communication options.

Globalization has the following implications for marketing: It creates competitive markets. It shortens the processes of change or decision making. It involves the development of a complicated structure for marketing tactics. Changes in client education and communication, improvements in marketing information systems, and qualifications for marketing managers (Sharifonnasabi et al., 2020).

2.5 Expansion in consumers' levels of education and communication

The rise of consumers' knowledge and communication competence results in a spike in product demand, accompanied by higher standards for product excellence. Consequently, there is an increase in the number of complaints, and messages related to the product, and a heightened emphasis on product packaging, particularly the perception of product attributes(Boz et al., 2020)

(Agarwal & Dutta, 2015) says that in the present period, characterized by evolving technology and communication networks, businesses have shifted to the marketing 4.0 era. This new marketing technique is a response to the changing behavior of consumers. The marketing 4.0 strategy, which emphasizes consumer perceptions and attitudes, has increasingly incorporated the concept of neuromarketing. This field employs many methodologies to test consumer reactions to external stimuli on the human brain.

Communication facilitates the exchange of experiences among consumers and the swift collection of knowledge pertaining to product quality. Hence, corporations strive to promptly recognize the demands of consumers through technology and communication, enhance quality, and prioritize customers in response to competition. In addition, companies consider it their obligation to cultivate enduring relationships with clients and foster positive connections. The demand for items is determined by factors such as demographic structure, product quality, education, and communication level of consumers (Wang et al., 2012).

To ascertain the internal and external determinants that influence consumers' buying behavior and, consequently, to determine whether consumer preferences are volitional or predicated on some underlying rationale, businesses devise a variety of marketing strategies and tactics to increase their market share and favorability. The integration of brain scanning techniques is referred to as neuromarketing. The field of neuromarketing, which was established by Antonio Damasio, which proposed that consumer behavior involves the emotive as well as the rational faculties of the brain, is also defined as the study of consumer behavior's corticol responses. To put it another way, neuromarketing entails the examination of consumers' mental reactions and attitude components in response to specific marketing-related stimuli or messages from a neurological perspective (Ahmed et al., 2022)

Historically, businesses constrained their marketing activity. Businesses who persisted with a door-to-door marketing strategy recognized the necessity of focusing on specific demographics at a given stage. Mass media facilitated the development of novel communication tactics. With the increasing prevalence of such techniques, the era of door-to-door marketing has come to an end. Presently, we observe a like image. In the present day, there is a greater emphasis on the importance of creativity, innovation, and delivering value. For instance, if an advertisement is tailored for businesses but lacks relevance or appeal to the intended audience, it may lead to unsuccessful outcomes.

Neuromarketing is the integration of data from psychophysiology and neuroscience to provide a fresh approach to marketing strategies and procedures. Neuromarketing strategies are designed to comprehend customer behavior and ascertain the workings of decision processes during the purchasing process, as well as the various internal and external elements that influence them. They explained the comprehend consumer reactions by observing the impact on their brains of stimuli such as commercials, logos, and generic music associated with items. Neuromarketing plays a significant part in comprehending the experiences that shape consumer perceptions in the current marketing landscape, which places a greater emphasis on experiential marketing (Hubert & Kenning, 2008).

2.6 The impact of technological advancements in marketing on global competitiveness

Adapting to changing market conditions has become an unavoidable necessity for companies and countries in today's highly competitive environment. The rapid and significant transformations in the economic, social, cultural, and technological domains necessitate a comprehensive restructuring. The factors that facilitate swift and uninterrupted change are as follows: Global Competitive Landscape: In the present era, advancements in the economic, social, and technological spheres have led to the globalization of markets and the transformation of international competition in terms of structure and scale. Success now hinges on the prompt recognition of shifts in the surroundings and the ability to adjust to the demands of the business. Adaptation in Competitive Tools: Continuous innovation in production is now essential to maintain competitiveness in the dynamic business environment. Innovations in technology: Technological developments are the primary catalyst for change and impact the configuration of industrial rivalry. When the dynamics of competition shift, we encounter significant adversities (Dereli, 2015).

With advancements in technology, databases containing information on consumers, market segments, and their attributes are now being utilized more efficiently. This has made it simpler to assess whether the desired objectives have been accomplished. From the formulation of high-level strategies to the implementation of specific tactics and the achievement of objectives The dominant factors have been a focus on customer satisfaction and effective two-way communication. Perhaps Marketing communication tools are influenced by various factors. Incorporating it into the marketing mix has been perceived as a harmonious solution(Dittfeld, 2017).

The primary challenge in product planning for international competition lies in establishing marketing strategies for the same product that can be adapted to the unique requirements of different countries, taking into account the modifications required by the company (Sudirjo, 2023). Marketing strategies differ among product categories in relation to global competition. Certain countries have manufacturers that produce various consumer products, while other countries specialize in manufacturing specific industrial products. Countries engage in marketing activities based on the specific products they cultivate and manufacture. Regarding international competition, countries with individuals specialized in marketing practices can effectively implement these practices across different fields. Nevertheless, the options accessible to nations might restrict marketing strategies to guarantee global competitiveness.

In certain nations, despite the presence of product producers or growers, there is a lack of success in effectively promoting and selling these products. Marketing practices aimed at customers necessitate the execution of various services in conjunction. The ability to meet customer demands for packaging relies on the advancement of the packaging industry and its various sectors. It encompasses the establishment of an efficient distribution system to facilitate the transportation of goods (Sook-Fern Yeo et al., 2020).

Packaging refers to the protective covering that allows a product to be sold and stored by the purchaser. In both global and local markets, the packaging holds equal significance to the products and their prices. Selling a product becomes more challenging when the packaging is not considered and fails to align with the cultural characteristics and consumption habits of the target market. (Sook-Fern Yeo et al., 2020) Packaging design has played a crucial role in effectively promoting brand perception since its inception. The design process encompasses the evaluation of functionality, visual aesthetics, and marketing concerns (Dong & Gleim, 2018).

Initially, the purpose of packaging was primarily to safeguard and maintain the integrity of products. Conventionally, packaging serves the purpose of safeguarding products and maintaining their integrity during the entire supply chain until they reach their ultimate destination. As industrialization and technological advancements have become more commonplace, packaging design has also progressed and its fundamental purposes have expanded (Escursell et al., 2021).

Packaging serves a dual purpose of safeguarding products and boosting sales. Hence, packaging design necessitates not only the choice of materials and techniques, but also careful strategizing and deliberation of multiple factors, including visual design, communication of the brand's message and value. Hence, in addition to its primary role of safeguarding goods, product packaging now serves as a medium for conveying value, influencing consumers' assessments of products and their desires for consumption. Businesses must prioritize the interaction between users and packaging design to effectively promote their products and brand values. The role of product packaging is significant in everyday life. Today, innovative packaging designs have the potential to distinguish a product from its competitors and make it more noticeable among alternative options. For instance, the utilization of a novel raw material as packaging, the implementation of a user-friendly and easily transportable design, and the incorporation of diverse graphic elements can establish a competitive edge over conventional packaged goods. In order to adapt to the ever-evolving consumer habits and marketing techniques, companies must formulate innovative strategies to expand production and explore new markets. As nanoscale natural materials and composites are being created to enhance the primary purposes of packaging, which

are 'protection' and 'preservation', the functions of 'communication and interaction' are also advancing in combination with high-performance computing devices and technology (Tijssen et al., 2019).

In the era of Information Technology, digital technologies are widely utilized. Technological advancements shape the radical changes that take place in social structures. The predominant characteristic of this era is the transformative impact of technology.

The concept of the information society emerged in the years following the 1950s (Magnier & Schoormans, 2015). The widespread adoption of information technologies in America, Japan, and Western Europe arose as a consequence. Information technologies are widely employed in all domains in the present era. Health and agriculture. These technologies, employed in various sectors including industry, service, communication, and education, contribute to production and result in heightened productivity. The primary characteristic of this emerging change is its rapidity. In the midst of a period characterized by swift transformations in the realms of economics, politics, society, and culture, all aspects have an impact on societies (Wandosell et al., 2021)

The field of design undergoes development and transformation due to advancements in science and technology, as well as changes in the economic and cultural environment. The integration of different disciplines is growing, leading to the production of diverse and innovative outcomes. Recently, the packaging industry has shown growing concern for consumer-oriented matters. During the decision-making stage of packaging communications, the initial perception of consumers is primarily influenced by visually attractive elements, functionality, and graphic design of the packaging (Timney & Chamberlain, 2017).

By relying on the fact that over 80% of the global population utilizes smartphones, establishing connections to digital content serves as an effective method to enhance customer engagement. In today's hyperconnected world, the utilization of information and communication technologies to facilitate novel ways of engaging with products has the potential to create distinct business models that enhance consumer satisfaction, perception, and loyalty. Interactive experience is attained through the integration of interactive technologies, including QR codes, Augmented Reality (AR) technologies, smart sensors, printed electronics, and NFC tags, into the design of packaging. By implementing these technologies in packaging, shoppers can be engaged by the brand's narrative and past, receive discounts, obtain extra product details, and be drawn to other related products from the same brand. Therefore, enhancing and fortifying the customer experience is possible. (Paolucci et al., 2018) says the term Augmented Reality refers to the combination of superimposed

media with computer-generated images, resulting in a mixed reality experience. Furthermore, "AR" denotes the overlaying of a virtual object onto the physical world, thereby augmenting the user's immediate surroundings through the inclusion of an image or animation superimposed upon their real-world perspective. Augmented reality is employed for attaching virtual objects to tangible objects in the user's perception. Additionally, it facilitates interaction with the actual environment surrounding the individual in a virtual manner. Augmented reality can also facilitate a purchasing decision by visually demonstrating the appearance, functionality, and potential life-enhancing benefits of a product.

As technology develops, designers are exploring the intricate connection between consumer behavior and interactive system design, as new types of human-packaging interactive systems are being developed. In this section of the study, digitally created packaging is examined as a digital interactive system, drawing connections to theories of human-computer interaction, interaction design, and user-centered design. The objective is to examine the essential components of creating a successful interactive packaging. The showcased packaging designs establish a correlation between a commonplace element, namely product packaging, and interaction design. Interactive packaging surpasses the conventional unidirectional exchange of information and initiates a distinctive communication capability between the packaging and the consumer. The widespread adoption of these technologies enables designers to craft unique experiences and settings, providing brands with the chance to establish emotional and profound connections with their customers. Yet, the achievement of establishing this connection can be credited to the adherence of the designed structures and surroundings to user anticipations. Hence, the primary objective of interaction design is to develop interactive products and systems that possess the qualities of usability, learnability, effectiveness, and user satisfaction (Sun & Zhang, 2023)

The promotion is a crucial element in the marketing strategy of companies that operate in international markets. It encompasses various processes of transmitting information and influencing others in relation to products. Marketing is crucial for enhancing and expanding the global reputation and perception of companies. For businesses involved in international marketing, it is vital to establish a favorable business reputation in order to successfully enter foreign markets and maintain ongoing operations (Witek-Hajduk & Zaborek, 2022).

The promotion mix comprises advertising, personal selling, direct marketing, internet and online marketing, sales promotion, and public relations. Advertising has the ability to rapidly increase awareness due to its broad reach. It aids sellers by facilitating brand promotion in untapped markets. Individual sales allow for seamless customization of sales strategies for international

customers and maintaining continuous communication with them. Direct marketing involves conducting activities that can be concealed from competitors. The target customers are inclined to react positively to the opportunities presented. In the realm of internet and online marketing, it is possible to attain worldwide reach at a relatively low expense, and it is also feasible to quantify website traffic. It is efficient in terms of product search and purchase. Sales development is accelerated by the implementation of incentives, which effectively generate significant sales within a limited timeframe. In my announcement, I want to emphasize that the messages in question originate from third parties, which greatly enhances their reliability. It enhances the legibility of technical publications and advertisements (Lazuardi & Satiri, 2022).

Distribution refers to the process of transferring goods from the manufacturer to the customer. The flow typically differs from one country to another. The examination of change systems, distributors, channel choices, and employment segmentation will vary in multinational companies. During the initial decades of the 20th century, notable transformations took place in economic systems. Technological advancements in machines and tools have led to improvements in management approaches and production systems. According to (Yamin, 2019) the late 20th century is characterized by the dominance of monopolistic corporations and the widespread production of standardized goods. There are laborers employed in the processes of mass production, consumption, and receiving wages. The system observed during this period was characterized by mass production, Fordist production automation management, centralized organization in production, low level of qualification, and the state playing a controlling role. Over time, this system has been replaced as a result of numerous factors. Post-Fordist production refers to a system where information and communication technologies are extensively utilized, labor and mechanization are specialized in a flexible manner, and production is adaptable. Instead of a collective comprehension, an individual comprehension has been embraced, resulting in fragmentation and homogeneity in markets, as well as the growth of globalized and integrated industries.

The functions of companies have been impacted by globalization, the reduction in information and communication technology costs, and the widespread use of the internet. The advent of the internet and information technologies has revolutionized marketing by introducing a novel dimension to companies. The impact of technology on marketing is analyzed through three aspects: the transformation of marketing activities, the evolution of marketing information, and the restructuring and expansion of the marketing function. Redesigning that are identifying, and organizing marketing in any organization is a challenging endeavor. The process of gathering,

organizing, and examining customer data allows for ongoing monitoring of consumer attitudes and behaviors, and aids in predicting sales and dividing customers into groups (Kasem et al., 2024).

The internet, a highly significant technological tool, is currently utilized in the realms of exchange, distribution, and communication. Regarding change, it encompasses data regarding digital products and services. The internet has fundamentally altered all aspects of the marketing mix. Through the removal of limitations related to location and environment, it has become feasible to conduct promotional activities in a virtual setting and customize products according to individual preferences(Liu et al., 2020).

One of the transformations in the field of online marketing is the modification of the product development process. The product development process exhibits greater flexibility in the virtual environment, enabling it to swiftly adjust to environmental changes. Another alteration involves the establishment of a brand presence on the internet. Utilizing branding and brand strategies on the internet allows companies to attain a competitive edge over their rivals (Harvey & Griffith, 2007).

The Internet facilitates companies in tracking innovations. One additional impact of technology on the marketing industry is the enhancement of customer service and support. Product and service information can be transmitted through email, catalogs, or product samples. There has been another modification in this area, specifically related to the distribution channel feature. The advent of the World Wide Web and e-commerce has had a profound impact on the operations of companies (Terziu, 2020).

Given the significance and efficacy of marketing, the dynamic nature of the company necessitates the acquisition of additional data regarding consumers and the business environment. However, simply gathering data on customers and consumers is not the sole path to attaining success. Furthermore, it is imperative to efficiently acquire and disseminate both internal and external information to business managers in a timely manner. Thus, it is imperative to establish a Marketing Information System as part of the company's Management Information System. This impacts the company's decision-making process and enhances its efficiency(Rodríguez Torres et al., 2022).

Technology is a rapid form of marketing that enhances the effectiveness of all marketing methods, expands the reach of influence, and allows immediate access to a large audience that is receptive to new ideas. Embracing innovations; In the realm of technological marketing, novel domains are

constantly emerging. Emerging mobile and interactive platforms present a promising marketing opportunity that is ripe for exploration and growth.

One notable aspect of technological marketing is the expansion of marketing domains across various sectors due to advancements in technology. Utilizing technological infrastructures allows for the dissemination of marketing efforts to significantly broader audiences in various regions. The instant access feature enables rapid technology marketing. In contemporary times, there is typically a rise in the utilization of the internet among young individuals in contrast to their rate of watching television. By employing effective marketing strategies, it is possible to rapidly reach a large audience (Setiawan et al., 2023).

Various applications and techniques in technological marketing are continuously emerging. A process is evolving in which current applications are revitalized and enhanced. Social media refers to online platforms that enable users to create public profiles and establish connections with other users. These platforms provide a system for users to define their privacy settings, list their connections, and easily navigate through the connections of other users (Turp, 2020).

Social network marketing is a lucrative industry that is widely utilized and continuously evolving by numerous companies. This business structure offers numerous advantages compared to alternative structures. In the realm of social network marketing, advertisements are not accounted for as expenditures. Advertisements are created by visitors. Individuals who engage in advertising generate income from this circumstance. Social network marketing holds significant commercial significance. The dynamic nature of social media marketing holds the potential to transform into the very essence of the internet in the future. Search engines are tools used to target specific audiences by optimizing content and achieving high rankings in keyword-based and organic search results with significant search volume (Sharma et al., 2019).

Marketing activities conducted through search engines are referred to as Search Engine Marketing (SEM). Search engine marketing is a form of paid advertising that enables advertisers to reach their target audience by utilizing paid advertising networks. According to Moura (2020) in general, these techniques offer the most efficient means of reaching the target audience through clicks and impressions. The scope of SEM applications extends beyond search results. This ensures that different versions of advertisements are shown within the appropriate website and market based on the chosen criteria.

Viral Marketing is a strategic approach that aims to incentivize internet users to share marketing messages with others. Viral marketing plays a crucial role in disseminating messages. This technique provided by companies is one of the most efficient and economical methods for

spreading rumors about products and services (Dinh, 2001). Viral marketing conducted online can be defined as the technological aspect of word-of-mouth marketing.

Mobile marketing refers to the utilization of wireless interactive marketing tools to promote products, services, and ideas through mobile phones. Mobile phones play a crucial role as a promotional tool in the field of marketing. It guarantees the effective execution of sales, advertising, public relations, and direct marketing activities. Mobile marketing employs two distinct promotion strategies. These strategies involve the use of push and pull techniques.

In the push strategy, businesses engage in accessing individuals' mobile phones by utilizing their databases. It involves transmitting information, such as SMS campaigns and discounts, to users. In the pull strategy, the phrase "send your password and participate in the raffle" is used. In this method, individuals engage in the campaign, which is publicized through traditional advertising methods, using their mobile devices (Vieira et al., 2022).

The increasing availability of technology-driven direct marketing tools has led to a rise in the utilization of new tools in mobile marketing. The tools utilized in mobile marketing include short message services (SMS), enhanced message systems (EMS), multimedia message services (MMS), mobile internet, interactive voice response systems (IVR), ringback tone (RBT), mobile games, mobile payments, location-based services, mobile TVs, mobile tagging, embedded mobile devices, and mobile social networks.

Developing and cheaper smartphones have a great impact on the rise of mobile marketing and marketing communications. The fact that it is low-cost, measurable, individual and interactive compared to traditional channels has also contributed to the development of mobile marketing according to (Md. Zainal Abedin & Laboni Ferdous, 2015).

Yadav confirmed that marketers should not hesitate to deviate from traditional methods and embrace mobile platforms, as there is no legitimate justification for not doing so. Previously, mobile marketing required marketers to dedicate significant time and resources, leading to eventual errors. In recent years, there has been a significant improvement in the availability of mobile services in Asia, Europe, and the USA. In modern times, marketers can delegate the task of mobile marketing campaigns to brand and content-focused service providers, thereby reducing the need for extensive time and financial investment (Yadav et al., 2015).s

Essentially, there are three distinct methods that a company can employ to engage in mobile marketing through campaigns. The utilization of internal resources, the delegation of services to one or multiple external agencies, and the integration of two methodologies (Tong et al., 2020).

Due to advancements in technology and communication infrastructure, mobile advertisements have become increasingly popular. Nevertheless, certain issues have emerged regarding mobile advertisements, including privacy infringements and consumers disseminating advertisements without acquiring the requisite authorizations. Consumers, as a whole, desire a feeling of assurance and protection. Four elements present challenges to privacy. Mobile spam, individual spam, location information, and wireless security are the topics mentioned (Limpf & Voorveld, 2015).

Users on social networks prioritize privacy and security. Although users are vigilant about security matters, they neglect to enable the privacy settings in their accounts. Security and privacy settings on social networks also undergo changes. Social media owners utilize personal information for marketing purposes through algorithms like data mining (Shin, 2010).

According to (Thomas & N, 2022) companies utilize innovative marketing strategies to perform essential operations including the acquisition, retention, categorization, and dissemination of customer information. These transactions are conducted using technologies. Companies must consolidate the gathered data into a database, analyze customer segments, and execute marketing strategies tailored to specific customer groups.

The advancement of information technologies and the reduction in costs have provided companies with the opportunity to engage in global business operations. In the present era, as computer technologies and internet usage continue to grow, the potential of the global market for electronic commerce may surpass that of traditional commerce (Neboha, 2018).

While numerous factors contribute to globalization, it is undeniable that technology holds a significant position. Technological advancements have led to a differentiation in the global economy. The rapid development of technology has significantly reduced transportation and communication costs. Globalization has gained momentum due to its low costs. It’s not surprising that there is a technological advancement in this process, wherein globalization leads to increased interactions at a reduced cost, and concentration intensifies. In addition to these advantages, the technological advancement has facilitated the creation of information superhighways through the use of fiber optic cables, which have replaced copper cables and brought significant advancements in the telecommunications industry.

An unfavorable aspect of the globalization process can be characterized as a state of excessive and uncontrolled consumption. In contemporary times, the focus lies not on the products individuals create, but rather on the goods and services they consume. During an era characterized by the prevalence of popular culture, Multinational Companies have strategically cultivated a consumer base through their marketing efforts, leading to excessive consumption among individuals. The

advent of technological products in the digital era has brought to light the notion of technology consumption. Individuals' acquisition of technology to adjust to their surroundings leads to superfluous expenditures. Consumerism, a significant contemporary issue, has become an unstoppable force (Cochoy et al., 2020).

(Ferreira Pantoja, 2023) says technological advancements have greatly influenced the field of transportation, playing a crucial role in the process of globalization. Within this particular context, characterized by the consolidation of cultural unity under a single central authority, there has been a notable progression towards economic integration among nations, marked by the growth of both goods production and trade volume. Furthermore, significant advancements have occurred in road transportation concurrent with the growth of the automobile industry, albeit not on a worldwide scale. In addition to the manufacturing of automobiles, the trading of spare parts and oil has facilitated the expansion of this industry into the global market.

It is evident that technology brings substantial advantages to the global stage in terms of transportation. This concept aligns with the central argument of the radicals. The utilization of technology in the industrial sector plays a significant role in the development of a global economy, as well as in the growth of production. A significant benefit is the simultaneous growth of the global economy and individual national economies. Economies that have embraced foreign trade and experienced an economic revival have emerged stronger than before, shedding their stagnant and lifeless state. The perception of competition and the increase in production and quality have an impact on various aspects, including social, cultural, economic, and technological domains. Nevertheless, the establishment of a global economy brought about certain drawbacks. Specifically, the states that wield influence over the economy and generate technological advancements have exerted dominance over less powerful nations on a worldwide level according to (Allam, 2020).

Technology has introduced a new development in the economic realm during the era of globalization. This involves the participation of banks and electronic currency, which plays a significant role in the creation of new markets and the establishment of interconnections. The advent of technology has brought about new tools such as the internet, smartphones, media, and social networks, which have significantly enhanced interpersonal interaction (Ho & Mallick, 2010).

Globalization is a phenomenon characterized by contradictory elements. The incorporation of technology in this process and the utilization of robots in industry also give rise to certain challenges. Furthermore, it can be asserted that it exerts a significant influence on global issues as

it has repercussions on a global scale. On the global stage, it functions as a system in which different sectors within countries experience varying degrees of success or failure in their domestic affairs. There has been a recent observation that global issues are manifested through unemployment for those who are negatively affected.

As a result, there has been an increase in criticism and efforts have been made to find solutions to address the growing problem of unemployment. Another issue arises from the growing disparities in countries that have access to information and information technologies (Jaumotte et al., 2013). Based on the 2024 Digital In World Report, which focuses on this topic;

Table 1. The state of Digital

Source: (Own work)

World Population: 8.08 billion		
Internet users	5.35 billion	66.2% of the World Population
Social Media users	5.04 billion	62.3% of the World Population
Mobile Technology users	5.61 billion	69.4% of the World Population

The provided statistics demonstrate the insufficiency of technological access for individuals residing in an era dominated by digital advancements. On this scale, the presence of technological access challenges primarily in developing and underdeveloped countries raises concerns. The advancements in globalization within the education sector, along with the proliferation of information and communication technologies, have led to notable transformations in the realms of education, science, and culture. Concepts such as Information Society, Network Society, Social Informatics, and Governance have become part of and exerted influence on human existence. The necessary adjustment of concepts such as information technologies, education reforms, performance-based criteria, lifelong learning, learning society, and e-learning to various cultures has resulted in substantial advancements in the field of education (*World in Digital Report*, 2024). While technology plays a crucial role in education, it is evident that there are substantial disparities between the beneficiaries of globalization (capitalist states) and the disadvantaged parties (underdeveloped states). While it is true that technology has made access to information easier on a global scale, it is important to acknowledge that there is a growing disparity in this regard.

Regarding this topic, it is also beneficial to discuss the phenomenon known as the digital divide. The concept of digital inequality, also known as digital divide, pertains to the insufficiency of technological infrastructure and equipment across various countries and societies. Generally speaking, the unequal access to technology across societies, with some societies still lacking computers, reinforces this issue (Cemalettin Kalaycı, 2013).

3. METHODOLOGY AND DATA ANALYSIS

This chapter presents the research methodology used in this thesis and explains the process of data collection and analysis.

3.1 Data Collection

This research utilized primary data sourced from raw unprocessed database of Eurostat and IMD Competiveness Report. The way this study is done, it's to look into what affects global competitiveness between countries in 2020. The main place where data comes from for this analysis is the World Competitiveness Yearbook. It gives a detailed list of countries that are ranked by different economic and development signs. The thing being looked at, or dependent variable, in this research are the rankings for Global Competitiveness which measure how well-off people can be thanks to their country's success. The ranking is based on many factors, and some of these are also included as main independent variables in this study.

One example of an independent variable is the degree of digital transformation in companies, which we denote as 'dig_transform'. This variable assesses how businesses have adjusted and incorporated digital technologies into their work. A crucial independent variable is 'rd_expec', showing the overall spending on research and development as a part of national expense. This indicator reflects a country's commitment to innovation and its potential for technological advancement.

Moreover, we also have some control variables. These are other factors that could affect the ranking of competitiveness. The variable 'Bigdata' looks at how much companies use big data and analytics, which can help in making strategic decisions and improving operational effectiveness. The variable 'man_enterp' looks into whether manufacturing enterprises adopt new marketing methods or not. This factor could show how actively they respond to market challenges and customers' demands. The third one, 'busseffic', gives us information about how well businesses in these countries are working. The fourth one is 'gdppc' which shows Gross Domestic Product per Capita with Purchasing Power Parity, this measures economic strength by looking at average living standards and how well off people are financially in a country.

Through studying these variables, the research is trying to recognize what makes a country competitive and also learn how digital change, investment in R&D and effective business methods help with economic victory. The study's discoveries are anticipated to provide helpful understanding for policy creators and businesspeople who want to improve their nation's competitiveness in worldwide markets. The data collected from World Competitiveness Yearbook is very important for making sure this study gives accurate results that are useful.

3.2 DATA ANALYSIS

Table 2. Variables List

Source: (Own work)

Code	*Variable Name*	*Description*
	Dependent Variable	
competitiveness	**Global Competitiveness Ranking**	Measures the competitiveness of countries in 2020.
	Main Independent Variables	
dig_transform	**Digital transformation in companies**	Evaluates the level of digital transformation within companies in 2020 based on the World Competitiveness Yearbook's findings.
rd_expec	**Total expenditure on R&D (%)**	The percentage of total expenditure dedicated to research and development in 2020, as indicated by the World Competitiveness Yearbook.
	Control Variables	
bigdata	**Use of big data and analytics**	Assesses how extensively big data and analytics are used by companies in 2020 as reported by the World Competitiveness Yearbook.
man_enterp	**Manufacturing enterprises that introduced new marketing methods**	Refers to the number or percentage of manufacturing enterprises that have introduced new marketing methods for promotion, packaging, pricing, product placement, or after-sales services.
buss_effic	**Business Efficiency Ranking**	Evaluates the efficiency of businesses within countries in 2020
gdppc	**GDP per capita (PPP, $)**	Gross Domestic Product per capita listed countries.

The countries for which the data were collected are presented in the following table.

Table 3. List of the Countries

Source: (Own work)

Austria
Belgium
Bulgaria
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Netherlands
Norway
Poland
Portugal
Romania
Slovak Republic
Slovenia
Sweden
Switzerland
Turkey

The study's analytic method includes a strong statistical structure to thoroughly look into the variables affecting worldwide competitiveness. At first, we will use descriptive statistics for getting basic knowledge about data such as measures of center like mean or median, dispersion measure and shape measure that describe how each variable spreads out from its average value. This is important in summarizing general characteristics of data and preparing it for more advanced analysis.

After that, we will do correlation analysis to find and measure the power and path of connections between the dependent variable - global competitiveness; as well as independent and control variables. This process assists in understanding patterns or possible links within data which can show areas for deeper study.

Expanding on the understanding we got from correlation analysis, regression analysis is next to look into more about how variables can predict each other's changes. We will create a model that shows the combined impact of main independent variables: digital transformation and R&D spending; along with control factors such as use of big data, new marketing methods, business efficiency and GDP per capita on competitiveness rank for countries.

The regression analysis has a crucial role in assessing the influence of every predictor on the reliant variable. It also manages to control for other variables present within the model, giving a more precise understanding of how much each factor contributes to global competitiveness. The outcomes from this study will give important understanding into what factors determine competitiveness and which ones are most significant among all these studied variables.

For making sure the regression analysis in this study is strong and dependable, we tested the model very thoroughly to see if it follows Gauss-Markov assumptions. These are crucial for Best Linear Unbiased Estimator (BLUE) features of Ordinary Least Squares (OLS) estimators. First assumption, linearity in parameters was checked to confirm that relationship between independent variables and dependent variable is linear. The second assumption, which is that the error term should be zero, has been looked into to make sure there's no systematic over or under-prediction of outcomes by our model.

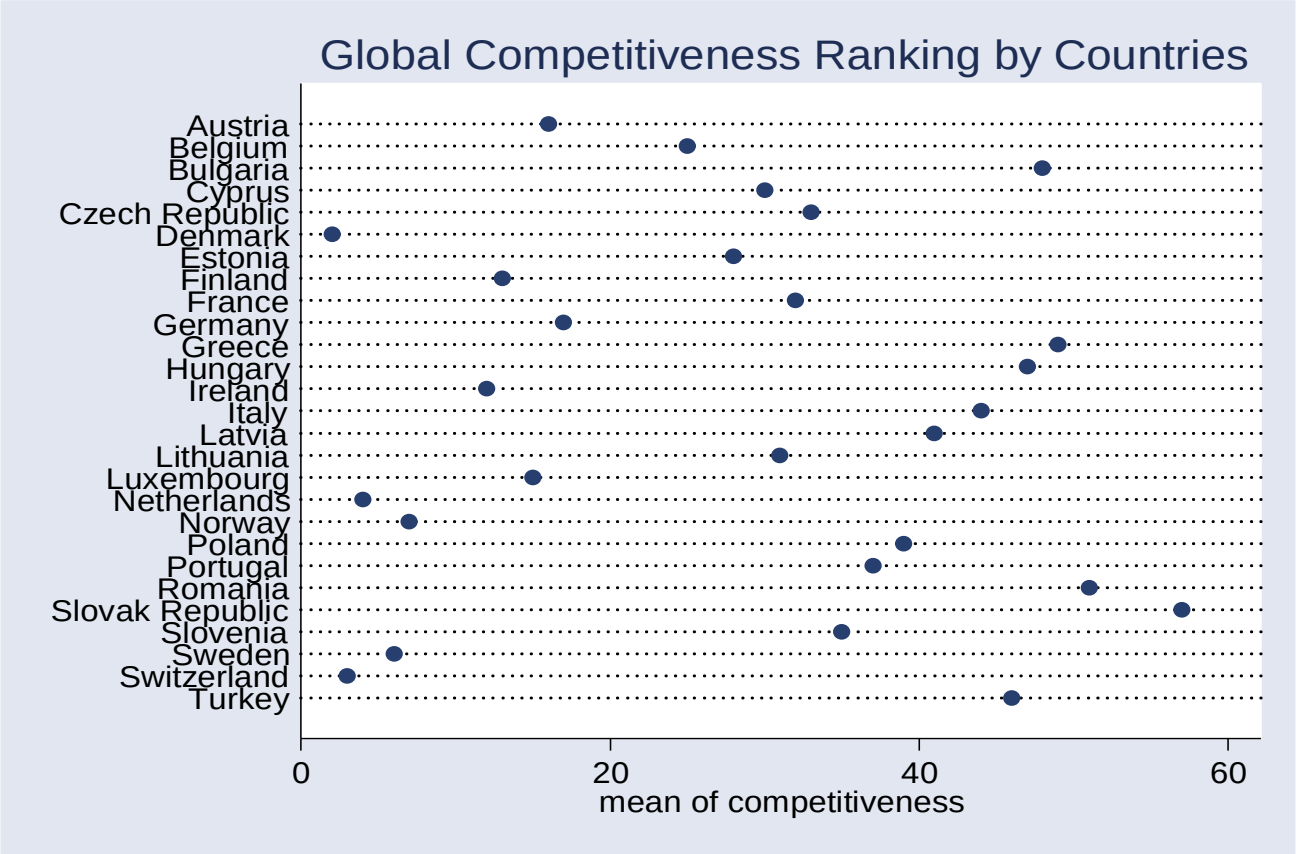
For the third assumption, homoscedasticity, it was carefully examined if error term's variance remains constant at every level of independent variables. This is to avoid any heteroscedasticity which can cause inefficient estimators. The fourth assumption about no perfect multicollinearity was reviewed by looking into Variance Inflation Factor (VIF). This confirms that independent variables are not perfectly correlated with each other because otherwise, statistical importance of coefficients would be jeopardized.

The fifth assumption of independence among error terms was checked. This means that the error in one observation should not be related to errors in other observations. Autocorrelation, when present, can violate this simple linear regression assumption and result in incorrect standard errors for hypotheses testing. The sixth and last assumption, which is normality of errors, was confirmed by applying White and Breusch Pagan tests to check if error terms are normally distributed or not - a crucial condition for hypothesis testing validity.

Results

Figure 1. Global Competitiveness Index by Countries

Source: (Own work)

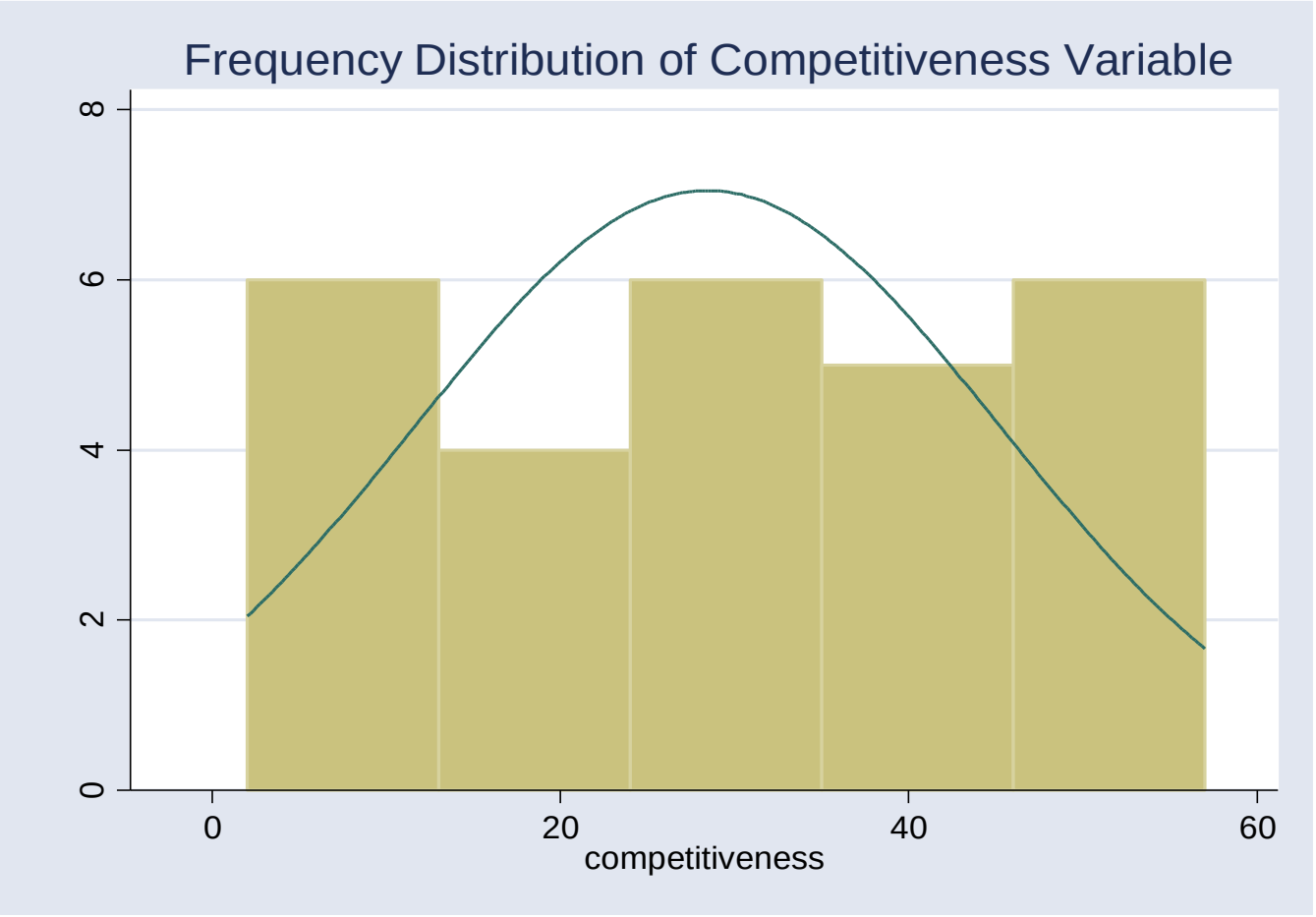


In the Global Competitiveness Ranking of 2020, Denmark emerges as the standout performer among the listed countries, securing the second position globally. Its high level of competitiveness positions it as a leader in economic performance and efficiency. Following closely behind are Switzerland and the Netherlands, ranking 3rd and 4th respectively, showcasing their robust economic structures and competitiveness on the global stage. Nordic countries like Sweden (6th)

and Norway (7th) also demonstrate significant competitiveness, reflecting their strong economies and business environments.

Figure 2. Histogram of Frequency Distribution of the Dependent Variable

Source: (Own work)



The histogram is skewed to the left. This means that there are more observations in the lower competitiveness range than in the higher competitiveness range. In other words, there are more firms/products/countries (depending on what the data represents) that are less competitive than those that are highly competitive.

Figure 3. Relationship Plot between Competitiveness and Digital Transformation

Source: (Own work)

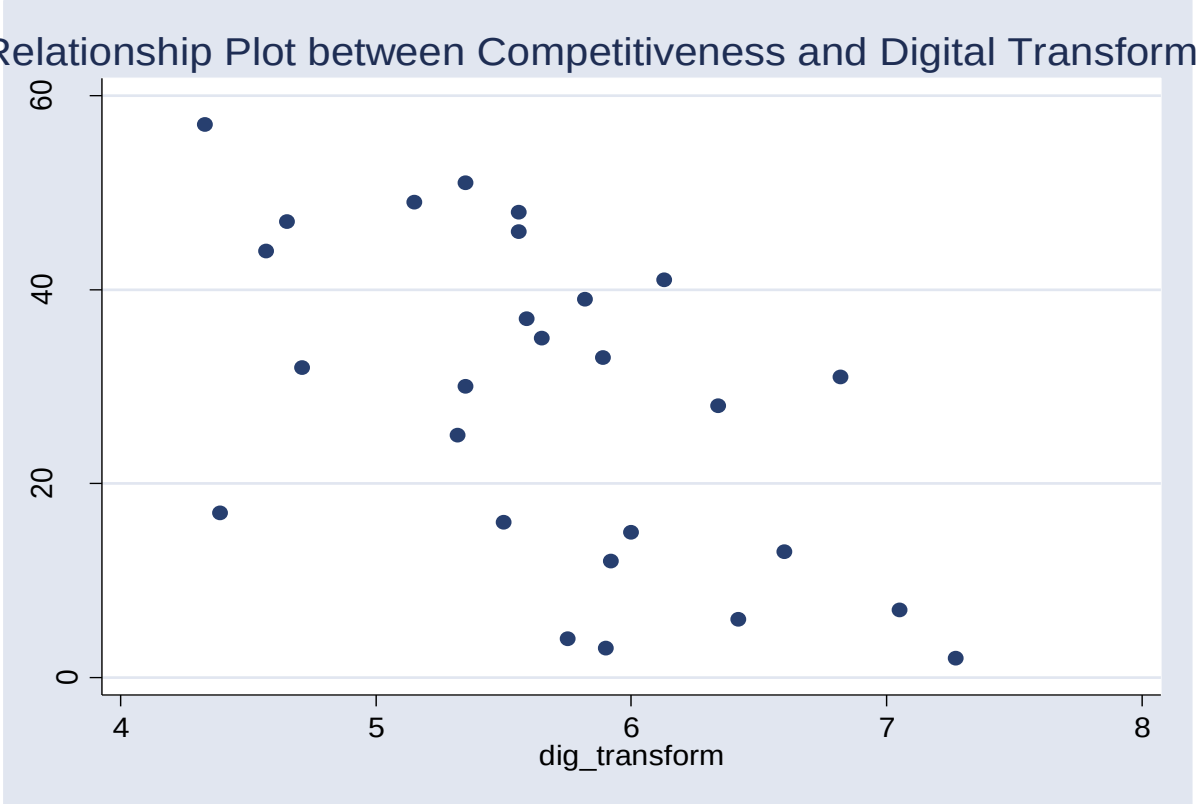
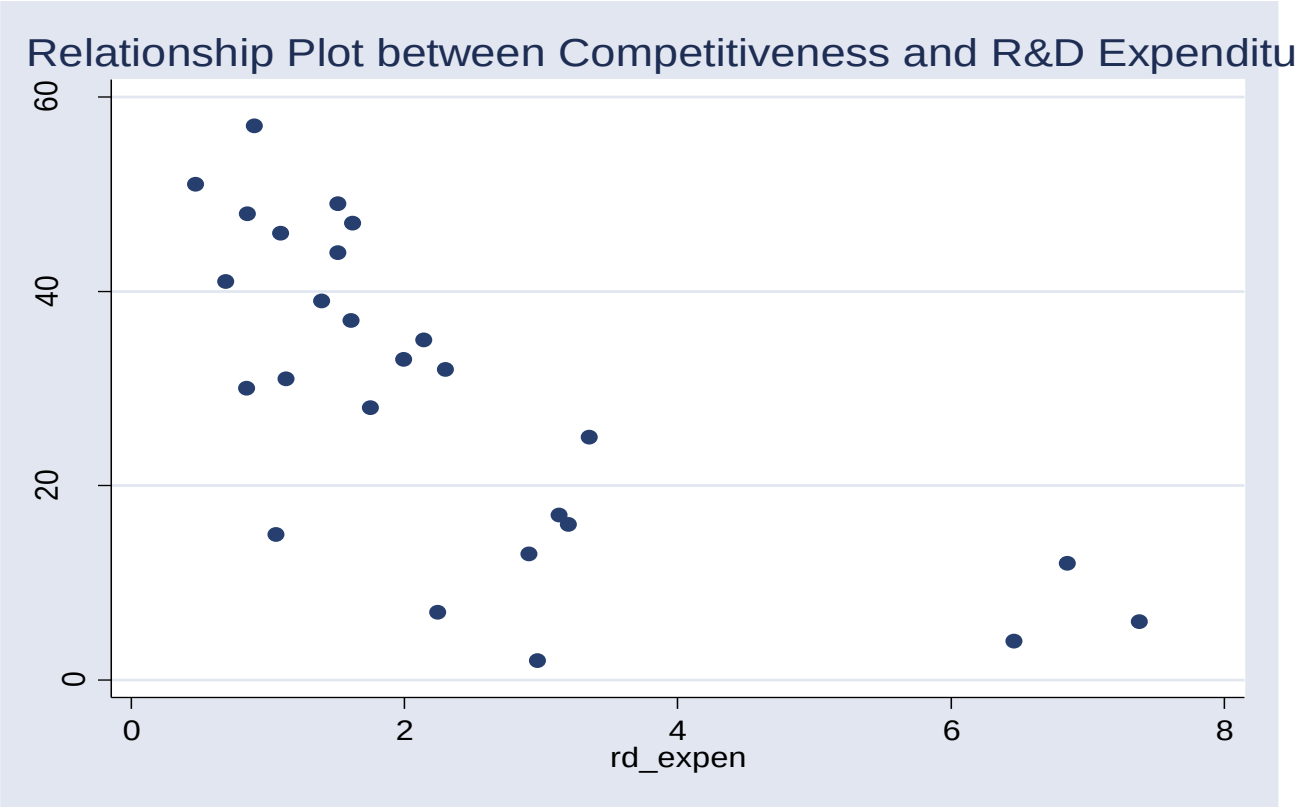


Figure 4. Relationship Plot between Competitiveness and R&D Expenditure

Source: (Own work)



As a result of relationship, it can be discerned that there is a linear relationship between dependent variable and independent variables

Table 4. Descriptive Statistics

Source: (Own work)

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
man_enterp~s	27	2585.407	4433.257	39	16778
competitiv~s	27	28.44444	16.80964	2	57
buss_effic	27	30.11111	18.55208	1	61
gdppc	27	48203.03	21446.44	23679.21	120086.3
bigdata	27	7758.839	23283.09	4.06	96925.46
dig_transf~m	27	5.688519	0.770383	4.33	7.27
rd_expen	26	2.359231	1.866483	0.47	7.38

Based on the summary statistics provided for the variables, several observations can be made. Firstly, in terms of competitiveness, the mean competitiveness ranking stands at approximately 28.44, with a standard deviation of 16.81. This ranking varies widely, ranging from a minimum of 2 to a maximum of 57. Moving on to the level of digital transformation in companies, the mean score is approximately 5.69, with a standard deviation of 0.77. The range of digital transformation levels spans from a minimum of 4.33 to a maximum of 7.27, indicating variability in the extent of digitalization across companies. Regarding expenditure on research and development (R&D), the mean percentage of total expenditure allocated to R&D activities is approximately 2.36%, with a standard deviation of 1.87%. This percentage ranges from a minimum of 0.47% to a maximum of 7.38%, indicating variations in R&D investment levels across countries. Furthermore, the utilization of big data and analytics by companies exhibits considerable diversity. With a mean value of about 7758.84, the usage of big data ranges from a minimum of 4.06 to a maximum of 96925.46, highlighting differences in the adoption and implementation of big data technologies among companies. In terms of manufacturing enterprises adopting new marketing methods, the mean number or percentage of such enterprises is approximately 2585.41, with a standard deviation of 4433.26. This metric spans from a minimum of 39 to a maximum of 16778, showcasing variations in marketing innovation within the manufacturing sector. The business efficiency ranking, with a mean value of around 30.11 and a standard deviation of 18.55, reflects diversity in the efficiency levels of businesses across countries. This ranking ranges from a minimum of 1 to a maximum of 61, indicating disparities in business operational effectiveness. Finally, in relation to GDP per capita, the mean value is approximately $48203.03 (PPP), with a standard deviation of $21446.44. GDP per capita ranges from a minimum of $23679.21 (PPP) to a maximum of $120086.3 (PPP), illustrating variations in economic prosperity among the countries.

Table 5. Correlation Analysis

Source: (Own work)

	man_en~s	*compet~s*	*buss_e~c*	*gdppc*	*bigdata*	*dig_tr~m*	*rd_expen*	*lgdppc*	*lrd_ex~n*	*lman_e~s*
man_enterp~s	1									
competitiv~s	0.1295	1								
buss_effic	0.1151	0.9647	1							
gdppc	-0.1235	-0.6901	-0.674	1						
bigdata	-0.1585	-0.4585	-0.5127	0.4609	1					
dig_transf~m	-0.4525	-0.5802	-0.6583	0.2767	0.1459	1				
rd_expen	-0.0664	-0.7092	-0.7164	0.4533	0.8564	0.2028	1			
lgdppc	-0.0841	-0.8086	-0.7812	0.9683	0.4752	0.3094	0.5594	1		
lrd_expen	0.0287	-0.757	-0.7359	0.4405	0.663	0.1985	0.9281	0.5808	1	
lman_enter~s	0.8063	0.17	0.1708	-0.4256	-0.2109	-0.3938	0.0098	-0.3303	0.1637	1

The correlation analysis reveals several relationships between the variables under consideration. Firstly, there exists a weak positive correlation (0.1295) between the number or percentage of manufacturing enterprises that introduced new marketing methods (man_enterp) and competitiveness rankings (competitiveness). This suggests a slight tendency for countries with more innovative marketing approaches in manufacturing to have higher competitiveness rankings, although the correlation is not particularly strong. Similarly, a weak positive correlation (0.1151) is observed between business efficiency rankings (buss_effic) and competitiveness rankings (competitiveness). This implies that countries with higher business efficiency may also tend to have higher competitiveness rankings, although again, the correlation is not significant.

Conversely, a negative correlation (-0.6901) is found between GDP per capita (gdppc) and competitiveness rankings (competitiveness). This indicates that countries with higher GDP per capita may have lower competitiveness rankings. Potential explanations for this relationship could include higher costs of doing business in more developed economies or lower levels of innovation. Furthermore, there exists a weak negative correlation (-0.4585) between the use of big data and analytics (bigdata) and competitiveness rankings (competitiveness). This suggests that countries

with more extensive utilization of big data and analytics may have slightly lower competitiveness rankings, although the correlation is not particularly strong. A moderate negative correlation (-0.5802) is observed between digital transformation in companies (dig_transform) and competitiveness rankings (competitiveness). This indicates that countries with higher levels of digital transformation in companies tend to have lower competitiveness rankings. This might reflect challenges in adapting to rapid technological changes or disparities in digital infrastructure across countries. Finally, a strong negative correlation (-0.7092) is found between total expenditure on R&D (rd_expen) and competitiveness rankings (competitiveness). This implies that countries with higher levels of R&D expenditure relative to GDP may have lower competitiveness rankings. This suggests that factors other than R&D investment may be more critical in determining competitiveness.

Table 6. Regression Analysis

Source: (Own work)

Dependent variable = Global Competitiveness

Variable	Coeff.	Std.dev.	T-score	P-value
Const	45.24	66.04	0.69	0.501
Lrd_expen	-5.75	2.46	-2.34	0.030
Dig_transform	0.91	2.12	0.43	0.673
Lman_enterprises	1.05	0.81	1.29	0.212
Lgdppc	-4.48	4.68	-0.96	0.351
Buss_effic	0.72	0.15	4.69	0.000
bigdata	0.0001	0.0005	2.51	0.021

Number of Obs. = 26
F(6, 19) = 70.91
Prob > F = 0.0000
Adj. R-squared = 0.9438

The regression analysis provides valuable insights into the relationship between various factors and competitiveness. Overall, the model demonstrates a strong fit, as indicated by the high F-statistic of 70.91 and the associated p-value of 0.0000, suggesting that the regression model explains a significant proportion of the variability in competitiveness. Additionally, the high R-squared value of 0.9573 implies that approximately 95.73% of the variance in competitiveness can be accounted for by the independent variables included in the model, indicating its substantial explanatory power.

Examining the coefficients of the independent variables reveals notable associations. Total expenditure on R&D (lrd_expen) exhibits a statistically significant negative relationship with competitiveness, with a coefficient of -5.754405 and a standard error of 2.458708. However, digital transformation in companies (dig_transform) does not demonstrate statistical significance at the 0.05 level, despite its positive coefficient of 0.9099342 and standard error of 2.124815, suggesting a potential positive relationship with competitiveness. Similarly, the number or percentage of manufacturing enterprises that introduced new marketing methods (lman_enterprises) shows a positive coefficient of 1.049575, but it fails to reach statistical significance, indicating no substantial impact on competitiveness. GDP per capita (lgdppc) also lacks statistical significance, with a coefficient of -4.479245 and a standard error of 4.684667, implying no significant relationship with competitiveness.

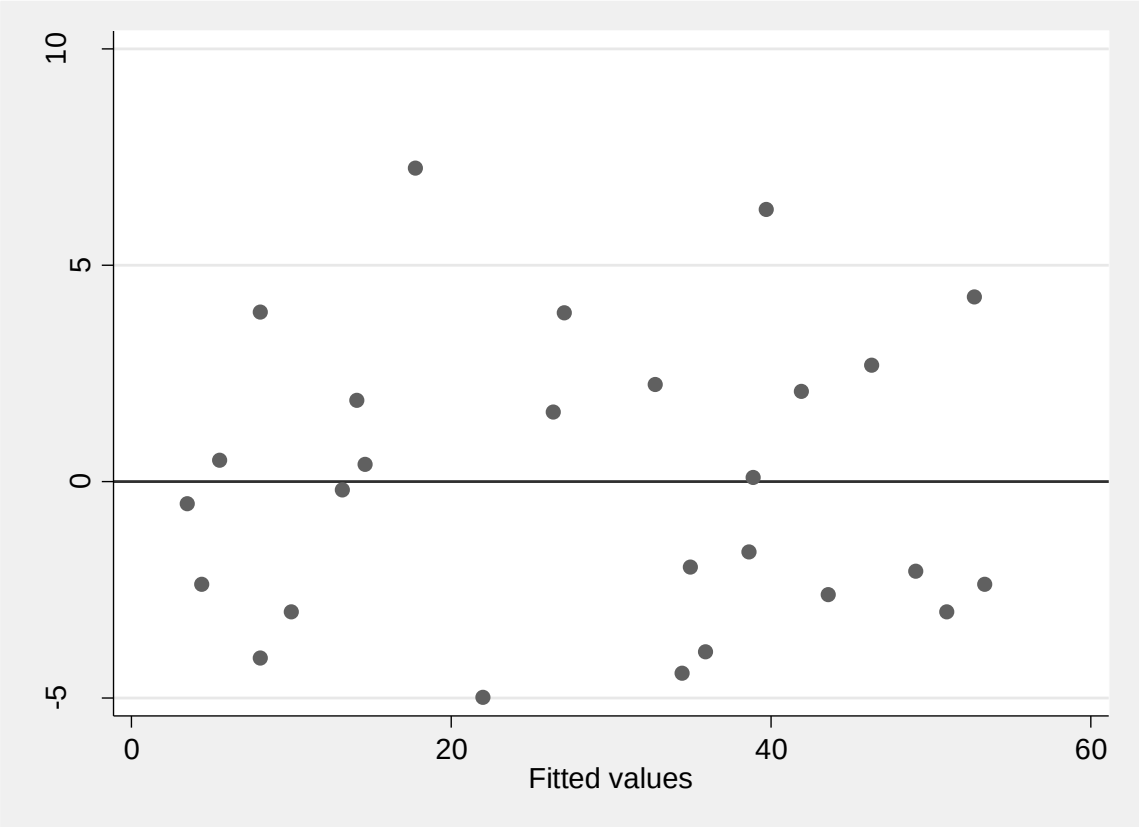
Conversely, both the business efficiency ranking (buss_effic) and the use of big data and analytics (bigdata) exhibit statistically significant positive associations with competitiveness. The coefficient for business efficiency is 0.7177868 with a standard error of 0.1529161, while the coefficient for big data usage is 0.0001256 with a standard error of 0.00005. These findings suggest that factors such as total expenditure on R&D, business efficiency ranking, and the utilization of big data and analytics play crucial roles in influencing competitiveness. However, digital transformation, the introduction of new marketing methods by manufacturing enterprises, and GDP per capita do not emerge as significant drivers of competitiveness based on the regression analysis.

Gauss-Markov Assumptions

a) **Linearity:** linearity assumption was checked with the relationship plots between the dependent and independent and control variables. No non-linear relationship was observed.
b) **Homoskedasticity:** this assumption was checked with the post estimation command predicting residuals and plotting their plot.

Figure 5. Residuals Plot

Source: (Own work)



The plot of residuals indicate to the uneven distribution of the error terms around the 0-line. For numerically proving the homoskedasticity of the model, the Breusch-Pagan and White tests were carried out.

Table 7. Breusch-Pagan Test for Homoskedasticity

Source: (Own work)

H0: Constant Variance
Chi 2 = 0.01
Prob > chi2 = 0.9061

Table 8. White Test for Homoskedasticity

Source: (Own work)

H0: Homoske dasticity
Chi 2 = 31.65
Prob > chi2 = 0.5342

The Breusch-Pagan test results indicate that the null hypothesis of constant variance cannot be rejected, as evidenced by a chi-square statistic of 0.01 and a high p-value of 0.9061, suggesting that there is no significant evidence to suggest heteroskedasticity based on this test. On the other hand, the White test results also fail to reject the null hypothesis of homoskedasticity, with a chi-square statistic of 31.65 and a relatively high p-value of 0.5342. This further supports the notion that there is no significant evidence of heteroskedasticity in the regression model.

Based on the findings of both tests, it can be concluded that the assumption of homoskedasticity appears to hold for the regression model, which implies that the variance of the error terms is constant across all levels of the independent variables, which enhances the reliability of the regression analysis results.

c) **No Multicollinearity:** The correlation analysis prior to the regression analysis did not reveal any “high” relationship between the independent and control variables. For the sake of completeness, the VIF test was carried out.

Table 9. Multicollinearity Test

Source: (Own work)

Variable	*VIF*	*1/VIF*
busseffic	5.06	0.071109
dig_transform	6.45	0.095666
bigdata	6.13	0.163188
lgdppc	5.68	0.176096
lrd_expen	2.7	0.370294
Lman_enterprises	2.27	0.441145
Mean VIF	3.88	

Lrd_expen
Dig_transform
Lman_enterprises
Lgdppc
Buss_effic
bigdata

The mean VIF value of 3.88 which is less than the acceptable threshold of 3.88 indicates the model does not suffer from multicollinearity.

d) **Random Sampling:** The sampling of the research can be considered to be random as the selection of the variables and countries were made merely according to the data availability.
e) **No Autocorrelation:** This assumption is not applicable for the cross-sectional data type.

4. CONCLUSIONS

The advancement of technology, particularly the growing influence of information and communication technologies, has brought about changes in various domains. These modifications also proved to be efficacious in the realm of marketing, which is closely interconnected with management, prompting the adoption of novel methodologies and techniques. Due to the advent of the Internet, numerous products and services have become prevalent in recent years, prompting companies to devise novel strategies for marketing and selling their offerings. Furthermore, enhancing communication structures is essential to ensure the efficiency of marketing activities. Technology is constantly evolving, leading to the emergence of new needs, products, and services. As a result, marketing methods in the technology industry are also undergoing significant changes. Companies must adapt to technological advancements in order to compete with both internal and external rivals.

Technological advancements have a positive impact on the productivity of a country, businesses, and sectors. Thus, technology provides a beneficial influence on the competitiveness of companies. R&D activities and innovation play a crucial role in providing countries and companies with the necessary technological inputs to attain a sustainable competitive advantage. Companies must allocate additional resources to enhance their human capital, enabling them to advance their technologies and management. Moreover, they should adapt to technological changes by making investments in education.

This thesis aimed to determine the impact of the information and communication technologies on managerial behaviors, much more specifically certain performance indicators shows the competitiveness between some countries within a specific year. In conclusion, it has been found that it can be discerned that there is a linear relationship between dependent variable and independent variables. The study also discovered that there is a weak positive correlation between the number or percentage of manufacturing enterprises that introduced new marketing methods and competitiveness rankings between the countries. This suggests a slight tendency for countries with more innovative marketing approaches in manufacturing to have higher competitiveness rankings, although the correlation is not particularly strong. Furthermore, there exists a weak negative correlation between the use of big data and analytics and competitiveness rankings between the countries. This suggests that countries with more extensive utilization of big data and analytics may have slightly lower competitiveness rankings, although the correlation is not particularly strong. A moderate negative correlation is observed between digital transformation in companies and competitiveness rankings. This indicates that countries with higher levels of digital

transformation in companies tend to have lower competitiveness rankings. This might reflect challenges in adapting to rapid technological changes or disparities in digital infrastructure across countries. Finally, a strong negative correlation is found between total expenditure on R&D and competitiveness ranking. This implies that countries with higher levels of R&D expenditure relative to GDP may have lower competitiveness rankings. This suggests that factors other than R&D investment may be more critical in determining competitiveness. Hence, it's difficult to say there's strong relationship between the application of information and communication technologies and its application fields such as enterprises enterprises that introduced new marketing methods for promotion, packaging, pricing, product placement or after sales services and similar kind of transformations in other companies as well as the investments done on the research and development and competitiveness rankings in global level. However, it's quite impossible to deny the impacts of these kind of technologies and innovations maden through the recent years. The author could have read more previous studies on the information and communication technologies and innovations in related fields to improve the research's effectiveness and could have used other research techniques to support the collection of more detailed information regarding the primary data sourced from raw unprocessed database of Eurostat and IMD Competiveness Report. Another limitation in this research that can be improved for further research is an independent variable. There should be more theories involved in developing the research to have the dependent variable get predicted better. Furthermore, this research may become more accurate in the future.

We conducted a thorough analysis of the subject within the framework of technological globalization, a topic that has been overlooked in existing literature. These investigations have yielded significant discoveries. Recent findings indicate that technology and globalization are inseparable, and that technology should be viewed as an intrinsic component of globalization. In the future, the globalization process will continue to bring about technological advancements that provide insights into the past, present, and future, resulting in various benefits.

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LIST OF TABLES AND FIGURES

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Annex 1
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