How Can Artificial Intelligence Enhance Economic Effectiveness: A Comparative Study between the Czech Republic and Ukraine

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Theses guidelines

Introduction
Define the objectives and the application methods used in the Master's thesis.
I. Theoretical part

- Compile a literature review on the influence of the Artificial Intelligence on the economy.

II. Practical part

- Investigate the current state of Artificial Intelligence adoption in both countries.
- Analyze the challenges and risks (ethical, social, law and economic) associated with the applying and not applying AI technologies in the Czech Republic and Ukraine.
- Examine real-world examples of AI implementation to Enhance Economic Effectiveness in various economic sectors in Czech Republic and Ukraine.
- Analyze the impact of AI on key economic indicators such as Gross domestic product, innovation, productivity and job market.

Conclusion

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AGRAWAL, Ajay; GANS, Joshua and GOLDFARB, Avi. *The Economics of Artificial Intelligence: An Agenda.* University of Chicago Press, 2019. ISBN 9780226613338.
JOHANNESSEN, Jon-Arild. *Artificial Intelligence, automation and the future of competence at work.* ROUTLEDGE, 2022. ISBN 9781003121923.
MAKARENKO, Elena; VOVCHENKO, Natalia and TISHCHENKO, Evgeny. *Technological trends in the AI Economy: International Review and ways of Adaptation.* Springer Nature Singapore, 2023. ISBN 9789811974106.
MUNOZ, Joseph Mark and NAQVI, Al. *Business strategy in the Artificial Intelligence Economy.* Business Expert Press, 2018. ISBN 9781948198981.

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ABSTRAKT

Účelem této studie je posoudit, jak umělá inteligence ovlivňuje ekonomiku a jaké jsou cesty České republiky a Ukrajiny při zavádění umělé inteligence do ekonomiky. Studie hodnotí příležitosti a výzvy spojené s technologiemi AI a zkoumá přístupy k AI používané v obou zemích. Studie použila průzkum smíšených metod, aby shromáždila poznatky od zaměstnanců v obou zemích ohledně jejich vnímání vlivu AI a jejich postojů k jejímu přijetí. Studie navíc vyvíjí model umělé inteligence schopný předpovídat dopad proměnných, které nejvíce ovlivňují HDP, včetně umělé inteligence.

Studie ukazuje, že umělá inteligence má významný vliv na HDP, trh práce a celkovou ekonomickou efektivitu. Navzdory obtížím Česká republika a Ukrajina demonstrují úspěšné příklady integrace umělé inteligence do svých obchodních procesů.

Klíčová slova: umělá inteligence, ekonomický dopad, Česká republika, Ukrajina, trh práce, HDP, automatizace

ABSTRACT

The purpose of this study is to assess how AI affects the economy and what are the ways of the Czech Republic and Ukraine in implementing AI in the economy. The study assesses the opportunities and challenges associated with AI technologies and examines the approaches to AI used in both countries. The study used a mixed-methods survey to gather insights from employees in both nations regarding their perceptions of AI's impact and their attitudes toward its adoption. In addition, the research develops an AI model capable of predicting the impact of the variables that most affect GDP, including AI.

The study shows that artificial intelligence has a significant impact on GDP, the labor market and overall economic efficiency. Despite the difficulties, the Czech Republic and Ukraine demonstrate successful examples of integrating artificial intelligence into their business processes.

Keywords: artificial intelligence, economic impact, Czech Republic, Ukraine, labor market, GDP, automation

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I hereby declare that the print version of my Bachelor's/Master's thesis and the electronic version of my thesis deposited in the IS/STAG system are identical.

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INTRODUCTION

Artificial Intelligence (AI) is considered as one of the most revolutionary technologies of our era, it can reshape economy and its whole sectors. We are living in the "golden age" of artificial intelligence according to Jeff Bezos, CEO of Amazon, and this allows us to solve problems which were until recently found only in science fiction (Smith, 2020). Artificial intelligence has been a top focus and area of study globally. AI has received attention in the modern world due to its capacity to surpass people's capabilities and carry out tasks that were previously exclusive to humans (West & Allen, 2018). Therefore, application of artificial intelligence in economics can change economic decision-making forever and impact global economies including Ukraine and Czech Republic.

However, it's important to also remember that while people always seek improvement and solutions to problems, there are two sides of a coin regarding developments in artificial intelligence. In this perspective, the most important questions are for example: How will AI affect a nation's economy? What effect does it have on the business world? Will it have a favorable or negative impact on the labor market?

This research aims at examining how AI technologies interact with economic dynamics within the Czech Republic and Ukraine, thereby providing an insight into present state affairs as well as forecasting future possible ways forward for these countries.

Additionally, the war in Ukraine would be the "elephant in the room" if we do not consider such factor while studying AI in this country. Its significance cannot be overstated, as it has not only disrupted the country's socio-economic position but also influenced its technological development. Therefore, any analysis of AI in Ukraine must take into account both negative and positive impacts of the ongoing conflict on technological innovation.

1.1 Scope Objectives and Methodology

This research begins with a comprehensive review of existing literature on the impact of artificial intelligence on the economy globally. Subsequently, in the Analysis part, the study narrows its focus to examine the specific cases of the Czech Republic and Ukraine. This part shows how AI technologies are being utilized in various sectors of the economy in these countries and explores the potential for further integration and enhancement. Additionally, the study assesses the policy frameworks and strategies employed by the Czech Republic and Ukraine in implementing AI technologies. The scope also includes an analysis of the

opportunities and challenges presented by AI adoption, with a specific emphasis on its implications for economic growth, job markets, and overall economic development.

1.1.1 Research Objectives

1. Evaluate the current state of AI adoption in economic sectors in the Czech Republic and Ukraine, including the level of implementation and key applications.
2. Investigate the economic impacts of AI adoption in the Czech Republic and Ukraine, focusing on indicators such as productivity, efficiency, and competitiveness.
3. Examine the societal attitudes towards AI integration in economic activities in the Czech Republic and Ukraine, exploring factors influencing acceptance and resistance.

1.1.2 Research Questions

1. How does the level of Artificial Intelligence (AI) adoption in economic sectors vary between the Czech Republic and Ukraine, and what factors contribute to these differences?
2. To what extent does government policy and regulatory frameworks influence the integration of AI in the economies of the Czech Republic and Ukraine?
3. What are the specific AI applications in manufacturing, finance, healthcare, energy sector and other in the Czech Republic and Ukraine, and how do these applications impact economic productivity and innovation?
4. How do societal perceptions and ethical considerations surrounding AI deployment differ between the Czech Republic and Ukraine, and how do these factors influence the acceptance and implementation of AI in economic activities?
5. What is the comparative analysis of AI's economic impact on GDP, productivity, and employment trends in the Czech Republic and Ukraine, and what are the key patterns and disparities observed?

1.1.3 Hypotheses

Hypothesis 1: There is a significant difference in the level of AI adoption between the Czech Republic and Ukraine, and this difference is influenced by factors such as technological infrastructure, education, and industry composition.

Hypothesis 2: Government policies and regulatory frameworks play a crucial role in shaping the economic effectiveness of AI in both the Czech Republic and Ukraine, with more favorable policies leading to higher AI integration and economic benefits.

Hypothesis 3: The impact of AI applications on economic sectors varies across industries, with certain sectors experiencing more significant productivity gains.

1.1.4 Research motivation

My personal experiences living in both the Czech Republic and Ukraine served as the initial inspiration for this research project. I became curious about how AI was incorporated differently in each nation. As I observed the development of AI technology, I couldn't help but recognize their revolutionary potential. My goal with this research is to shed light on AI's role in economics today and what it could look like in the future, specifically within the Czech Republic and Ukraine.

I. THEORY

2. ARTIFICIAL INTELLIGENCE

2.1 Historical Context

The emergence of artificial intelligence (AI) has significantly affected the world. This new technology has sparked considerable interest within scholars, policymakers and industry leaders (Manyika et al., 2017). AI is advancing at such a rapid pace that we need to understand its impact on growth, productivity and employment (Bughin et al., 2017).

Although the idea of intelligent robots has existed for decades, the term "artificial intelligence" was first used in the 1950s by computer and cognitive scientist John McCarthy, and it helped the field of artificial intelligence acquire popularity (Taylor, 2019). In the 1950s and 1960s, scientists worked on programming computers to solve problems using logical rules. By the 1970s, they developed expert systems to mimic human experts in specific fields (Russell & Norvig, 2021). However, progress slowed in the 1980s and 1990s during "AI winters" - periods of high hopes followed by disappointment.

In the 21st century, AI is growing rapidly due to big data, cloud computing, and deep learning. The ultimate goal of artificial intelligence is to develop systems that can perform tasks and make decisions autonomously, exceeding the capabilities of human intellect. In some areas, such as for example manufacturing, transportation, and customer service, technological advancement has already made it possible to replace human labor in manual and cognitive routine tasks (Petropoulos, 2018).

2.2 Definition of AI

AI encompasses a wide range of ideas and terminology and there isn't a single definition that is accepted by all. In general, artificial intelligence can be classified into two types. The first and most common type is Artificial Narrow Intelligence (Narrow AI), which excels at specific tasks but lacks general intelligence. It is designed for solving specialized issues or activities, e.g., chess-playing computers. Modern examples of Narrow AI include virtual assistants like Siri, Amazon’s Alexa, and IBM Watson, which are designed for particular functions such as natural language processing. Narrow AI is also used in recommendation engines, fraud detection algorithms, and personalized content delivery (Ahmed, 2023).

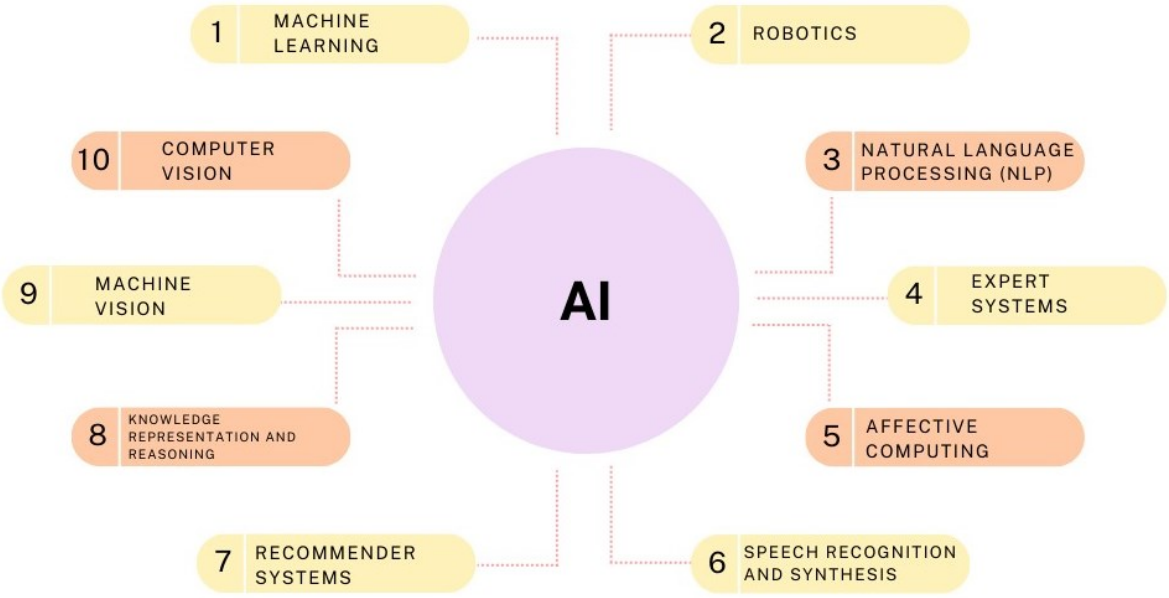
The next is Artificial General Intelligence (General AI or AGI), which still largely a theoretical concept. AGI systems would be able to learn from experience and adjust

themselves to any context just like humans do and would not be limited to a single domain or task but perform a wide range of activities (Custers & Fosch-Villaronga, 2023).

In scientific fiction books, we can find Artificial Superintelligence (Super AI) which is strictly theoretical and goes beyond human intelligence entirely. It could think, reason, and learn at levels that exceed human abilities.

The AI can be further divided into other fields. In the table below I have depicted the main ones. Each of these fields has a distinct area of study of AI, with its own sets of methods, algorithms, and applications.

Figure 1. The fields of AI. Source: The Author



There are still more possible implementations yet to be explored in this area which promises an exciting future for AI. And as we continue harnessing the power of artificial intelligence we expect more innovative applications that will even further transform our world.

2.3 AI in Economics

AI has left its mark on various fields, and economics is under its influence too (World Economic Forum 2023). As highlighted in the McKinsey Technology Trends Outlook 2023, AI is reshaping the landscape of business and boosted innovation and progress. The potential economic impact of generative AI is gigantic, it is estimated that AI will add up to $4.4 trillion in economic value through various applications, from routine tasks like assisting with

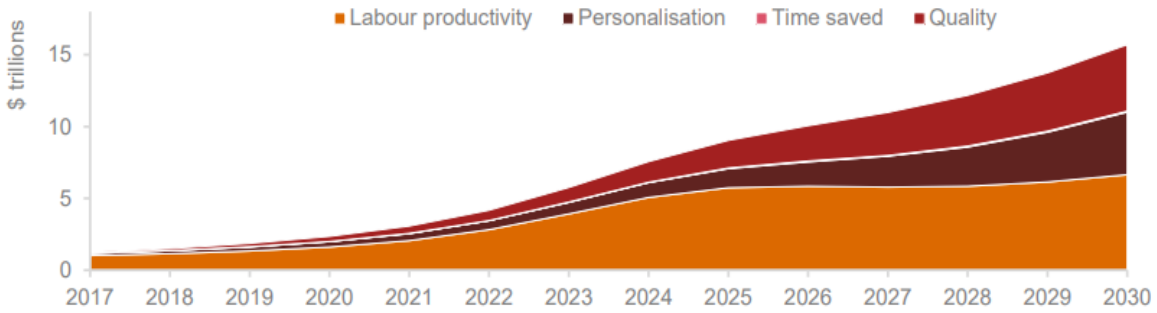
email drafts to more specific use cases (McKinsey, 2023). As compared to $86.9 billion in revenue earned during 2022, the AI market is expected to be valued at $407 billion by 2027 (Picks, 2024). By 2030, Forbes predicts that AI will contribute a remarkable 21% net increase to the GDP in the US (Forbes, 2024).

The Accenture's research points out that now Artificial Intelligence is driving economic growth, not increases in labor and capital. AI has the power to provide new perspectives for value creation and growth by overcoming the physical constraints of labor and capital. By 2035, artificial intelligence might double the rate of yearly economic growth. In such a manner, government officials and corporate executives need to get ready for the artificial intelligence-driven future (Accenture, 2017).

2.4 AI impact on GDP

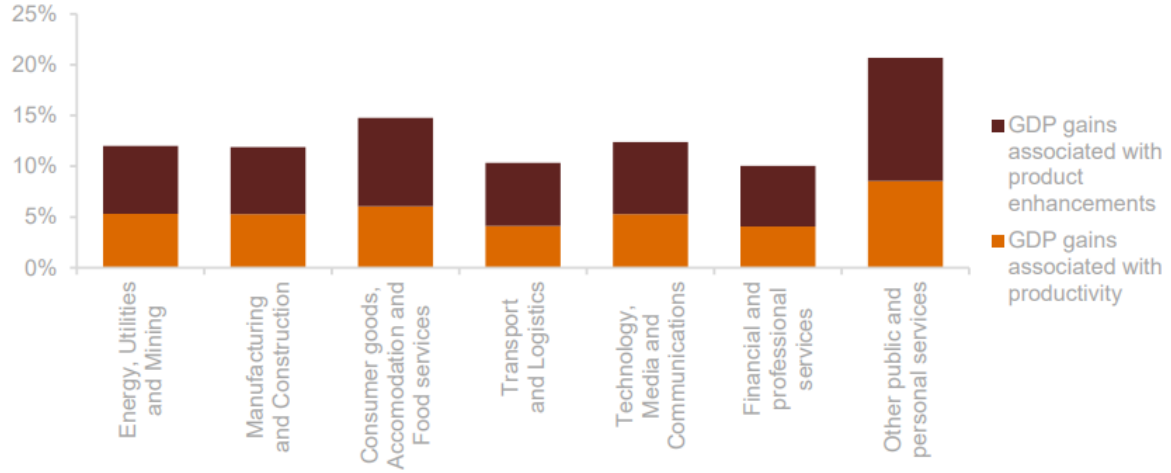
Research papers published by Analysis Group, Accenture, McKinsey and PWC reveal their opinions of AI impact ranging from $1.49tn to $15.7tn, but all of them see Artificial Intelligence as key factor shaping future economic landscape.

Figure 2. Global GDP impact by effect of AI in mail scenario. Source: (Gillham et al., 2018)



The PwC analysis prediction, depicted above, shows that the world's GPD can be boosted through the use of AI to around $15 trillion by 2030 (Gillham et al., 2018). This can be driven by the increase in productivity of AI empowered workers, output quality, as well as personalization demand. The company project that productivity gains will account for about 55% of the GDP benefit during the 2017–2030 period. Nonetheless, consumption side effects will account for about 58% of the 2030 GDP impact that is equal to $9.1 trillion. By the same year, North America and China will gain most with 26.1% and14.5% rise in GDP respectively, translating it into $10.7 trillion which makes up about seventy percent of the global AI effect on GDP (Gillham et al., 2018).

Figure 3. GDP gains in 2030 resulting from AI by industry sector (% of GDP). Source: (Gillham et al., 2018).



By 2030, AI is expected to be the foundation of economic growth, and it is projected that each industry will have at least a 10% increment in GDP (Gillham et al., 2018). The table above, depicts that the services sector, particularly health and education, stands out with an anticipated increase of 21%, largely driven by productivity and product enhancements. The retail, wholesale trade, accommodation and food services are also expected for huge gains of around 15%. Transport & logistics, and financial & professional services will experience a 10 % GDP lift. Nevertheless, capital-intensive sectors such as energy, utilities, mining, manufacturing, and construction are estimated to gain more from the productivity than any other sector, accounting for approximately 44% of total GDP impact (Gillham et al., 2018).

2.5 AI automation and impact on labor

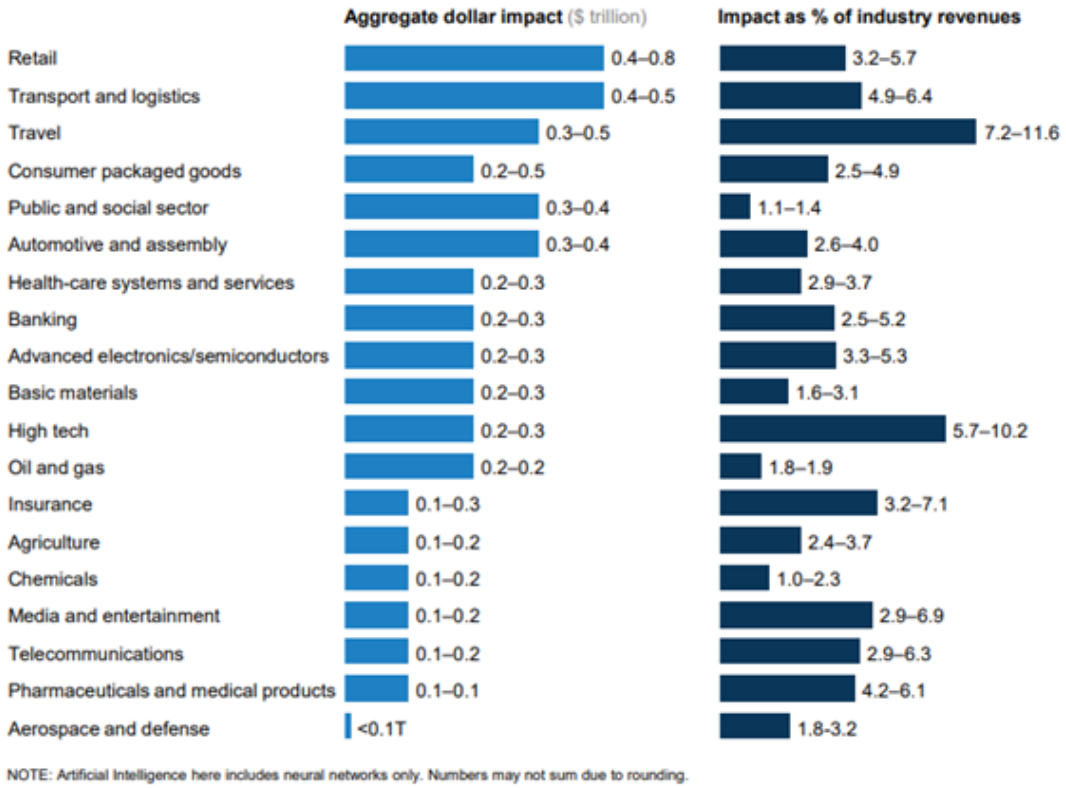
Different studies have different opinions about the impact of AI on a labor market, but to sum up, the majority suggest that the impact will be balanced – AI will disrupt jobs, as well as create new ones.

According to the PWC: The macroeconomic impact of Artificial Intelligence study, the total number of jobs impacted by AI is estimated to be over 326 million by 2030. The 67%, meaning 218 million of these jobs will be unskilled while 33% (107 million) will be skilled. However, in the result the impact of AI on the labor market is projected to be significant and generally positive, although the net effect on job creation remains uncertain (Gillham et al., 2018).

On the other hand, according to McKinsey Global Institute, AI's overall effect on employment over the long term could be neutral or slightly negative. Although AI could potentially replace up to one-third of work activities by 2030, new job creation driven by AI investment could contribute around 5% to employment by the same year. Moreover, AI's stimulation of economic activity through innovation and increased labor demand could result in a positive employment contribution of approximately 12%, even thought, most jobs generated by AI are expected to emerge outside the technology sector itself (McKinsey Global Institute, 2018).

Another McKinsey research predicts that between 3.5 and 5.8 trillion dollars might be generated annually by Artificial Intelligence in 19 key global economic sectors. Referencing the table below, the most value can be brought in areas like retail, transport and logistic, and travel. Even the aerospace and military industry, which has the lowest potential value, yet has the possibility to produce an annual value equal to US$50 billion. This value will be realized in a number of ways, such as more revenue, cost savings, greater product and service value, or even consumer surplus. Even if the total numbers might appear little, the accomplishments in certain industries in percentages have a profound impact (Chui et al., 2018).

Figure 4. The potential value of AI by sector. Source: McKinsey Global Institute, 2018



By 2030, automation has the potential to contribute as much as $9 trillion or about 11% more output than currently produced. Furthermore, AI-based innovation could add about 7% or an estimated six trillion dollars into global GDP by 2030 thus driving further economic development. In such a manner, by 2030 at least 14 percent of employees may switch professions with transition and implementation costs projected at around $7 trillion (Chui et al., 2018).

Artificial Intelligence, automation, and the future of competence at work (Johannessen, 2022) warns about mass unemployment because of machines occupying routine tasks. Hence, the author emphasize that educational systems need to quickly adopt new competences, as well as teach students how to collaborate effectively with AI systems. Lifelong learning will likely become a necessity for most workers if they want to keep up with technological change (Johannessen, 2022).

The demand for highly skilled technology workers is expected to remain strong while middle-skilled workers will need reskilling opportunities to be able to adapt to changing job requirements. The low-skill workers might see an increase in productivity, however, they may face wage pressures. As more routine tasks are automated, human skills like logical reasoning, problem solving, social/emotional intelligence, creativity will become increasingly valuable. Therefore, the education systems must evolve to prepare individuals for the evolving job market, with a focus on STEM skills (Manyika et al., 2017).

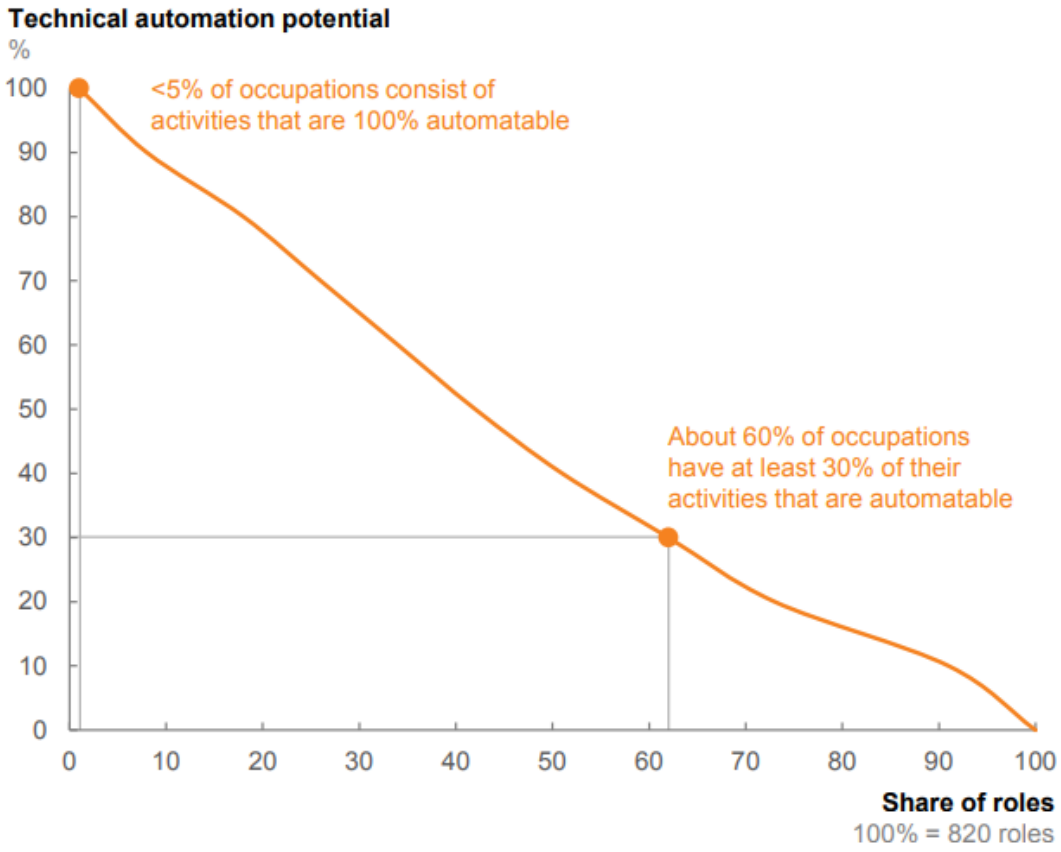
Artificial Intelligence and a Theory of Economic Growth (Acemoglu & Restrepo, 2020) provides a framework for understanding how AI will affect economic growth. They distinguish between routine and non-routine tasks. They argue that while it is easier to automate routine tasks using AI, which means job displacement, it is more likely to happen in sectors like manufacturing where such tasks dominate, while innovating on non-routine tasks requires human labor. The writers point out that the society powered by humans who are supported by an AI could grow at unprecedented rates thanks to the efficiency gains unlocked by this division of labor.

Bostrom (2014) and Brynjolfsson & McAfee (2014) are also worried that AI will displace routine tasks workers. Manual workpeople in the manufacturing sector, truck drivers, warehouse workers, retail clerks and administrative staffs could be among the hardest hit. If they cannot find new work or reskill themselves at scale, they could suffer from prolonged unemployment and poverty. This could in turn exacerbate social unrest and hostility towards other members of society who benefit from their jobs being automated. As a result, societies

could become more divided with every advancement made by AI. Bostrom also examines the long-term view, where the author wonder whether or not AI can become "superintelligent" and surpass human cognitive abilities in all domains. Although this theory sounds sci-fi, with rapid advancements already occurring, Bostrom believes we need to take a step back and consider what could happen if these improvements keep developing. He looks at possible economic scenarios in which all work could be automated by superintelligent AI, making human labor obsolete. But he also concedes that AI might prove to be a potent weapon for economic expansion, increasing productivity and entering in an era of unheard-of wealth. Bostrom says the key is to create AI that is in line with human values and objectives so that it serves mankind rather than endangering it.

On the other hand, the McKinsey & Company research see automation as mostly good outcome, as the automation offers people a chance to take advantage of their special human skills in a changing labor market while welcoming the revolutionary possibilities of technology, they point out that "Automation could make us all more human" (Manyika et al., 2017).

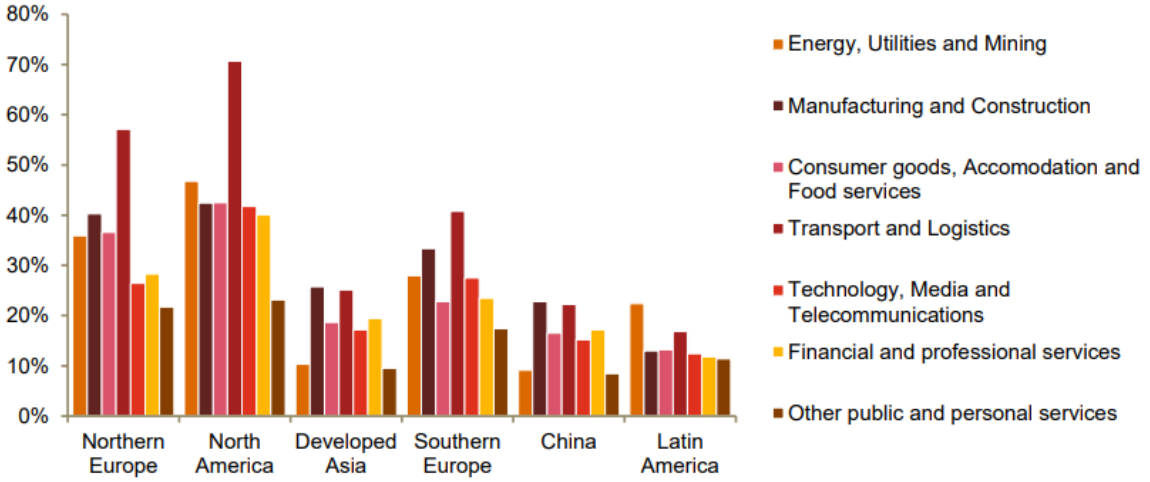
Figure 5. Technical automation potential. Source: McKinsey Institute, 2017



McKinsey Institute analysis estimates that in the global economy, 49% of occupational activities, but not entire occupations, have the potential to be automated. As depicted on the table above, about 60% of occupations have at least 30% of activities that may theoretically be automated, although less than 5% of occupations can be totally automated (Manyika et al., 2017).

When it comes to percentage projections for threatened jobs due to automation, the estimated results differences across various regions and industries. North America and Europe, however, seem more exposed with their technological unemployment varying from 23% up-to 76%.

Figure 6. Percentage of jobs at high risk of automation by 2030, by geographic region and industry sector. Source: (Gillham et al., 2018)



On the other hand Asian nations such as China and other developed countries have relatively low exposure to automation as their job risk ranges between 11-29%. This variation in automation risks across regions stems primarily from differences in the levels of task automatability within sectors. Sectors heavily reliant on basic computations and rule-based activities, such as transportation logistics and manufacturing, experience the highest rates of job loss. However, there is a low likelihood that jobs will be taken over by AI in service sectors with focuse on social skills and management like healthcare, technology finance and education (Gillham et al., 2018). From this follows that the extent to which artificial intelligence is used may have different effects on the economy in different regions, because of the main economic activity in the area and, consequently, on artificial intelligence's capacity to affect this economic activity. However, given the current trends in AI

accessibility, AI has the potential to assist both developed and emerging nations significantly, regardless of wealth levels.

2.6 Adoption of AI

Artificial intelligence has become prominent tool worldwide and it is definitely among most important technologies of this century. However, research on Economic Impacts of Artificial Intelligence within European Parliamentary by Marcin Szczepanski points out that Artificial intelligence adoption in the EU is structurally deficient (Szczepanski, 2019). He explains that its lack of scale is confirmed by the absence of a significant homogeneous database, which is a critical prerequisite for the development of an AI ecosystem. In the EU, there are few companies that use artificial intelligence on a large scale, and the level of investments and patents in artificial intelligence is lower than companies in the US or Asia.

According to the McKinsey Global Institute, the adoption and integration of AI are influenced by several key factors. Firstly, the promise of significant returns drive companies to embrace AI to maintain or enhance their market positions. Secondly, AI's effective deployment relies on robust technical infrastructure, especially with machine learning algorithms requiring access to extensive data and digital frameworks. Moreover, companies with higher levels of digital maturity tend to adopt AI more rapidly, indicating that advanced digital capabilities facilitate AI utilization. Finally, competition acts as a catalyst for AI adoption, as firms may proactively embrace AI to stay ahead of potential disruptions from rivals or in response to innovative market entrants (McKinsey Global Institute, 2018).

People’s opinion also plays role in an adoption rate. People might feel uncomfortable in an environment where AI replaces human interaction, especially in life-and-death situations such as healthcare or driving. According to a recent Ipsos survey for World Economic Forum, 60% of adults worldwide think artificial intelligence-powered products and services will change their way of living considerably within three to five years from now today. The same percentage also believes that AI goods and services will make their lives easier while only half can identify more benefits than shortcomings associated with them. And only 50% say they trust companies using AI as much as other companies (World Economic Forum, 2022).

According to the results of Analysis Group provided at the table below (Chen et al., 2017), if AI follows a trajectory similar to historical broadband adoption (like internet, mobile

phones, robotics etc.), its cumulative economic impact could range from $1.49 trillion to $5.89 trillion through 2025, corresponding to 0.2% to 1.0% of GDP for high-income countries. The expected positive effects are likely to be both direct GDP increase in sectors developing or producing AI technology, as well as indirect growth through enhanced productivity in industries employing it through faster and more efficient processes and decision-making, as well as increased knowledge and access to information (Chen et al., 2017). The following data is originally obtained from a research table and recreated in a table below.

Table 1. Estimated Economic Effect of AI from Potential Broadband Benchmarks 2016-2025 in Millions. Source: (Chen et al., 2017 p.18).

Year	High Income GDP	Estimated AI Diffusion Rate (per Broadband)
2015	53,868,829	0.01%
2016	55,000,074	0.06%
2017	56,155,075	0.30%
2018	57,334,332	1.21%
2019	58,538,353	2.93%
2020	59,767,658	4.87%
2021	60,843,476	7.28%
2022	61,938,659	10.34%
2023	63,053,555	13.78%
2024	64,188,519	16.79%
2025	65,343,912	19.65%

As we can see from the table, the diffusion rate or also known as the adoption rate, shows the speed at which AI spreads through a population, it starts from 0,01% in 2015 and rapidly rise in 2022 to 10.34% and will achieve almost 20% in 2025. Similarly, technological change throughout history has led to job losses but has also created new types of work and opportunities over time.

According to McKinsey Global Institute calculations, AI technology absorption is expected to outpace previous generations of digital technologies like web, mobile, cloud, and big data. While the average adoption rate of previous digital technologies was approximately 37 percent in 2017 and is projected to reach 70 percent by 2035, AI could reach the same level as today's digital absorption rate by 2027 (Chui et al., 2018).

2.7 AI in business

Many businesses are adapting to the new norm of making work more efficient and cost effective for highest productivity (Marr, 2019). AI is currently being utilized by 55% of organizations in at least one business function, like marketing, sales, customer services, security, data, and technology (AIMultiple, 2024). One of the most innovative applications of AI is in the field of generative models or Large Language Models (LLMs) such as ChatGPT, which are used for tasks where there isn't a single correct answer. Such models have found uses in various areas including software code generation, writing, content creation, etc. (AIMultiple, 2024). LLMs can also assist economists in several ways, like ideation and feedback, writing, background research, data analysis, coding, and mathematical derivations. For example, they can automate micro-tasks, leading to significant productivity gains (Korinek, 2023).

Business strategy in the Artificial Intelligence Economy (Munoz & Naqvi, 2018) takes on a business perspective. The book explores how AI can be leveraged to develop a competitive edge in the AI economy. By embracing AI and developing AI-powered strategies, businesses can improve efficiency in operations to create new value propositions for their customers. Munoz & Naqvi argue that companies that strategically integrate AI can gain a significant competitive edge.

However, the combination of AI's productivity factors gets stronger over time. The initial costs associated with AI implementation are offset by the wider adoption and integration of AI technology within the companies. As a result, these early adopters, who are usually large companies with significant budgets, have competitive advantage over their medium and small sized peers, which might create a divide between adopters and non-adopters (Chui et al., 2018).

2.8 Regulations and Ethics

The role of government policies is crucial in shaping the economic impact of AI (European Commission, 2018). Policymakers face complex challenges related to ethics, privacy, data security, and algorithmic bias in AI adoption (Floridi & Cowls, 2019).

The North Atlantic Treaty Organization (NATO) is paying considerable attention to artificial intelligence (AI) technologies and the practical aspects of their use in terms of developing

national and joint capabilities, and fully considering the potential problems and challenges associated with the widespread use of these technologies in the world.

The European Union (EU) is also actively involved in AI issues. In 2018, the EU adopted the Coordinated Plan on Artificial Intelligence, which aims to boost cooperation and make Europe a leader in the development and use of ethical and reliable AI (Van, Rossetti, Perset, Galindo-Romero 2022). An important step was taken in 2024 when the EU Artificial Intelligence Act (AI Act) was legally adopted by the European Parliament. This is the first in the world comprehensive framework for limiting the hazards connected with artificial intelligence. The AI Act sets different rules for the creation and use of AI systems and categorizes them into four risk categories: "unacceptable, high, limited, and low". It covers moral dilemmas and practical difficulties in a variety of industries, including healthcare, education, banking, and energy. Notably, the AI Act mandates that generative AI systems, such as ChatGPT, disclose content generated by AI and forbids the use of AI technology in biometric monitoring (Artificial Intelligence Act: MEPs adopt landmark law, News, European Parliament 2024).

Apart from, in the book The Alignment Problem: Machine Learning and Human Values (Bostrom, 2016), Bostrom emphasizes the importance of aligning AI development with human values. He warns that without proper checks biases present in the data they are trained on could lead to discriminatory outcomes such as hiring decisions or loan approvals.

2.9 Job creation

The PwC research suggests that AI could create an equal number of jobs as those automated, resulting in a neutral net job effect. According to autors, earlier studies underestimate the strong complementarities between automation and labor that can increase productivity, raise wages and stimulate labor demand. In addition ,this effect is cascaded down through the business value chain starting from first productivity gains thus experiencing amplification effect (Gillham et al., 2018).

In addition to AI development and application, there will be a need for individuals who can construct, take care of, run and control these technologies. The authors divide the jobs expected to be created by AI into three broad categories: Trainers, Explainers, and Sustainers. Trainers are those who instruct AI systems on how to carry out tasks and imitate human behavior. Explainers are technical experts who can ascribe the workings of AI

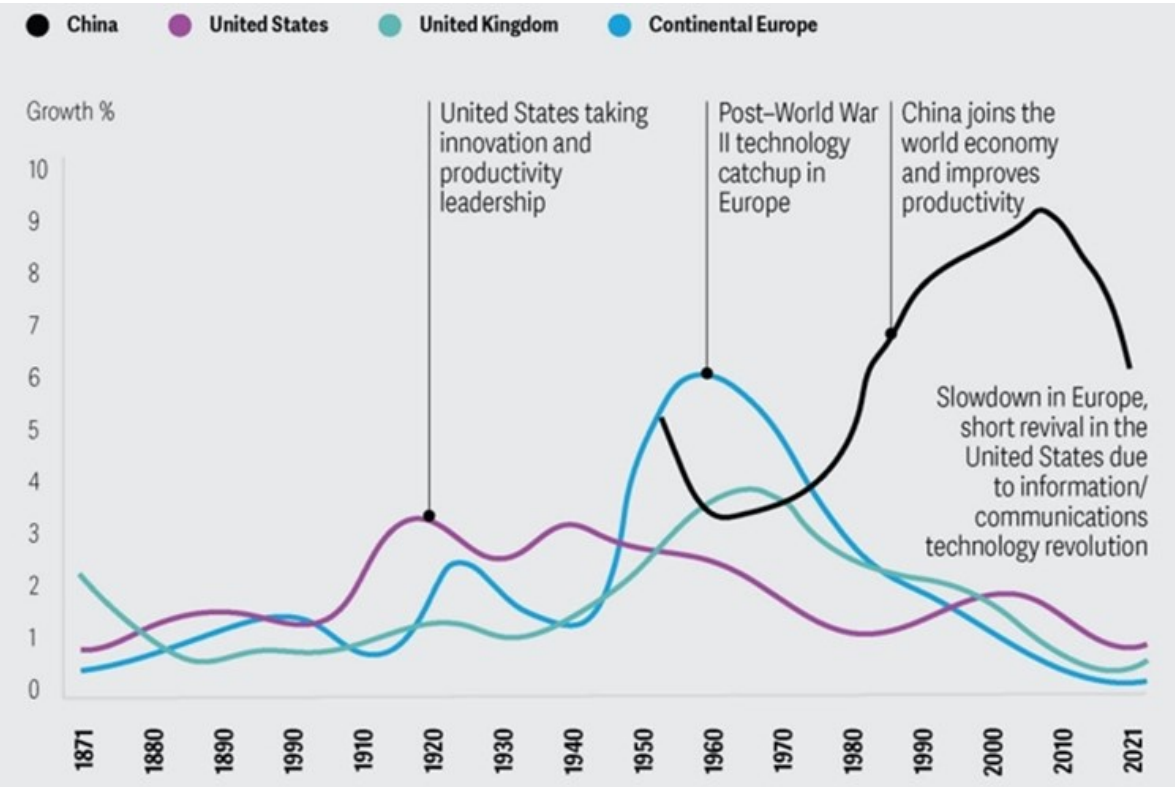
systems and algorithms. Sustainers are the experts in charge of guaranteeing the moral and effective functioning of AI systems. These three positions will bridge the divide between business and technology (Gillham et al., 2018).

McKinsey Global Institute in 2018 also accurately predicts that investing in AI lead to job creation beyond labor substitution, with new roles such as data scientists, business intelligence developers, and computer vision engineers (McKinsey Global Institute, 2018).

2.9 Limitations of measurement of AI on productivity

Modern realities show, that the business conventional productivity metrics, like working hours, task completion time, output produced per employee or revenue per worker, are not correctly represent the productivity as they have remained the same for over a century. Those criteria were initially developed during the industrial revolution era where large scale production and automation and standardized processes were crucial for efficiency. However, as we are currently in the midst of the Fourth Industrial Revolution (4IR) characterized by innovative technologies that rely on interconnected systems of smart devices, it becomes increasingly doubtful if these traditional metrics can still work effectively (Syverson, 2019).

Figure 7. Labor productivity growth 1871-2021. Source: Global Innovation Index 2022 (WIPO)



Importantly, if we look at the historical trends of productivity growth, it is not just stagnating, it is noticeably decreasing. As depicted on the table below, with all the new technology we have, the labor productivity growth in 2021 in Continental Europe is even smaller than the level of growth in 1871 (Cantrell & Commisso, 2023).

According to Chad Syverson article, four potential explanations for the current combination of technological optimism and poor productivity performance include false hopes, mismeasurement, concentrated distribution and rent dissipation, implementation and restructuring lags (Syverson, 2019). The simplest explanation is that optimism about potential technologies is misplaced. The hypothesis of "mismeasurement" argues that new technologies are already delivering productivity benefits, but the measurements are yet to catch up with them.

The next possible explanation is concentrated distribution and rent dissipation. Concentration distribution occurs when opportunities, wealth, resources, and in our case, AI benefits, are concentrated in the hands of a small number of people or entities rather than being distributed equally throughout the populace. Rent dissipation is the inefficient use of resources because of rivalry between people or organizations vying for control of such resources. Recent research partially supports some parts of this narrative suggesting increasing performance differences between industry leaders/laggards, higher profit margins among top firms, rising market share concentration along with growing inequality levels found indirectly via it.

The lag hypothesis claims that there is a large time lag, often greater than conventionally thought. The immediate arrival of AI does not necessarily lead to immediate productivity gains. General purpose technologies (GPT) have profound implications on the entire economy and society at large, nevertheless, the immediate impact of AI may take some time before being reflected in terms of current levels of productivity. This lag in productivity can occur when there is a need to create a significant stock of new capital, or when additional types of tangible and intangible capital must be identified, produced, and deployed to fully exploit the productivity benefits of AI. And if we want to see this transition, firms must undergo significant organizational and cultural changes when adopting AI technologies. This restructuring process can take time as managers and entrepreneurs work to optimize their operations and adapt to new technologies (Syverson, 2019).

The final possible reason for this paradox nowadays according to Syverson is mismeasurement. One of the problems with measuring AI as a form of capital and its

influence on productivity growth is that most its outputs are not tangible, thus it makes AI value hard to estimate precisely. The difficulty in assessing is further complicated by the fact that AI usually serves as an input for other forms of capital, like human labor and software, which are also mostly intangible. AI often provides intangible benefits that improve processes or add value in ways that are not easily measurable. Among examples are personalized experiences or better decision-making, which are not possible to accurately translate into money or time terms.

Traditional tools such as GDP and simple measures of productivity are inadequate at capturing the subtleties surrounding this technological revolution. This can underestimate the real worth of AI capital and its contributions to increasing productivity. If we are not applying accurate measurements for intangible assets due to AI investment, then total GDP and productivity may be under-estimated. Therefore, less measured productivity growth may occur even if true productivity is rising. As a core requirement, there is a need to update economic measurement tools that can capture accurately how AI together with its complements impacts productivity. Data analytics coupled with machine learning algorithms may for instance, be used to assess the impact of AI on labor productivity, process efficiency and innovation. With the help of advanced data analysis techniques applied to this domain, economists and policy makers can obtain a more complete picture of how productivity growth is influenced by AI, which in turn will enable them make decisions about its optimization (Syverson, 2019).

In this chapter, I conducted a comprehensive review of several chosen articles relevant to my thesis topic. For a better understanding, I summarized key findings from the chosen studies and organized them into a table below, with each column dedicated to the results of a specific study.

Table 2. Summary of chosen studies' findings. Source: The Author

STUDY	**McKinsey Global Institute: A future that works**	**Accenture: Why AI is the future of growth**	**PWC: The macroeconomic impact of Artificial Intelligence**	**McKinsey Global Institute Notes From The AI Frontier**
IMPACT	1. In the next five decades automation will increase economic growth between 0.8% and 1.4%. 2.Productivity increase by above1.8%.	1. AI-induced productivity boost translates into 3.8% to GDP 2. AI is predicted to boost growth from the current rate of 0.8 percent to 2.7 percent by 2035.	The minimum expected global economic impact of AI in 2030 is $11.2tn or 9.8% of global GDP.	By 2030, AI could contribute $13 trillion to the global output which globally translates to about an additional annual GDP growth rate of around 1.2%.
KEY FINDINGS	1. Different activities, jobs, wage and skill levels will all have differing effects from automation in terms of speed and scope 2. Adoption of automation in a variety of circumstances will take decades. 3.Automation may have negative effects, such as the displacement of human labor and the concentration of benefits among digital and physical capital owners.	1. Increases in capital and labor are no longer driving the levels of economic growth but AI. 2. AI is "new normal" leading it into a prolonged period of robust economic expansion that may even become another factor input. 3. By 2035 labor productivity increase to 35% in US. Among impacts are: TFP impact (3.8%), Intelligent automation (16.9%), and Augmentation (14.1%) that result into aggregate figures of 35%.	1. There will be more substantial gains in productivity in knowledge-intensive sectors (software development, pharmaceuticals, financial services) 2. Northern Europe is expected to see significant productivity gains from AI due to its developed and diversified economy, skilled workforce, and strength in knowledge-intensive sectors 3. Potential gains in Southern Europe could be less significant due to weaker infrastructure and smaller pool of skilled workers.	1. China is the biggest follower of AI while US comes second 2. The skills required for jobs may shift with AI 3. The impact of the AI may be different among industries, more tech-savvy and vibrant sectors may be affected greatly 4. Disparities between winners and losers could increase 5. The effect that AI has on employment is complex, some jobs will become automated while others will be augmented. 6. AI's economic impact shall remain relatively low during the short run.

CHANNELS OF IMPACT	The primary impact of automation is expected to come from labor substitution, with potential additional benefits like improved quality and reduced breakdowns.	The main Channels of Impact are: Intelligent automation; Enhancement of labor and capital; Dissemination of innovation	1.Automation lead to significant increases in labor productivity, boost their profitability and competitiveness. 2. AI technologies are also expected to enable firms to develop higher-quality products tailored to the individual preferences. This could lead to increased demand for these products, driving economic growth.	The report identifies seven potential channels of impact of AI: AI-driven automation of labor AI-driven substitution of labor Application of AI to innovate new and better products and services Economic gains from increased global flows Wealth creation and reinvestment Transition and implementation costs Trust, ethics, and regulation.

To sum up, the analysis of the theoretical framework provided valuable insights into the capabilities, limitations, and ethical considerations surrounding AI technology. Every researcher agrees that AI is capable of changing the economy greatly. However, each author has their own opinion on how those changes will manifest. By examining these diverse perspectives we got a richer understanding of a broad influence AI has on the economy.

II. ANALYSIS

3. BACKGROUND AND CONTEXT OF ARTIFICIAL INTELLIGENCE (AI) IN THE CZECH REPUBLIC

The Czech Republic is leveraging its rich industrial heritage and technological expertise to establish its unique place in the global AI landscape. Czech Republic has a strong foundation of mathematics, computer science, and engineering with well recognized institutions like Charles University and the Czech Technical University in Prague. This nation is one of the leading countries in AI research and education (Atlantic Council 2023). The country actively explores AI integration into manufacturing industry through collaborations between academia and industry that yield innovative applications particularly aimed towards reducing production cycles.

Prague stands as a prominent hub for tech startups, that depicts a thriving innovation ecosystem within Czech Republic (Emerging Europe 2023). This forms an ideal environment where start-ups and tech companies contribute to creating AI solutions thereby attracting talent and capital support. Active involvement of the Czech Republic in various research undertakings on Artificial Intelligence demonstrates its commitment to moving this field forward thus placing it at the center stage among European countries shaping future developments concerning Artificial Intelligence technologies.

3.1 Legal and State AI regulations in the Czech Republic

The Czech Republic is active in promoting the assessment of artificial intelligence from a legal point of view. In 2018, in a dossier on AI and smart contracts to United Nations Commission on International Trade Law (UNCITRAL) Czechia suggested that future research and development in these fields should be closely watched. The Czech Republic also filed a proposal on AI in 2018 to UNIDROIT (International Institute for the Unification of Private Law), with an emphasis on contracts governing AI services and goods. Three specialist reports were prepared as a result of the Office of the Government of the Czech Republic's intensive investigation on AI development potential. The Czech Republic proposed self-regulation, soft law based on the best practices and horizontal “red lines” for the preservation of fundamental rights and legal clarity in a position non-paper titled "Regulatory Framework for Artificial Intelligence in the European Union" that was developed for the EU in 2019 (AlzbetaKrausova, 2020).

The Law on Artificial Intelligence was the Czech Presidency's top objective in terms of digital policy in 2022. The act seeks to place the first comprehensive set of regulations based on the possible harm. The majority of EU nations have decided to provide the European Commission instructions to adopt these systems' obligations through an implementing act. The final version of the AI Act establishes guidelines for large, general-purpose models of AI (Bertuzzi, 2022).

As for the national regulations, the government commissioned scientific institutions of the Czech Republic to draw up an expert report that would highlight the country's potential for AI development. The Government and the Department of Industry and Trade are collaborated to establish the Artificial Intelligence Observatory and Forum (AIO&F) that works as expert body to identify legal barriers to AI development, study and use, and development of solutions. Also in 2019, the Czech government and industry representatives signed a Memorandum of Cooperation on the Development of Artificial Intelligence. The main goal of this memorandum was a cooperation between the parties on the preparation of a comprehensive national strategy for artificial intelligence (AI Strategies in Czech Republic | CMS Expert Guides, n.d.).

Hence, the National Artificial Intelligence Strategy (NAIS) of the Czech Republic was released in 2019. The strategy consists of seven chapters, each focusing on a different topic. The NAIS has chapters on promoting science, financing AI, addressing AI's impact on industries, education, labor market, social systems, legal and societal aspects, consumer protection, security issues, and international cooperation. The National Strategy was created for advancing artificial intelligence with the priority to position the country as one of Europe's leading innovation hubs (Emerging Europe, 2023). This plan aims at driving economic growth while boosting competitiveness through responsible, trustworthy AI ecosystem development. This includes promoting digitalization among businesses, especially small and medium-sized enterprises (SMEs) and ensuring equitable access to AI benefits across society (European Commission, 2023).

Additionally, NAIS is designed to boost research and development in AI with support from the Ministry of Education, Youth and Sports through funding projects at universities and research institutions. The NAIS concentrates on adapting education programs and enhancing training opportunities with an aim of preparing individuals for AI maintenance, deployment, development etc. As part of these initiatives, the Czech Republic is focusing on transforming its education system with AI learning at every level. In this regard, new curricula were

introduced into primary education for 2021 which significantly increased computer science lessons and added essential digital competences. Furthermore, since the adoption of the strategy, the Technology Agency has supported several projects related to Artificial Intelligence with total funding amounting up to 120 million EUR (European Commission 2023).

Furthermore, the Innovation Strategy of the Czech Republic for 2019-2030, presented in 2019, defines new priorities that, if achieved, should place the Czech Republic among the most innovative countries in Europe by 2030. It clearly states that the goal is that The Czech Republic should prepare society for such trends as AI (AI Strategies in Czech Republic | CMS Expert Guides, n.d.).

3.2 Legal issues of using AI in the Czech Republic

Legal restrictions that can potentially cause issues for the usage of artificial intelligence in the Czech Republic the national level are yet unclear. However, on the EU level, there are few troublesome difficulties. AI stakeholders in the Czech Republic have cautioned against overly stringent EU regulations, citing potential roadblocks to AI research and development. As previously stated, Chechia support self-regulation, placing a strong emphasis on voluntarism, but at the same time prioritizing public safety, and thoroughly evaluating risks prior to enacting new laws. The Czech Republic advocates for the removal of legislative obstacles to the development of artificial intelligence in an effort to strike a balance between enforcing laws and fostering the field's quick advancement (Brzozowski & Hendrych, 2020).

4. BACKGROUND AND CONTEXT OF ARTIFICIAL INTELLIGENCE (AI) IN UKRAINE

In terms of AI-driven solutions, Ukraine stands with its huge tech talent and a thriving innovation ecosystem. Kyiv and Lviv cities host numerous skilled IT professionals who form a strong baze for integrating artificial intelligence technologies into various spheres of economics. Supported by government initiatives and policies, Ukraine's tech sector is strategically positioned to harness the economic benefits of AI. This commitment is evident in the emergence of numerous startups and companies specializing in AI applications, contributing to innovation in the economy. According to Atlantic Council, with over sixty Ukrainian tech companies actively involved in AI innovation, Ukraine is recognized as one of the world's leading pioneers in this field (Dickinson 2023).

Moreover, Ukrainian educational institutions such as Taras Shevchenko National University of Kyiv and Lviv Polytechnic National University play an important role in the development of AI. These universities have been designed to improve the quality of training and teaching in computer science and artificial intelligence, thereby increasing the nation’s intellectual power.

Additionally, artificial intelligence is proving to be a valuable factor in the ongoing war with Russia. It serves as a crucial tool for data analysis, and troops on the battlefield (CNAS, 2023).

4.1 Legal and State AI regulations in Ukraine

Ukraine adheres to the OECD's principles on artificial intelligence and participates in the Council of Europe's Committee on Artificial Intelligence (CAI) discussions on AI development.

The Expert Committee on the Development of AI in Ukraine was established by the Ministry of Digital Transformation of Ukraine to draft the strategy for the AI development. This committee coordinated the efforts of the state, business, scientific and educational, public and expert circles in the field of artificial intelligence. The committee created a monograph and recommended eight important areas of state policy in AI area: Education and human capital; Science and innovation; Economy and business; Cyber security; Defense and security; Public administration; Legal regulation and ethics; Justice. This monograph reveals the AI position of Ukraine in Europe and shows that Ukraine is the third in Eastern Europe

in the terms of the quantity of AI companies. Noteworthy, most research in the field of AI is concentrated in state institutions, as the National Academy of Sciences of Ukraine (Верховна Рада України, 2020) (Verkhovna Rada of Ukraine, 2020).

Hence, a joint initiative of a consortium of Ukrainian scientists and well-known research institutes developed a strategic plan for the period 2023-2030 that meets the specific needs of Ukraine. In 2020 the Cabinet of Ministers of Ukraine approved this Concept of the Development of Artificial Intelligence in Ukraine until 2030. The strategy is aimed at bringing Ukraine to a leading position in the world in the field of artificial intelligence, as well as improving the well-being and quality of life of citizens, and attracting significant investment. In addition, this strategy align with NATO's framework program and European Union's AI Act, that emphasizes the thrive for legitimate and responsible use of AI technologies in Ukraine.

The Concept is also accelerating the post-war recovery of the country's economy with an emphasis on strengthening security, defense, science and education. Consequently, the military is one of a key area of focus, it includes the development of AI countermeasure systems, anti-aircraft and reconnaissance systems to identify hostile targets and fend off attacks. From an economic point of view, the plan aims to promote entrepreneurship in the field of AI, improve business environment and ensure a consistent tax policy. Also retraining workers whose roles could be automated within a decade is on the agenda. In the field of education, the main goal is to increase the skilled workforce via courses on the basics of artificial intelligence for teachers and promote digital literacy among students. In the field of cyber security, information and technological systems is of primary importance. This involves the creation of national information systems to reduce dependence on foreign software. It is expected that the application of AI in information security will allow effective detection and neutralization of threats. Finally, the legal regulation is aimed at harmonizing the principles of AI with European standards, as well as defining the legal and ethical limits of the use of AI. Additionally, it is planned the creation of a strong legal framework in Ukraine for the protection of intellectual property rights, as well as control over the safe storage and transfer of data and information related to artificial intelligence obtained as a result of economic and scientific activities (Верховна Рада України, 2020) (Verkhovna Rada of Ukraine, 2020).

To achieve this goal, the Consortium has planned organizational and financial support from state for research and startups in the field of AI, as well as development of domestic software

and expansion of data availability. The strategy also highlights that it is equally important to develop international cooperation with the participation of Ukraine in organizations and institutions engaged in research in the field of AI. This includes facilitating the exchange of knowledge, developing expert exchange programs and encouraging the participation of national experts in international AI initiatives, programs and conferences.

It is expected that the adoption of the Concept of the Development of Artificial Intelligence in Ukraine will bring positive results for Ukrainian enterprises, state institutions, local self-government bodies and citizens. It will also create favorable conditions for expanding scientific research in the field of artificial intelligence, improving their quality, and ensuring Ukraine's leadership in the world scientific community. The implementation of artificial intelligence technologies will lead to the optimization of business activities, cost reduction, competitive advantages, increased profits due to innovations and increased labor productivity due to the automation of processes and the use of artificial intelligence technologies (Верховна Рада України, 2020) (Verkhovna Rada of Ukraine, 2020).

Moreover, Ukraine has always wanted to integrate to the European Union, so with this long-term aspiration the Ministry of Digital Transformation of Ukraine created Roadmap for regulation of artificial intelligence in Ukraine. This Roadmap is a strategic plan to support local businesses and comply with the EU’s AI Act. The strategy for implementing AI regulations adopts a gradual, bottom-up approach, progressing from simpler to more complex measures. On the I stage, businesses will be equipped with the necessary instruments before passing the legislation. In such a manner, the government has an opportunity to collect information on the market, evaluate risks and develop appropriate infrastructure for implementing this law This approach is designed to take into consideration the interests of all key stakeholders, ensuring a balance between business interests and the protection of citizens' rights. Ukraine wants AI to be a force that benefits society without compromising personal freedom. This approach shows that we recognize the awareness about artificial intelligence (Міністерство цифрової трансформації, 2023) (Ministry of Digital Transformation, 2023).

As mentioned above, the plan is created to not only maintaining competitiveness, but also about putting Ukrainian business on global map and developing closer ties with the European Union. On the II stage it is initiated to start the implementation of the AI Act itself. It is also planned to form a culture of business self-regulation. Specifically, by voluntarily signing agreements of ethical use of AI by companies. To address the questions of a various

businesses of what to do and how to prepare to law adoption, it is also planned to provide sector-specific and general guidance (Міністерство цифрової трансформації, 2023) (Ministry of Digital Transformation, 2023).

5. THE COMPARISON OF GOVERNMENT AI ADOPTION OF THE CZECH REPUBLIC AND UKRAINE

The Government AI Readiness Index was created by Oxford Insights to reflect the worldwide focus on artificial intelligence (AI Readiness Index - Oxford Insights, 2024). The index indicates how much the governments are ready to implement AI in public services. The framework for assessment has 39 indicators that are distributed over 10 dimensions, and grouped under three main pillars: Government, Technology, and Data & Infrastructure.

Government Sector evaluates a government's strategic vision, regulatory framework, ethical considerations and internal digital capacity. The Technology Sector looks at the level of maturity in the technology sector with emphasis on innovation, good business environment and large research and development (R&D) expenditure. It also includes the human capital that reflect skills and education levels of individuals within this sector. Data & Infrastructure focuses on data availability, representativeness and adequate infrastructure for effective AI deployment.

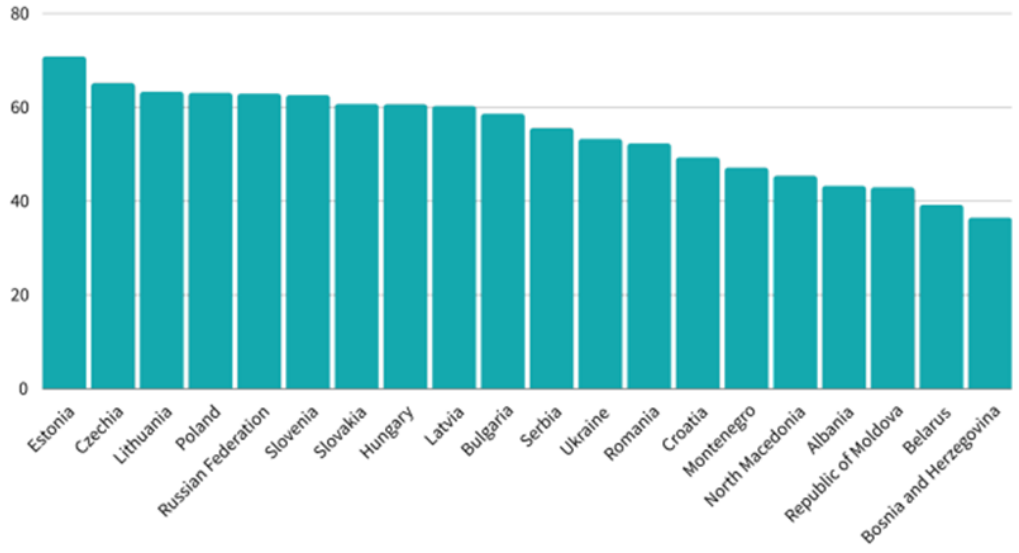
Figure 8. Comparison of Czechia and Ukraine Government AI Readiness. Source: AI Readiness Index - Oxford Insights, 2024

Czech Republic shows good results of the AI readiness landscape in Eastern Europe. The country takes second place, after Estonia. One of the most notable aspects of Czechia is its strong technology industry that enjoys high levels of innovation and a supportive environment for entrepreneurs. To keep up their human resources capacity for AI, Czechia invests in skills and education programs. By emphasizing both technological advancement and human resource development, Czechia demonstrates a comprehensive approach towards AI readiness. The country actively works to align itself with international digitization standards. With its cooperative approach, Czechia is positioned to play a significant role in shaping the future of digital services (AI Readiness Index - Oxford Insights, 2024).

In the overall score comparison, Czechia is significantly more AI-ready than Ukraine, with a 11.88 points average advantage. In the Technology Sector, Czehia is also in the lead with an 11.54 points margin showing better ecosystem for AI development. Czech Republic has its most significant lead in Data & Infrastructure where it has a 20.8 points advantage comparing to Ukraine, indicating better digital connectivity and data availability. However, Vision, Digital Capacity, Adaptability and Maturity all have very similar position across these two countries.

Ukraine’s efforts are adding up to the overall positive trend of AI regulation in Eastern Europe. As mentioned earlier, Ukraine has released a comprehensive plan on regulations for artificial intelligence, which is consistent with European Union's AI Act. This proactive strategy showcases Ukraine's preparedness and places Ukrainian businesses for the future regulatory environment in Europe (AI Readiness Index - Oxford Insights, 2024).

Figure 9. AI adoption index in Eastern Europe (AI Readiness Index - Oxford Insights, 2024)



From the Oxford Insights table provided above we can observe what positions have both Czechia and Ukraine among Eastern European countries. One possible explanation for the observed variation in scores among Eastern European countries is the support and investments from the European Union. The five countries with the lowest scores are non-EU members, while all of the top five countries, except Russia, are EU members.

When we compare the Czech Republic and Ukraine, we can see that the countries both have differences and similarities in the adoption of Artificial Intelligence. It is very clear that AI implementation has been greatly influenced by active government interventions. Even though Ukrainian government's attitude and regulatory framework towards AI have been much slower as compared to Czech Republic. This has been influenced by concerns surrounding data privacy, budgeting and displacement of jobs due to AI automation leading to less supportive policy environment for AI development in certain sectors.

During investigating the introduction of artificial intelligence in Ukraine, some problems have been identified that distinguish it from its more advanced counterpart as the Czech Republic. The war is an obvious obstacle on the Ukraine's path to effective AI development. Because of unstable political context, the shortage of skilled IT experts is becoming a threat. When on the other side, the Czech Republic's economic stability, strong currency with politically stable atmosphere has created more opportunities for an advanced level comparing to Ukraine. Nonetheless, amidst these setbacks, Ukraine exhibits resilience and advancements in respect to AI integration. The country has a robust IT talent pool as well as a growing start-up ecosystem that presents opportunities for AI growth and innovation.

6. CASES OF AI USAGE IN THE CZECH REPUBLIC

6.1 ŠKODA AUTO

A key component of the Czech Republic's economy is a manufacturing sector, and it serves as a strategic hub for the incorporation of artificial intelligence. Given the importance of the this sector, utilizing AI in industrial processes has enormous potential to spur innovation, increase productivity, and guarantee long-term competitiveness on the local and international stages. Furthermore, by incorporating AI into manufacturing processes, the Czechia is able to take advantage of new opportunities in Industry 4.0 and establish itself as a leader in the use of cutting-edge technology.

In their present form, AI technologies are often used to perform autonomous digital and physical operations as they offer efficiency gains and cost savings. This is applicable to not only manufacturing, but logistics and customer service where use of AI-driven automation helps to streamline the processes and lower labor expenses.

Škoda Auto is one of the largest users of artificial intelligence among major Czech automakers. Their “Sound Analyser” is an innovative phone application based on artificial intelligence (ŠKODA AUTO uses artificial intelligence for even more accurate car diagnostics - Škoda Storyboard 2020). It records sounds made during car movement using spectrogram technology to graphically interpret sound waves produced inside engine compartment. Then, the AI compares particular vehicle sounds with sounds in database to identify even a small deviation from the standard. A total of 245 SKODA dealers, within 14 countries, took part in this real-life pilot project (Czech news agency CTK Economics, 2020). The mobile app currently recognizes ten different sounds with over 90% accuracy, including components like air conditioning compressor or steering systems. The “Sound Analyser” app expedites traditional diagnostic processes that involve manual inspections, trial and error, and substantial troubleshooting. The app provides data-driven accurate diagnostics for technicians, thereby enhancing productivity, shortening diagnosis time and speeding up completion of repair or maintenance services. Finally, the proactive nature of the app identifies minor concerns before they turn into major repairs.

ŠKODA is also applying predictive maintenance principles in car production facilities (Ondrej.Petr, 2023). The usual maintenance plans are performed at fixed intervals or after equipment’s failure. However, AI algorithms can analyze data, sensor results and performance patterns to detect potential faults in machines in advance. In this way,

manufacturers can plan preventive maintenance by early detection in their facilities, which will reduce downtime and extend the life of equipment, as well as ensure continuous production without emergency shutdowns or defects.

For example, Mladá Boleslav's – the busiest line, Hall M13 of ŠKODA's plant, use MAGIC EYE. The MAGIC EYE system integrates AI algorithms with camera technology for real-time monitoring of equipment and detection of anomalies, defects or signs of wear. Consequently, whenever an anomaly that might cause a problem in future is spotted, the alerts will be sent to the maintenance teams to enable them act as quickly as possible. Key to MAGIC EYE system are artificial neural networks (ANNs) which learn from thousands of equipment photos to recognize patterns associated with defects. The system's knowledge base grows at all times. The new method has also attracted interest from Volkswagen Group so that it could be applied more widely within the automotive industry (Škoda Auto: "Magic Eye" camera system quickly identifies maintenance needs on the assembly line - Škoda Storyboard 2023).

Apart from this, ŠKODA AUTO project OPTIKON exemplifies integration of artificial intelligence in logistics. OPTIKON is an AI-based approach used to optimize container space utilization in its logistic operations. Thus, using AI algorithms, OPTIKON examines numerous combinations till it finds the perfect arrangement for high container loading capacity. It resulted in more efficient packing and 151 saved container shipments, which reduced approximately 80 tons of CO2 emissions (ŠKODA AUTO Logistics optimises use of container space with help of artificial intelligence - Škoda Storyboard 2020).

6.2 Aireen

Artificial intelligence-powered Aireen DR is a medical device software, which offers painless screening for chronic diseases through analysis of digital retinal images. It uses AI technology to detect changes in the retina using neural network models developed from more than one million annotated images with the cooperation of leading retina specialists. When assessing a new retina image, Aireen's solution provides over 99% accuracy. Moreover, the outcome results are created without the emotional conditioning that comes with a process conducted by humans since it's being generated with mathematical rigor. (AI medical Diagnosis Solutions transform healthcare 2024) Since May 2023, Aireen® has been certified as a class IIb EU-MDR medical device for diabetic retinopathy screening. This indicates its

commitment to innovation and furthering medical science (Kuřina 2021). The earlier detection of diabetic retinopathy that is important for reducing the risk of fatal complications or sight loss. Diabetic Retinopathy AI by Aireen detects diabetic retinopathy with high accuracy provide diagnostic results in under 60 seconds. In addition, Aireen provides an intuitive user interface that is easy for healthcare providers to navigate through thus making analysis simpler and easier. The importance of Aireen include improved compliance with screening requirements, reduced late stage diagnoses, and extended expert capacity hence improving access to screening, and reducing examination times. (Kuřina 2021).

6.3 GoodData

GoodData is based in Prague and it offers organizations a robust cloud-based analytics platform designed to unleash their data potential. GoodData uses artificial intelligence applications in order to enable businesses to profitably use their data for decision making purposes. By integrating data visualization, reporting capabilities as well as predictive analytics, GoodData makes it possible for firms to optimize operations, identify emerging trends and foster growth opportunities (Avidon 2023).

The foundation on which GoodData's platform stands upon is its leverage on artificial intelligence (AI) for uncovering valuable insights from data. The tip of this technology spearhead is FlexQuery an innovative AI-driven analytical engine. FlexQuery allows fast development of scalable data products that meet specific requirements desired by end-users. With its intuitive no-code UI, FlexQuery can be used to build custom data products that can be used to make dashboards, custom apps and advanced AI/ML use cases. Moreover, there are other AI-powered features such as forecasting, key driver analysis and natural language querying (NLQ) which enhance data visualization and decision making. The GoodData platform also offers its Analytics as Code tools focusing on efficiency and collaboration for faster development, seamless embedding capabilities into existing workflows and a Collaboration Hub for centralized teamwork knowledge sharing (Avidon 2023).

6.4 PEKAT VISION

The Brno Datalogic Group's division called PEKAT VISION is a leading provider of artificial intelligence (AI) software solutions specifically created for quality inspection in manufacturing environments. Designed for easy deployment by application engineers, the

software includes modules dedicated to anomaly detection, object recognition, surface quality assessment, and optical character and symbol reading (OCR).Moreover, unlike traditional quality inspection systems where fixed cameras are stationed along conveyor belts, PEKAT VISION's offer collaborative robots, which are intended for businesses of nearly any size and necessitate a minimal degree of technical know-how to implement in a production setting. This brings us to highly versatile and configurable robots that are repeatable in nature hence affordable making fully automated quality inspection feasible for a wide range of companies (Zikmund 2024).

Central to PEKAT VISION's approach is a distinctive kind of artificial intelligence designed specifically for industrial visual inspection and quality control purposes. This technique is different from the usual traditional deep learning methods that usually require huge datasets; it excels at learning from few images, making it suitable in situations where large dataset collection might be difficult. Like human eyes, the algorithm carefully examines image details so as to detect any inconsistencies, defects or anomalies on objects or materials. It is noteworthy that PEKAT VISION can detect even previously undetected defects due to its focus on understanding the general characteristics of a high-quality product, rather than simply memorizing specific defects. Thanks to its versatility for different materials and self-learning capabilities, PEKAT VISION becomes an excellent solution for automated control in various industries (Zikmund 2024).

6. 5 Typegrow

With heaquaters in Prague, Typegrow, an AI-backed tool that speeds up the grow of LinkedIn audience by ten times. It streamlines content creation and planning to widen coverage, engagement, and follower growth by reducing user effort to a minimum. The Typegrow is most appropriate for professionals who manage clients' profiles on different social media platforms as well as individuals developing their brands on LinkedIn.

With this tool content creation turns into a more time-efficient process when a person uses AI Typegrow as a virtual assistant. Additionally, its post scheduler is easy to use in scheduling likeminded posts thereby saving valuable minutes when posting them altogether. On top of this are growth-oriented facilities such as carousel makers and post previews Typegrow's provides specialized post recommendations based on a large viral content library (Typegrow [no date]).

7. CASES OF AI USAGE IN UKRAINE

In 2020, Ukraine ranked as the number 1 Eastern European supplier of artificial intelligence, with its 150 certified providers (Oxford Government AI Readiness Index, 2022).

7.1 Grammarly

The journey of Grammarly dates back to the late 1990s at the International Christian University in Kyiv, where three visionary Ukrainian tech minds, developed MyDropBox—a plagiarism detection tool. This early project laid the foundation for more ambitious endeavor – a comprehensive grammar checker. Grammarly initially concentrated on addressing common grammatical errors. Presently, Grammarly's advanced AI engine provides users with a sophisticated writing experience that captures any mistakes, adds suggestions for improved clarity and tone, as well as detecting plagiarism. Furthermore, international recognition of Grammarly has attracted significant investments into the AI industry of Ukraine, which in turn led to further research and development as well as created a vibrant AI ecosystem (Bozhok 2024).

7.2 Metinvest

Metinvest is a Ukrainian international mining and metallurgical enterprise. The group includes a worldwide distribution network and mining and metallurgical plants in the USA, Europe, and Ukraine. The CEO of the Metinvest Group, Yuriy Ryzhenkov, discussed the unique aspects of steel production in war-torn Ukraine as well as how new technologies have changed heavy industry business processes, particularly in regards to green technology adoption and compliance with the European Green Deal. Using his own experience as evidence, he argues that artificial intelligence may not only make the steel industry more environmentally friendly but also more productive and competitive.

Their nowadays known to the whole world metallurgical facility Azovstal is located in Mariupol in eastern Ukraine, is destroyed by russian military. «In 2021, Azovstal outperformed its competitors in terms of process efficiency thanks to AI and analytics" says the CEO. The company's specialists by using augmented reality completed maintenance twice faster than most of their rivals in nearby nations, and in such a manner their computer vision technology Space, raised the bar for product quality ("IT and AI can make the steel

industry greener and more efficient" - General Director of Metinvest Group Yuriy Ryzhenkov at the G7 meeting on green transformation in 2024).

Metinvest utilizes advanced technology across its entire production process, from automating individual units and production procedures to integrating different units and enterprises into a unified information network. This results in lower product costs, higher quality, and safer, smarter, and more comfortable work environments for employees.

Nonetheless, steel mills utilize AI and machine learning to plan gas consumption. Because of government regulations on gas consumption limits, Metinvest needed to minimize costs due to accurate forecasting. In the southeastern Ukrainian Zaporizhstal metallurgical plant, the company's specialists collected a vast amount of historical data on 20 parameters, including real consumption, thermal parameters, and steel grade characteristics. By constructing a model of correlation with parameters, artificial intelligence was able to assess data correlations and forecast numerical trends. In such a manner, with an accuracy of over 97%, the anticipated gas consumption for the following calculation day was predicted.

Additionally, the corporation measures bulk materials at enrichment facilities using unmanned drones, which replaced part of the inspectors who count and measure raw material volumes manually. Drones also provide workers with the ability to properly manage logistics and keep an eye on inventory by delivering most recent data across the production chain (Drones and artificial intelligence help industry save resources. Interview with Sergey Detyuk, CEO of Metinvest Digital, MetinvestDigital, 2019).

7.3 HURMA

In the HR sphere, The HURMA system from Ukraine is a proficient and efficient way to automate hiring, Human Resources (HR), and Objectives and Key Results (OKR). HURMA is the first human resource information system in Ukraine with own-made artificial intelligence and excellent data security. With the HURMA System HR and Recruitment process can be easily automated. Keeping track of performance, goals, and important outcomes, automating surveys and feedback, and analyzing HR data and analytics related to business operations, onboarding; etc. are all among the tools for AI automation. The company's system can save up to 43% of the time spent on repetitive tasks and 18% of the hiring expenditure (Ministry of Digital Transformation of Ukraine 2023).

7.4 YouScan

Last but not least, YouScan is a social media controlling industry-leading tool driven by AI. This platform monitors industry keywords, brand mentions, rival activity, and pertinent issues on popular internet channels like Facebook, Instagram, X, etc. The company uses artificial intelligence technology to assess the attitude and emotions mentioned in these posts and comments, determining if they are favorable, negative, or neutral. It assists marketers, researchers, CX specialists, and PR professionals in managing brand reputation, understanding customer perceptions, and gaining insightful knowledge thanks to its text, picture, and audience analysis capabilities. YouScan also helps find new trends, prominent voices, and subjects that are becoming popular and offer insightful information about online discussions. YouScan works with more than 400 clients globally, including well-known companies like McDonald's, PepsiCo, Coca-Cola, Samsung, and L'Oreal (Ministry of Digital Transformation of Ukraine 2023).

7.5 War usage

A new kind of warfare has been introduced by the Ukrainian-Russian conflict characterized by the strategic employment of Artificial Intelligence. Artificial intelligence has received a lot more mentions in the context of the Ukrainian war than any other topic, making it the most discussed topic among materials on the subject of war. (Штучний інтелект в Україні: досвід використання, перспективи, тренди в медіа, 2024) (Artificial intelligence in Ukraine: experience of use, prospects, trends in the media, 2024).

At the early stages of war AI had very limited impact, but Ukraine started using AI-powered tools for collecting Open-Source Intelligence (OSINT), processing social media data, satellite imagery, and responding to Russian cyberattacks against Ukrainian infrastructure.

As the conflict escalated, AI became an instrumental tool that Ukraine applied to resist Russia’s military aggression. This involved employing systems based on artificial intelligence enabling gathering intelligence on real time from satellite images and drones, providing valuable insights about current enemy locations, patterns of troop movements and equipment deployments. This relevant information made it possible for Ukrainian troops to be more proactive when deciding where to attack while at the same time increasing their responses time to threats and ability to protect vulnerable areas.

The collaboration between Palantir Technologies Inc. and Ukraine revealed a growing private involvement within geopolitical conflicts. Palantir Technologies is a well-known American software developer plays an important role in the war on the territory of Ukraine. The company collaborated with the Ministry of Economy of Ukraine to develop a digital approach to demining. Palantir's AI software will analyze the data to help Ukrainian authorities prioritize areas to clear mines and explosives left over from military operations. This will result in the safer and faster removal of mines and explosives, make the land danger-free and usable, and ensure public safety. Ukraine is also studying the possibility of implementing the Palantir situational awareness system used by NATO countries (Bergengruen 2024).

Clearview AI is a facial recognition technology that is being used to help Ukrainian enforcement to identify and track people. This advanced AI system collects intelligence information, making it possible to quickly receive data on the movement and actions of the enemy. It also aids in identifying Russian soldiers involved in war crimes by analyzing video footage and social media posts. This evidence is crucial for investigations and prosecutions, holding perpetrators accountable for human rights violations (Bergengruen 2024).

In addition, artificial intelligence is used to analyze satellite images and train drones to recognize objects on the battlefield in real time. Our drones now have artificial intelligence technologies installed by numerous Ukrainian enterprises. There are different types of drones that can be used for different tasks, for instance, artificial intelligence powered SAKER SCOUT drone complexes are currently used in operations and showing positive outcomes. Even when enemy’s military equipment, such as tanks, are camouflaged, drones can autonomously identify it and send its coordinates to the command center instantly. Our international allies are also helping us implement these technologies. The United States and Great Britain will supply Ukraine with thousands of modern Swarm drones equipped with artificial intelligence. These drones might launch coordinated group attacks against Russian targets. Additionally, they are efficient at destroying anti-aircraft defenses, warping the image of hostile radars, locating enemy radars, and communicating data to operators (Horbyk 2024).

7.6 Osavul

Beyond frontline operations, there is active “information front” and the disinformation is a huge threat, especially for a country at war state, and global democracy as a whole. To find the solution to this Osavul emerged in Ukraine. Osavul created an innovative AI-powered system for monitoring narratives in the information field and evaluating information threats. Working in Ukraine during the conflict shows that the company can use its technologies in real-world scenarios, and prove their goal of safeguarding nations, companies, and the general public from information operations and misinformation (Ministry of Digital Transformation of Ukraine 2023).

Nevertheless, Ukraine faces limitations in developing and deploying sophisticated AI systems, there are ethical questions revolving around the use of autonomous weapons systems and issues of data security related with made AI technologies. This equally calls for urgent steps towards addressing these issues to ensure responsible and ethical application of AI in any future conflicts while at the same time using it as a navigation tool.

Even in the bloodiest conflict in Europe since World War II, Ukraine use this period as an opportunity for innovation and revolution. Using artificial intelligence and other advanced technologies, Ukraine seeks to expand its capabilities and effectively respond to the changing nature of military operations.

8. RISKS AND CHALLENGES OF THE AI TO THE ECONOMIC PROCESSES IN THE CZECH REPUBLIC AND UKRAINE

8.1 Automation and Labor

As much as there are so many opportunities associated with artificial intelligence (AI) in terms of economic growth and innovation, there are also inherent risks and challenges that come with its implementation. One primary concern is whether jobs will be lost, especially for low-skilled workers employed in repetitive tasks, which are under the high risk of automation (Frey & Osborne, 2017). The Czech Republic is heavily depending on manufacturing, so its labor market is particularly exposed to such disruptions.

However, the government's choices will determine if AI's impact on the nation's economy is positive or negative. This includes decisions regarding investments in AI research and development, educational initiatives, and support for businesses involved in AI. This governmental efforts are outlined in both the Czech National AI Strategy and Ukraine's Concept of the Development of AI so the only question is whether it will be implemented as planned. Nevertheless, despite the risks, Czechia and Ukraine have shown mainly positive AI utilization in entities like Skoda or Metinvest as described above.

In addition, AI poses a risk of increasing skills gap. This can lead to social discontent and unemployment due to inefficiency of knowledge, thus hampering economic development in both countries. Even though new jobs open in AI development data science or automation management they require very specific skills not always available among the current workforce (Global McKinsey Institute 2017). Moreover, even distribution of gains may worsen inequality since income gaps might widen. Both Ukraine and Czech Republic must invest into retraining programs and upskilling efforts so that their workforces can adapt to the changing needs of labor market.

Another challenge in implementing AI is war in Ukraine. This ongoing conflict creates "brain drain" makes IT professionals work for indigenous AI companies, thus preventing the build-up of an essential pool of knowledge. Also, due to economic constraints brought by the war, Ukraine faces scarcity of financial resources for AI R&D activities. The global leadership aspirations of Ukraine cannot be achieved without significant investments, as well as constrain innovation and advancement.

8.2 Safety and Transparency

In the field of AI, there are safety and security concerns. It is possible for malicious actors to take advantage of flaws in AI systems in order to cause damage, like leaking sensible data, tampering with self-driving cars so as to cause accidents or launching cyber-attacks aimed at exploiting critical infrastructure. First and foremost, ensuring the safety and security of AI systems will be essential for mitigating potential risks and harmful activities (New report on the malicious use of AI - Future of Humanity Institute 2018).

AI deployment in Czech Republic and Ukraine needs to address data privacy concerns. Because AI is data-intensive, the issue of ensuring privacy and security of data becomes very important. Therefore, effective regulations are needed by these two nations to protect personal information that is collected or used by AI systems that emulates General Data Protection Regulation (GDPR) for European Union (Wolford 2023).

Eradicating bias within AI models is essential in ensuring equitable decision-making processes as well as fighting against systemic discrimination. Ukrainian AI Monograph discusses that, in most cases, complex AI models operate as black boxes implying that it's difficult to understand their decision-making process. Because of this, the lack of transparency in how such decisions are made raises concerns over fairness and accountability.

8.3 AI hallucination

Lastly, as a social risk, there is an effect of "AI hallucination". This phenomenon involves the creation of false or deceptive information. AI hallucination is a significant threat in AI systems, particularly those involving language generation or creative content production. AI creations such as text, images, or videos can contain misleading information, manipulate public opinion, or be used for malicious purposes like creating convincing deepfakes. Russians produced a deepfake video in 2022 with Ukrainian President Volodymyr Zelenskyy calling the people of Ukraine to surrender their weapons. Despite being resolved swiftly, the incident circulated on social media for some time (Allyn 2022).

The other ways in which AI Hallucination occurs on various platforms include inaccurate responses from chatbots, fake social media posts, fully computer-generated news articles and even scientific papers with reasonable yet invented data. Due to these realistic illusions produced by AI systems detecting them and mitigating the risks they pose becomes harder.

There are several ways in which it can be mitigated. First, is proper training data for an artificial intelligence model. Second, is developing more open and explainable models so it is easier to identify misinformation. Lastly, is the incorporation of strong fact-checking mechanisms and human expertise (What are AI hallucinations? | IBM [no date]).

9. RISKS OF NOT APPLYING AI TO THE ECONOMIC PROCESSES IN THE CZECH REPUBLIC AND UKRAINE

9.1 Smaller GDP growth and Labor shortage

The reports discussed in the Theory part show that AI will contribute trillions of US dollars to the global economies by 2030. Moreover, the analyzed Czech and Ukrainian case studies prove that using AI has significant contributions in various industries such as healthcare, manufacturing, mining, management of business tasks, IT services, and military sectors, and others.

Therefore, if both countries are not applying AI technologies they would miss out increased efficiency in business processes, optimization of supply chains, and improved outcomes that drive GDP growth, and boost productivity and innovation. However, the extent of this GDP growth will depend on some factors, in particular, investment in AI research and development, regulatory frameworks, and the availability of skilled talent.

Ukraine is famous for its skilled talent, especially in the IT sector, however, if Ukraine are investing is the developing AI, talented professionals, including software engineers, data scientists, and other IT specialists, would seek opportunities in Western countries. This situation can obstruct the long-term economic recovery and innovation potential. Most importantly, if there will be huge labor shortages, artificial intelligence has a potential with automation to effectively interchange some labor force. AI technologies can automate routine tasks and drive innovation, and thereby mitigate the effects of brain drain, and if those technologies are not applied country will have a decreasing effect on economy.

Likewise, the Czech Republic faces although not severe, but demographic challenges, such as an aging population, which could have significant implications for its labor market and economic competitiveness. That's why there is a need for innovative solutions to address labor shortages in the future. Artificial intelligence technologies are promising in this regard because they can automate, optimize processes, and improve productivity in various sectors

even more effectively than people. By leveraging automation and AI-based innovation, the Czech Republic can mitigate the impact of an aging population on the labor market, and maintain competitiveness in the global economy. In addition, investment in AI research and development can attract talent and investment, hence driving long-term economic prosperity.

However, AI is a "double-sided coin" here too, as discussed in the section on the Risks of applying AI above, the effects on the labor market would depend mostly on the ability of people to be skilled enough or re-skilled and other governmental efforts.

9.2 Stagnation, competitiveness and business process management

In today's, as competitive as never before, business landscape, AI will definitely become a must-have technology to remain rival and effective. Business intelligence tools and artificial intelligence systems help in understanding consumer behavior, optimizing production lines' operation and increasing customer satisfaction. In the absence of AI-driven innovations, companies lose their customers who prefer better-performing products or services from rival firms that revolutionize their business through deployment of AI. Businesses that don't apply AI also would fail to keep pace with market developments and industry standards, and finally would be far behind their AI-equipped counterparts.

Following this thought, businesses can use AI tools such as Ukrainian YouScan for insights & analytics, discovering hidden trends within data sets, finding new markets and guiding critical choices based on hard facts rather than guesswork. AI is important for businesses since they might find themselves unable to interpret vast amounts of data available now or misinterpret emerging trends. Opting against using AI could mean losing chances to expand, enter markets assess customers 'needs or grow revenues resulting in long-term competitive disadvantage for companies.

AI can change how businesses function not only by automating routine tasks, but also by streamlining procedures and eliminating human errors which are frequently made during the input/output process. Manual operations are often time-consuming, error-prone and expensive leading therefore to reduced productivity and increased costs in terms of operations. Lack of AI machine techniques would mean reliance on manual labor, thereby continuing inefficiency and wastage of resources. AI-based solutions on the other hand could improve workflows, decision making and resource allocation hence making organizations more efficient or effective (Nur, Harshini 2022).

9.3 Increased Risk and Uncertainty

In today's fast-paced and uncertain business world, effective risk management is essential to protect against potential threats and uncertainties. Artificial intelligence tools and predictive models help identify risks, assess their impact, and plan strategies to mitigate them. Moreover, AI-powered risk assessment tools can continuously monitor data in real-time, allowing businesses to be proactive in identifying emerging risks and quickly adapt their strategies accordingly. Facing these risks without preparation can lead to financial losses and reputational damage, making businesses more vulnerable to difficult times or unexpected crises.

It applies to the governmental level as well and in the next chapter, I will explain about the importance of AI predictions for both Czech and Ukrainian policy decision-makers.

10. ROLE OF AI IN PREDICTING COUNTRY GDP

10.1 Introduction

The Gross Domestic Product (GDP) is the total value of all goods and services generated inside a nation's boundaries during a certain period, and it is a crucial measure of a nation's economic success. GDP is an indicator of the economic condition of a country that allows analysts, investors, and decision-makers to assess the entire extent of the economy's growth. Understanding the elements of GDP—consumption, investment, net exports, and government spending—makes it easier to comprehend the variables influencing economic growth or decline. The calculation of GDP encompasses a nation's total consumption (both public and private), investments, changes in private inventories, government spending, and net exports (exports minus imports) (Fernando 2024).

10.2 The Model

AI is a vibrant subfield of computer science with roots in pattern recognition and computational learning theory. It is a set of methods that is used to make computer systems operate in an autonomous way by learning to improve from experience. In machine learning, there are two types of tasks: supervised and unsupervised learning. In supervised learning, a AI algorithm uses a labeled dataset to learn a mapping from inputs to outputs. The inputs consist of a set of attributes and the output is a label or a set of labels. The learned mapping is then applied to new unlabeled data. On the other hand, unsupervised learning has only input data and no output data. The goal is to learn the underlying structure of the data.

It is also well recognized that all the electronic data that is being generated around the world contains useful information. Today's technology has transformed society into a data-driven world where vast amounts of data are being generated daily. Discovering patterns and learning from large amounts of data has been particularlyusefull for success in various areas of business and science. The goal of AI is to build computer systems that can adapt and learn from their experience (Delua 2021).

A AI system can make predictions or take decisions by being trained on a set of historical data. It learns from the data that we provide and can be used to make predictions on new unseen data. For example, AI is taught to predict the outcome of an event, given certain input features. The system can be trained using data that was collected on the event and previous outcomes. By looking at the historical data, the system can uncover patterns that lead to certain outcomes. For example, the system may learn that the event is more likely to have a

positive outcome if there are more than X number of Y events in a given period. If the system can successfully learn these patterns, then when it is given new data, it can make a prediction on the outcome of the event. This involves finding the value of Y in the new data and comparing it to the pattern that was previously learned. If we are confident in the pattern, then we can also be confident in our prediction.

In this master thesis, with supervised learning, a predictive model is built on a historical dataset containing Ukraine and Czechia countries‘ attributes and the target variable - GDP. This predictive model can be directly used to predict GDP for new data. So, once a predictive model is built, it is necessary to identify a clear plan and the type of relationship that we want to discover using the model. Predicting GDP is an important and challenging task for policymakers. The ability to accurately predict GDP allows policymakers to track the effects of policy and assist in decision-making processes. This can be useful for identifying problematic issues in the economy and taking action to resolve these issues. GDP predictions are also beneficial for future planning and can improve a country's confidence and position in the international economy.

10.3 Importance of predicting country GDP

The significance of predicting the country's GDP growth rate has been highly recognized by prominent economists. It is more than pure academic research since it is considered a useful tool for decision and policy making for both government and multinational corporations. If a country's GDP growth is deemed largely unpredictable, it would be difficult to plan for the future, both for the government as well as the corporations investing in the country. For example, for the the government a wild swing in GDP is usually associated with higher unemployment, and the government could use an early indicator of GDP to make a pre-emptive policy such as a fiscal stimulus to try to balance the swing. Predicting future data can be an essential step in making a pre-emptive policy. If we can effectively predict a change in the GDP growth rate based on a change in policy, we have strong evidence that the policy is the cause of the change. If the data is not predictable, it would be difficult to determine if a policy is effective. Gaussian process is highly suited to this sort of analysis since the flexibility of the model can effectively capture the relationship between the policy and the GDP change. In such a manner, AI uncovered relationships from data can provide more insight on the best policy to affect change in an economy.

10.4 Limitations in Predicting the Impact of AI on GDP

In developing a model for predicting the impact of Artificial Intelligence on Gross Domestic Product (GDP), some constraints needed to be addressed since they unable accurate prediction of the economic impacts of AI.

a) AI as non an Economic Factor: The first limitation stems from the nature of AI itself. AI surely contributes to different sectors and processes in the economy, but it does not fit well into traditional economic indicators. Unlike tangible economic factors such as investment, consumption, or government spending, AI operates more as a transformative tool rather than a direct economic factor. Consequently, it cannot be measured quantitatively within GDP.

b) Limited Availability of Economic Data on AI: The second important constraint arises from absence of sufficient complete and standardized economic data specifically related to AI. Even though artificial intelligence is gaining recognition across many industries, attempts to objectively measure its economic effects have been hampered by inconsistent methods used to collect data and report findings. It is very difficult to evaluate role played by AI in GDP due to unavailability extensive datasets containing robust information, and currently it is almost impossible to find dataset for both Ukraine and Czechia in the AI landscape.

c) AI as a Young Industry: Another notable limitation is the relative youthfulness of the AI industry itself, as compared with more mature sector such as manufacturing or finance. Artificial intelligence is still at its early stages of growth. Also, this introduces uncertainties about long-term implications.

d) Indirect Effects: AI's indirect effects on GDP can take many different forms, including multiplier effects, enhanced innovation, altered labor productivity, and changes in consumer behavior. Because of the intricate interdependencies between many economic variables, it can be difficult to predict these indirect effects and precisely estimate their impact.

Tackling these limitations demands interdisciplinary collaborations between economists, data scientists, policymakers and industry players to come up with innovative ways of capturing and analyzing the economic implications of AI.

10.5 Linear regression as an example

To account for the inevitable differences between the actual values of the dependent variable and the anticipated values from the independent variables, a model contains an error term. The formula for a simple linear regression model is: $Y = a + bX + \varepsilon$, Y is the predicted value of the dependent variable, a is the intercept, b is the slope of the line, and X is the value of the independent variable. Substituting X for its value and rearranging this equation gives the value of Y in terms of X. This equation defines a line, to get an estimate of Y we must find the line that best fits the data. Best fitting line is found by minimising the sum of squared residuals. This allows us to find a and b by using the following formulas.

The general form of the model is: Y is the dependent variable. X1 is the independent variable. ε is the error term.

This method is appropriately explained by its name. Linear regression is a technique to model the relationship between one dependent variable and one or more independent variables. It is a case of supervised learning, and is used to quantify the relationship between the dependent and independent variables. In simpler words, it is used to predict the value of one variable based on the value of another variable. The variable we want to predict is called the dependent variable. Linear regression is a very simple method, and can in many cases outperform more sophisticated methods of prediction.

10.6 Feature selection and preprocessing

Feature selection and data preprocessing are of great importance for any AI application and the GDP prediction is not an exception. The process of feature selection involves choosing the features (inputs) that are most relevant for forecasting GDP. There are two types of features that can be used: 'hard' economic/financial data such as inflation rate, unemployment rate, etc., and 'soft' data such as survey results and sentiment indexes. The 'soft' data is generally processed using text mining techniques and transformed into numerical data. Before selecting features, the first task is to split the labeled data into training and test sets. This can be done by using a simple random split or splitting the data in a specific time frame such as the last year's GDP data being used as the test set. With time series data, it is important not to randomly split the data as this can affect the correlation between previous and current results.

Given the limitations in data availability and the difficulty of forecasting the impact of AI on GDP, it was decided to exclude AI as a factor in the forecast model. This decision was based on several limitations mentioned in above dedicated section. Instead, the focus was on

the identification and analysis of other key factors that have been more thoroughly studied and documented for their impact on GDP.

10.7 Dataset

In the evolving landscape of global economics, understanding the multifaceted dimensions of economic data becomes paramount. This study draws upon a dataset from Focus-Economics.com, a reputable source in the field known for providing comprehensive and up-to-date economic statistics and analyses. The dataset encompasses a range of economic metrics, including population numbers, GDP in several currencies, economic growth rates, consumption figures, investment trends, and others. The table below shows the data used for the purpose of model development for Ukraine.

In the proposed development predictive model focusing on Ukraine's economic outlook, linear regression techniques was employed to forecast the country's Gross Domestic Product (GDP) in billions of USD. The foundational steps encompassed the selection of relevant features from the above mentioned dataset, excluding specific variables to refine the predictive focus. With the target variable identified as the GDP, the data was divided into training and testing segments, ensuring both the integrity the predictive model through this partition. Essentially, the approach consisted of setting up and conditioning a Linear Regression model, using the training dataset to familiarize the machine with the nuances of Ukraine's economic trends. Post-prediction, the evaluation process closely examined the model's accuracy through the Root Mean Squared Error (RMSE) metric, a critical step in validating the precision of our forecasts. The culmination of this research was the generation of a detailed comparison between the actual GDP figures and the model's predictions, encapsulating the efficacy of the approach in predicting GDP for the coming years of Ukraine.

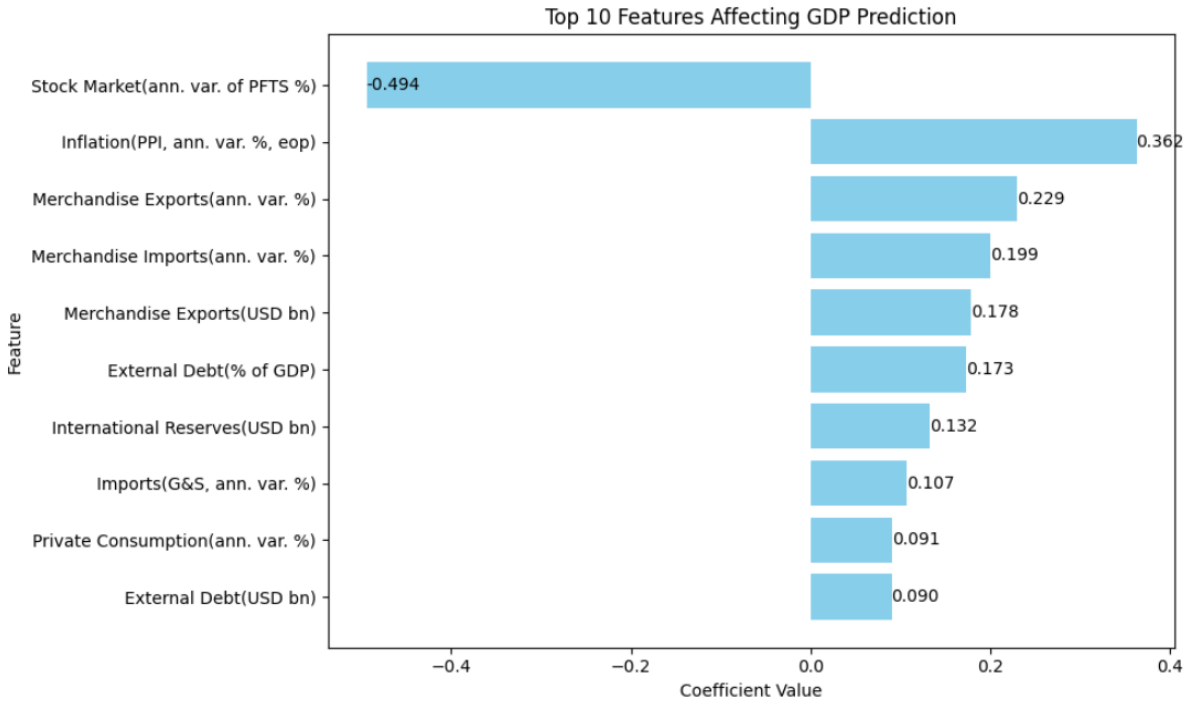
10.8 Prediction of GDP of Ukraine

The model predicted actual GDP value of 154 billion USD, a predicted GDP of approximately 167.577 billion USD, and a prediction error (the difference between the actual and predicted values) of approximately -13.577 billion USD. The photo below is a summary that shows model outcome to be considered about the model's performance and the specific prediction it made.

```
Root Mean Squared Error: 13.577
Results Summary:
   Actual GDP(USD bn)  Predicted GDP(USD bn)  Prediction Error
1                 154              167.57708         -13.57708
```

The fact that the model overestimates GDP values in this particular case, as indicated by the negative prediction error, raises the possibility that it is mistakenly detecting patterns in the data that lead it to predict GDP values that are greater than what are actually observed. There are a number of potential underlying causes for this phenomena, including the influence of outliers, and the existence of dataset imbalances, which will be an open research area for future research.

Figure 9. Top 10 Features Affecting GDP of Ukraine. Source: The model calculation



Each bar's length in the graph represents the absolute value of the coefficient, providing a visual representation of each feature's impact on GDP prediction. The longer the bar, the greater the impact. The direction of the bar (left for negative, right for positive) indicates the nature of the relationship (inverse or direct, respectively).

The feature with the most significant negative impact on GDP prediction is "Stock Market (ann. var. of PFTS)" with a coefficient value of -0.494. This indicates a strong inverse relationship between this variable and GDP prediction as per the model's findings. In other

words, an increase in the annual variation of PFTS is associated with a decrease in GDP prediction.

On the positive side, "Inflation (PPI, ann. var., % eop)" has the highest positive coefficient value at 0.362. This suggests that increases in this type of inflation are associated with increases in GDP according to this model.

Other features such as "Merchandise Exports(ann.var.%)," "Merchandise Imports(ann.var.%)," "Merchandise Exports(USD bn)," "External Debt(%ofGDP)," "International Reserves(USD bn)," "Imports(G&S, ann.var.%)," "Private Consumption(ann.var.%)," and "External Debt(USD bn)" also have positive coefficients, indicating that they are positively correlated with GDP prediction.

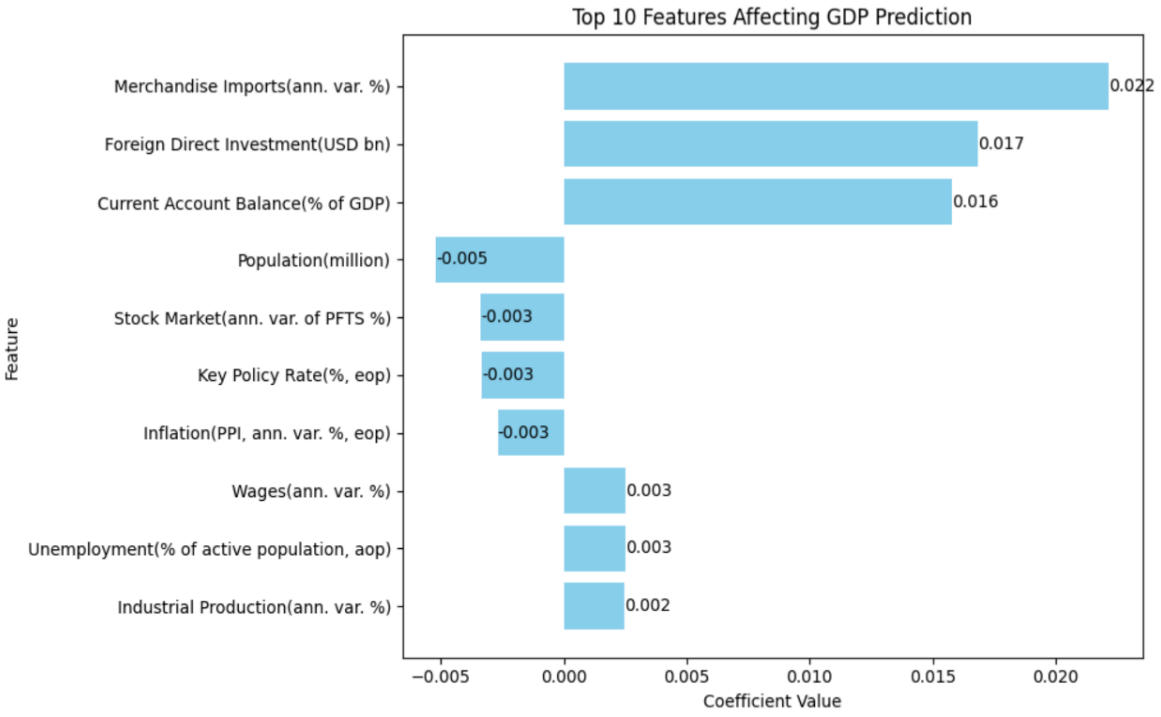
10.9 Prediction of GDP of the Czech Republic

Figure 10. Prediction of GDP of the Czech Republic. Source: The model calculation

```
Root Mean Squared Error: 7.191
Results Summary:
   Actual GDP(USD bn)  Predicted GDP(USD bn)  Prediction Error
1                 253             260.191289         -7.191289
```

As in the case in Ukraine, the model overestimates GDP value, but in case of Czechia the prediction error is smaller (approximately -7.191 billion USD).

Figure 11. Top 10 Features Affecting GDP of the Czech Republic. Source: The model calculation



According to the results, in Czechia, the Merchandise Imports (annual % change) has the strongest positive influence on GDP growth, with a coefficient of 0.022. Foreign Direct Investment (USD billion) also has a positive coefficient (0.017), suggesting a positive correlation between foreign investment and GDP growth.

The Current Account Balance (% of GDP) has a positive coefficient (0.016), indicating that a positive current account balance might be favorable for GDP growth.

Population growth (million) has a weak negative coefficient (-0.005), which might be due to factors like increased strain on resources or limited economic opportunities with a larger population. Key Policy Rate (% at end of period) coefficient for this factor is negative (-0.003). This suggests that higher key policy rates, which are typically set by central banks to influence inflation and economic activity, might have a weak negative influence on GDP. This is because higher interest rates can discourage borrowing and investment, potentially slowing economic growth.

The Inflation (PPI, annual % change, end of period) is also negative (-0.003). Inflation can erode purchasing power and reduce consumer spending, and have a negative influence on GDP

The coefficient for wages is positive (0.003). This aligns with our previous observation that wage growth can stimulate consumer spending and economic activity, potentially contributing positively to GDP growth. The coefficient for unemployment is positive too (0.003). This might seem counterintuitive at first glance. However, a low unemployment rate generally indicates a strong labor market with more people employed and contributing to the economy.

And finaly, Industrial Production (annual % change) is positive (0.002). This reinforces the notion that a thriving industrial sector, with a larger output of goods, can contribute positively to GDP growth.

11. SURVEY

11.1 Surveys By Other Institutions

During the period between July and August 2023, Randstad performed an all-inclusive survey across the Czech Republic involving 136 leaders of businesses in various industries soon (Survey: AI Integration Won't Lead to Massive Layoffs in Czechia, 2023). Among the most important takeaways, over 50% of firms confirmed having already incorporated AI into their operations. About the general perspectives to AI, 45% of respondents were positive about its worldwide influence while only 8% were pessimistic and 47% had neutral standpoints. About the impact that AI will have on jobs, large majority of respondents (90%) expect it to create new positions at the expense of others leading to little change in overall employment figures. Furthermore, it was discovered during the research that most people (88%) did not worry about job insecurity resulting from AI suggesting that they felt safe with their work because of technological progress.

However, Statista survey shows that Artificial Intelligence holds huge prospects for businesses but is still at its early adoption stages. Currently, only a few companies have scaled AI in its business processes. During the first half of 2023, the average percentage of firms in the Czech Republic utilizing artificial intelligence was 5.9% (Statista, 2023).

The digital institution Projector AI Lab, made a survey among employees of 150 Ukrainian companies (10 to 1500 people employed) to find out how Ukrainian companies are using artificial intelligence. According to the research, fifteen percent of respondents use in-house developed AI while another twenty-four percent of businesses have or plan to develop such services for themselves. Over fifty-five percent of participants either don't plan or do not know about plans regarding AI development in their firms. As indicated by 65% of responses, design is the industry that uses AI the most actively. Copywriters (52%), PR and marketing representatives (49%), team leaders (39%), and engineer-developers (21%), round out the top five. The most AI-used tasks include: writing / editing texts; idea generation; text analysis; drawing images using generative graphic tools; and translation into foreign languages respectively. When it comes to advantages associated with AI, the most popular answers mentioned is increased productivity (44%) and assistance in creative works (18%) (Як використовують ШІ в українських компаніях — дослідження Projector AI Lab 2023) (How AI is used in Ukrainian companies - Projector AI Lab 2023 research).

11.2 Conducted survey

The aim of this chapter is to outline the methodological approach that was followed during this research. The chapter provides information about the participants that is an essential component of the research, and what job positions the participants have. The tools that were used for data collection and the procedures that were followed to gather and administrate the data are also described.

11.3 Methodological Approach

Considering research as a systematic examination to establish, learn, and discover new information, expand, and verify existing knowledge to solve specific problem, the data collection process was designed to serve the purpose of answering below research questions.

To achieve the answers, a mixed-method of both quantitative and qualitative data collection methods were used in this research in order to gain more understating and cause-and- effect relationship between the factors..

11.4 Qualitative method

The qualitative method is an essential segment of this research. The research conducted in Ukraine and Czech Republic, via open-ended questions in a survey to have a detailed and understandable view the potential effect of technology on it as was mentioned in the previous chapters.

11.5 Quantitative method

Along with the qualitative method, quantitative data collection method was used in this research for the purpose of supporting the qualitative information collected and to reach out to the most possible accurate results and conclusions. In this research, both questionnaire and experiment were used to collect the information which later was coded and analysed by using Microsoft Excel and SPSS Software.

11.6 Population

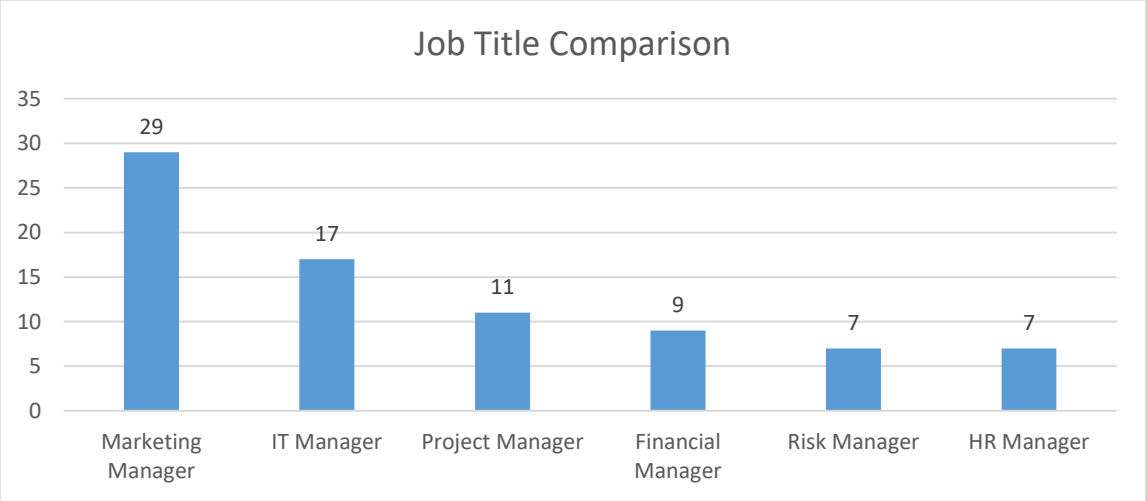
In the process of conducting this research, a series of interviews and questionnaires were conducted across a selection of companies in both Ukraine and the Czech Republic.

The study’s population was composed of 80 employees who are engaged in different roles within these companies. A questionnaire was prepared in order to have a clearer vision from

company employees' point of view. In the questionnaire, both open and closed-ended questions were asked.

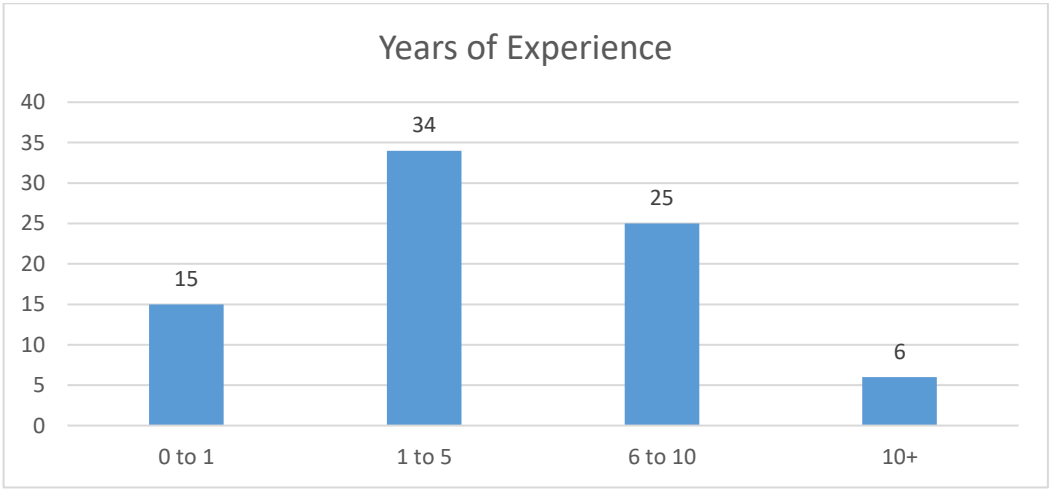
11.7 The overview of the participants responds:

Figure 12. Job Title Comparison Source: The Author



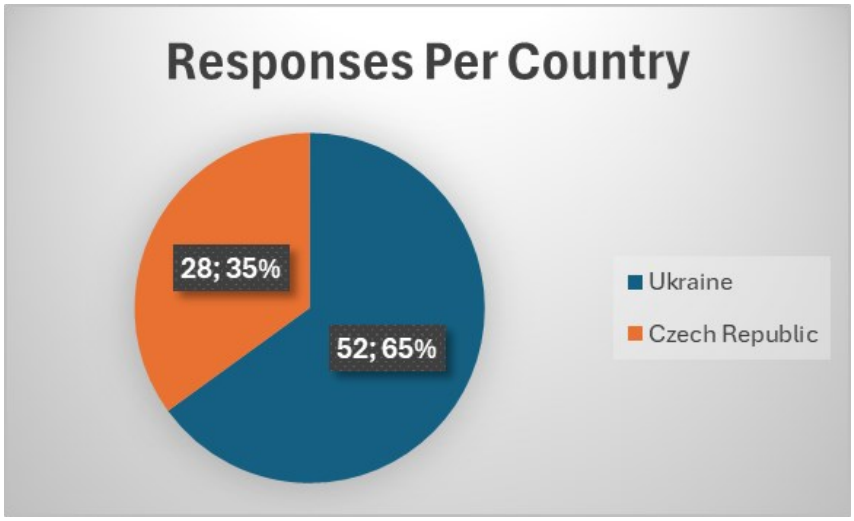
The most common role was Marketing Manager, with 29 respondets holding that title. Other popular titles include 17 IT Managers, 11 Project Managers, 9 Financial Managers, 7 Risk Managers, 7 HR Managers.

Figure 13. Years of Experience Source: The Author



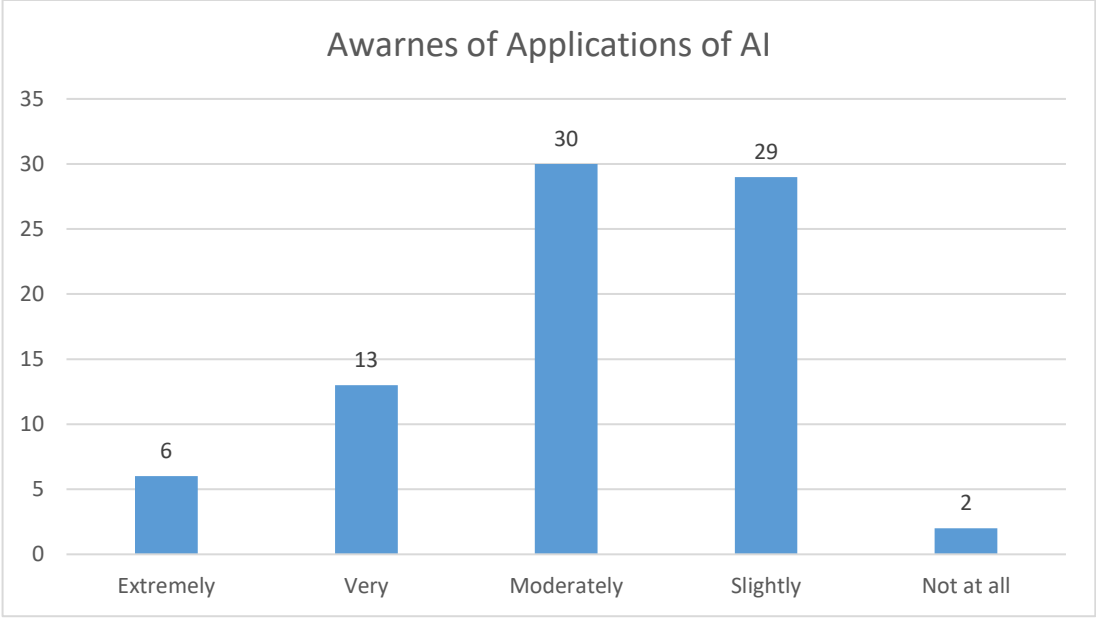
Regarding the distribution of years of experience among respondents,. Within the 0 to 1-year range we had 15 respondents, on the 1 to 5 years bracket, there are 34 employees, in the 6 to 10 years category there are 25 employees. Lastly, the 10+ years category comprises only 6 employees, representing individuals with extensive experience.

Figure 14.Responses per country. Source: The Author



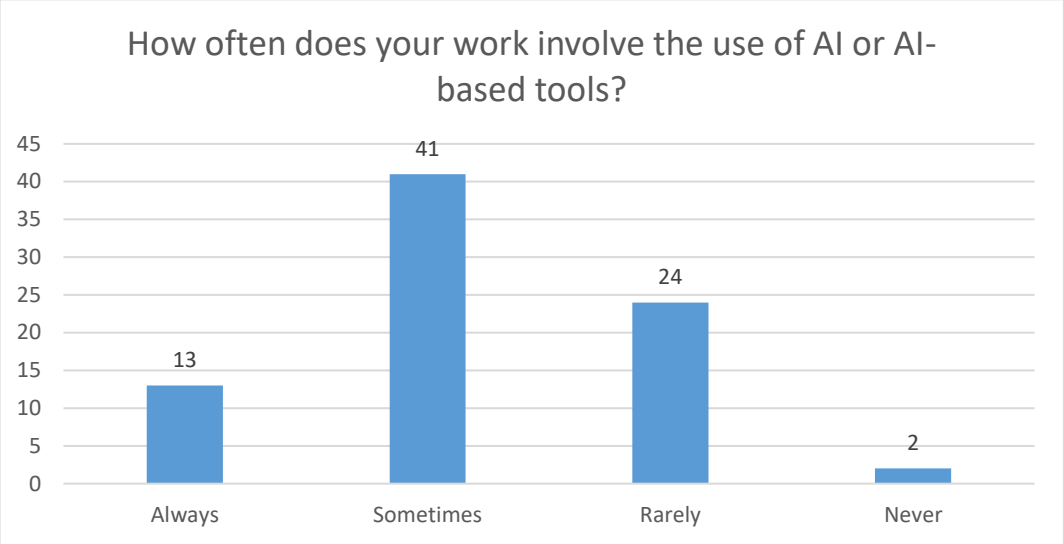
The responses were divided by Ukraine in the number of 52 and Czech Republic with 35 responses.

Figure 15. Awarnes of Applications of AI. Source: The Author



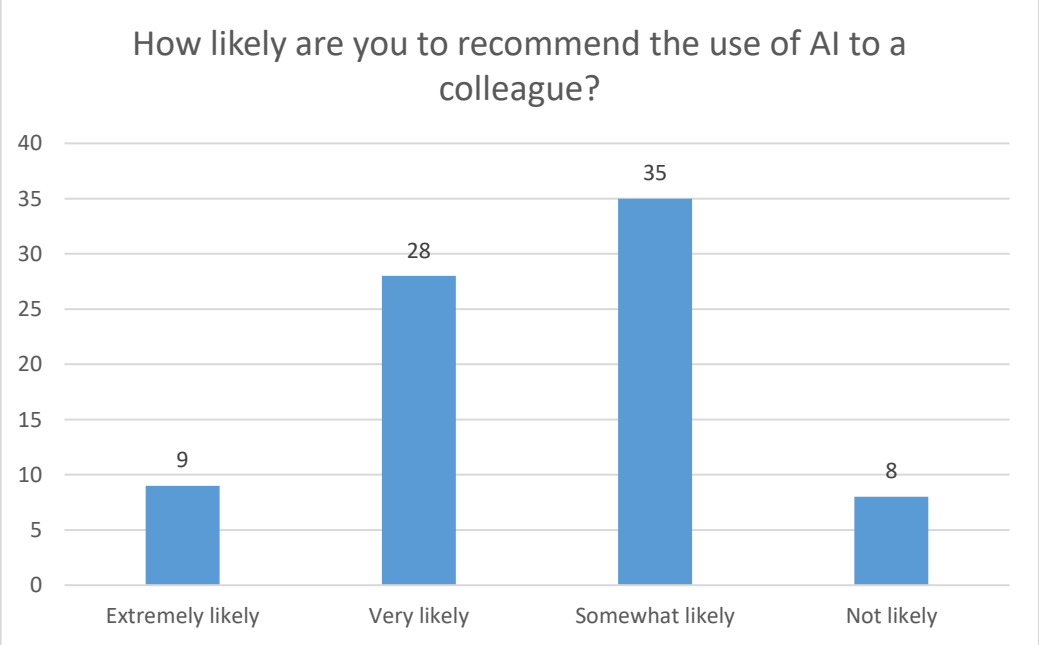
The chart illustrates the distribution of awareness levels regarding applications of AI in economics among respondents. Among the respondents, 6 individuals reported being extremely aware of AI applications, while l3 employees reported being very aware. A larger proportion, consisting of 30 and 29 respondents, indicated a moderate and slight level of awareness respectively, 2 respondents, indicated that they were not aware of AI applications.

Figure 16. How often does your work involve the use of AI or AI-based tools? Source: The Author



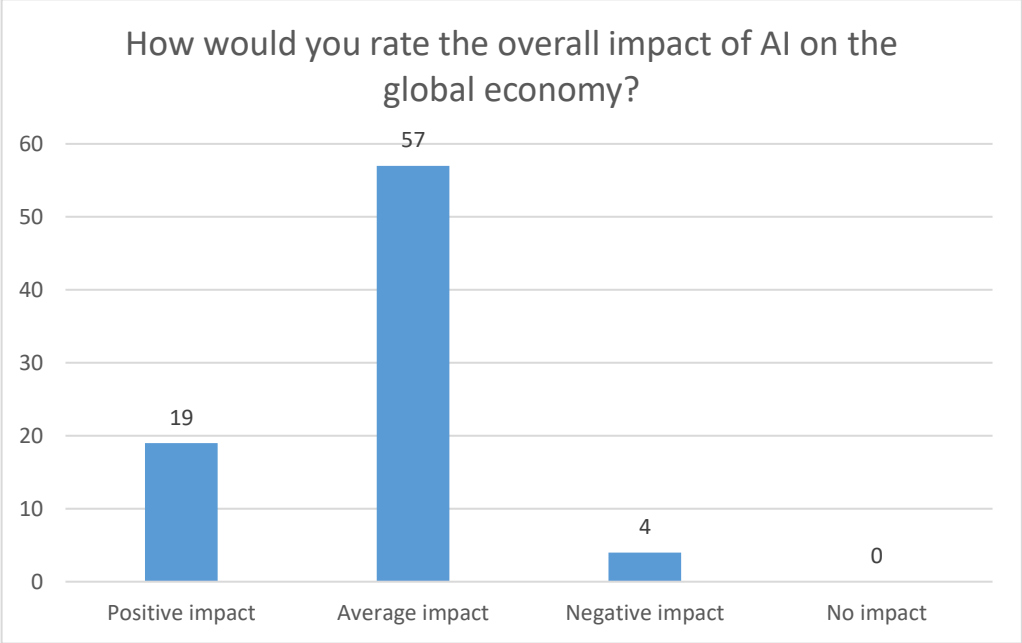
As for the frequency of using AI tools, 13 people said they always use AI tools, while 41 use them occasionally. 24 said they rarely do, and 2 said they never use AI in their work.

Figure 17. How likely are you to recommend the use of AI to a colleague? Source: The Author



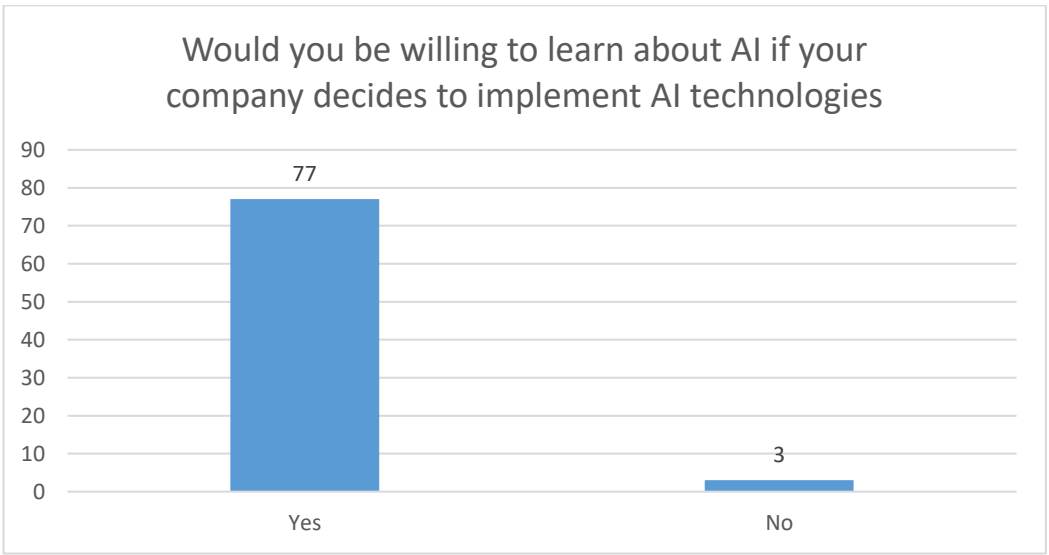
When asked about whether or not employee would recommend AI to colleagues, the highest number of people (35) expressed a somewhat likely inclination. 9 were extremely likely to recommend it, very likely recommendation got 28 people and 8 were not likely to recommend it.

Figure 18. How would you rate the overall impact of AI on the global economy? Source: The Author



When asked about the opinions on the overall impact of AI on the global economy, the largest group (57) felt that the impact is neither positive negative, rating it as average. 19 people evaluated AI impact as positive, but 4 respondents think that the influence is negative. Notably, no respondent thinks that AI doesn't have impact on economy.

Figure 19.Would you be willing to learn about AI if your company decides to implement AI technologies? Source: The Author



Regarding willingness to learn about companies' implementation plans of AI technologies, Almost every employee indicated a willingness to learn more (77), the rest 3 declined.

Qualitative questions:

Table 3. Qualitative questions. Source: The Author

Question	Summary of Responses
1. Has AI impacted your work? Please explain briefly.	In response to this question, participants shared their experiences with AI in their professional roles. Workers explained that AI-powered software has made her job easier by handling some tasks, allowing to focus more on more complicated tasks. They highlighted how AI has improved accuracy and efficiency in tasks. Some expressed concerns about job security due to increasing automation
2. In your opinion, how can AI help in improving the economics?	Participants reflected on the transformative potential of AI in enhancing economic analysis and decision-making processes, AI's ability to process vast amounts of data rapidly, enabling more comprehensive and timely insights into their work. However, experienced workers cautioned against overreliance on AI, highlighting the importance of human judgment and ethical considerations in decision-making
3. What concerns do you have toward implementing AI?	Participants articulated a range of concerns and considerations surrounding the implementation of AI. People expressed apprehensions about the potential for job displacement, stressing the importance of providing retraining and upskilling opportunities for employees to adapt to evolving roles. Employees highligted the importance of balancing innovation with ethical considerations and human well-being.

11.8 Survey fundings

The findings of the survey demonstrate that AI has had significant impacts on the work environments of respondents, with benefits such as task streamlining and improved effectiveness. Respondents recognized that AI could improve work environment. Interestingly, opinions on the overall impact of AI on the global economy varied, with a majority perceiving it as having an average impact, while some viewed it positively and a few saw it negatively. Notably, no respondents believed that AI has no impact on the economy. Occasional use of AI tools was reported by majority participants and much fewer said they used them regularly or rarely. Nonetheless, some respondents warned against relying too heavily on artificial intelligence and emphasized human judgment and ethical considerations in decision making.

However, there were also concerns about job security due to automation which mean that AI integration should be carefully managed in workplaces. There were also calls to strike a balance between innovation and ethical considerations for promoting human well-being. These perspectives help underscore how adopting AI must be done thoughtfully considering societal implications or ethical issues.

Finally, concerning their willingness to learn more about implementing Al in their companies, almost all participants expressed their readiness to know about Al technologies hence displaying a positive perception towards its inclusion into offices as well.

12. FURTHER DISCUSSION AND POLICY RECOMMENDATIONS

As it was mentioned in the Theory part, traditional tools such as GDP and simple measures of productivity are inadequate at capturing the details surrounding AI technological revolution. This can underestimate the real worth of AI capital and its contributions to increasing productivity. If we are not applying accurate measurements for intangible assets due to AI investment, then total GDP and productivity may be under-estimated. Therefore, less measured productivity growth may occur even if true productivity is rising. As a core requirement, there is a need to update economic measurement tools that can capture accurately how AI together with its complements impacts productivity.

Data analytics coupled with machine learning algorithms may be used to assess the impact of AI on labor productivity, process efficiency and innovation. With the help of advanced data analysis techniques applied to this domain, economists and policy makers can obtain a more complete picture of how productivity growth is influenced by AI, which in turn will enable them make decisions about its optimization (Syverson, 2019).

Additionally, the company-level data enables us to zoom in on the specific impacts of AI adoption within firms, which reveal productivity gains, job changes and shifting business models. Multifactor productivity (MFP) moves beyond simple output per worker by taking into account the combined influence of capital, labour and intangible inputs such as AI on growth. Moreover, including wellbeing indicators such as income inequality and job satisfaction gives a more holistic view of how AI is impacting society. Other possible metrics could be AI R&D spendings, patent filings, and business process optimization metrics derived from the successful implementation of AI. Finally, qualitative research offers insights into the personal side of AI use.

These tools combined will enable us to go past limitations imposed by traditional metrics to gain more comprehensive understanding about how artificial intelligence affects productivity or society generally. The future needs not only assessing change but developing new measurement systems targeting at capturing peculiarities of this transformative technology. It is therefore important that AI does not benefit a few people but is for everyone so that we can walk a sustainable path for intelligent machines' era.

Incorporating artificial intelligence within economic and governance mechanisms will lead to enhanced decision making procedures, thereby improving effectiveness, and transparency within public administration systems. Smart regulation, digital infrastructure investment, and data-driven innovation promotion can enable countries to use AI as a transformative tool

that will improve economic efficiency, achieve inclusive growth for all, and address current societal problems.

12.1 Investing in AI research and development

I would reccomend governments to put budget for AI research and development in a priority. This assessment should guide decisions as to when public funding for research and development should be directed at creating capabilities in AI technologies. While the best strategy for creating such capabilities can vary widely depending on circumstances, in general, it involves a combination of funding for basic research, public-private partnerships for development of pre-competitive technologies, and targeted funding for creation of specific capabilities usually by SMEs. This model has worked well in the past for various technologies in medical and defense industries, and for newer information technologies. For technologies that are highly capital-intensive and require access to specialized human resources, such as genetic engineering, it is often also necessary to provide industry with incentives to maintain domestic activity in the form of fiscal measures and market interventions. Consideration should be given to such strategies as AI becomes increasingly significant in biotechnology, and more recently nanotechnology.

In the short history of AI, we have seen bursts of activity and interest driven by rapid progress in one or more of the sub-fields of AI. The creation of new powerful technologies, such as interactive dynamic media or intelligent agents with sophisticated learning and planning capabilities, often spawns new commercial products and services. These in turn create new markets and industries. For example, developments in the technologies underlying e-commerce will lead to the creation of many new businesses whose competitive advantage will be based on intelligent agents that assist in complex purchasing decisions. The resulting changes in the economy and job market have a profound impact on national welfare and standard of living. Given the significance of these changes, it is important for countries to monitor the progress of AI and relevant developments in other countries, to assess when a new technology is becoming economically strategic, and therefore when national interest considerations should shift from encouraging use of the technology in question to active promotion of the creation of domestic capabilities in that technology.

The potential benefits and spillovers from AI are likely to be substantial, but there is a great deal of uncertainty about how they will be realised. Private sector investment in basic

research is likely to be thin as returns are hard to appropriate, so there may be a case for government to be involved in the funding of frontier research. Collaboration with the private sector in fields such as data analytics may be more fruitful. Public funding could be additionally incentivised by the creation of research councils earmarked for AI research, or through funding of AI-focused public-private partnerships. This will also simultaneously increase the quality of AI research in academia, which has potential on its own to raise productivity. Given the rapid international growth in AI capabilities, this is also an area where there could be substantial benefit from international knowledge sharing and collaboration.

12.2 Developing AI strategies and frameworks

Firstly, governments considering AI as a potential source of growth and efficiency should carefully assess the possible spillover effects and attempt to create a conducive environment for development and uptake of AI. As we know, Czechia and Ukraine have their own AI strategies. Hovever, alternative or additional strategies and policy mixes may be called for in different sectors and industries. While AI technologies are highly general purpose, the path to realizing their potential will vary and effective targeting of resources will be important. The presence of big data, increased computer power and global connectivity has lowered the cost of developing and deploying AI technologies, and this has expanded the range of actors who are conducting research and developing AI. Public funding both upstream, in the development of AI enabling technologies, and downstream in AI application, has an important role to play. Development and testing of AI technologies tends to be highly interactive involving clusters of activity and intense flows of tacit knowledge. Creating critical masses of activity in key areas of technology will be important to leverage private sector investment. The objective should not be to pick winners, but to encourage experimentation and learning that can facilitate the adoption of AI in the public and private sectors. Public procurement of AI can act as a major pull through for the development and testing of AI technologies and has the advantage of creating improvements in public service delivery. This may need an adaptation of procurement regulations to enable more risk taking and experimentation and a build up of in-house AI and data science skill sets.

Artificial intelligence is expected to be highly transformative in many industries; therefore, it is imperative for businesses and public sector organisations to develop a strategy to identify where AI can be usefully deployed and to create a roadmap for implementation.
The Deloitte article highlights the importance of modernizing data infrastructure, effective data integration, and building a data-centric culture to avoid confusion and bias in AI applications (Challenges of Using Artificial Intelligence, 2022). Their three-step strategy aims to improve data literacy, effective implementation, and measure business impact. Organizations face problems related to immature data management capabilities, which leads to the failure of AI programs. Integrating data and AI meets business needs, creating value and enabling real-time decision making. The lack of integrated data hinders the realization of benefits and increases the costs of data preparation. A data-driven culture is essential to reduce risk and modeling errors. Creating such a culture, improving the data delivery system, and improving business efficiency through constant access to data are key factors in successful transformation and value creation (Challenges of Using Artificial Intelligence, 2022).
The integration of data and AI emerges as a critical solution to this challenge for both Czechia and Ukraine. Enabling organizations to leverage data effectively facilitates value creation and empowers real-time decision-making processes. Nevertheless, non-integrated data proves a major block to AI benefits and increases data preparation expenses. Therefore, countries should develop a culture that is driven by data to minimize modeling errors, mitigate risks, and at the same time encourage innovation and growth. Additionally, more grants, tax breaks as well as funding opportunities are some of the incentives governments could offer for encouraging research works on artificial intelligence at their initial stage or/and supporting startups specialized in this field. Through fostering vibrant ecosystems for innovation around artificial intelligence.

12.3 Enhancing education and skills development for AI workforce

To educate the people at large, making AI skills available to people already in the workforce who might consider a career change or further training, there needs to be provision of continuing education programs. Here, short courses and distance education would be the best way to provide the necessary skills in a flexible manner. This would also be enticing for people in countries with developing economies, who could see it as a path for better integration into global AI research and development.

One major factor in the ability to enhance education and skills development is the provision of information to guide careers. Educational institutions, industry, and students themselves need relevant information in order to make informed decisions about what and where to study, and what types of jobs to look for and apply. For AI development and implementation to be considered as a potential career opportunity, it needs to be widely known and understood for the prospects and opportunities it may provide. Current perceptions of AI as being a research only task need to be changed in order to attract a wider range of talent, from software development to project management. This therefore requires action in marketing AI as a career, with detailed information on the types of skills and competencies required and what sort of work it would involve.

With AI's increasing relevance in the future, it creates a demand for human skills in the understanding of the AI processes and implementation. Developing specific AI skills in research, development and implementation require talent in the knowledge of computer science, computational engineering, data mining and analysis, and other related fields. Since picking up on these skills usually requires education from higher learning institutions, there is a need to ensure that the relevant fields of study are easily accessible and appealing to students. This high demand for future AI skills means addressing any shortages which could later hinder progress in development and implementation of AI technologies. This would best be handled through the identification of current and future skill needs, awareness of the possibilities that AI development could bring, and the provision of clear career pathways.

AI may also exacerbate income inequality. If its benefits are to specific sectors or those with specialized skills, it could widen the gap between rich and poor. It is increasingly being recognized that not everyone will benefit equally from AI advancements as the technology progresses. Instead, AI advances can disproportionately favor certain sectors or individuals with specialized skills resulting in wider wealth disparities between haves and have-nots. And it applies to both national and international levels, so the situation could have a far reaching socio-economic impact on the Czech Republic and Ukraine too.

The variation in readiness scores relating to Artificial Intelligence (AI) between Czech Republic and Ukraine might be caused by factors like financial assistance or investments made by European Union. In such a manner, AI adoption and best practices exchange, collaboration, knowledge sharing between Czechia, Ukraine and any other international partners can bring lots of benefits. For example, it may involve establishing coalitions between agencies with research branches in universities, industry players and the

governments to work together on artificial intelligence projects or share data, know-how and synergize their strengths in AI research and development.

Making public aware about AI will give them better understanding of its prospects and challenges. Both countries could launch public education campaigns, organize seminars, workshops and forums that promote AI literacy among citizens, and engaging stakeholders into discussions about social implications of adopting AI technology. Governments have had to ensure that such systems comply with fairness principles, transparency standards as well as accountability norms by subjecting them to human review. By creating an informed citizenry that is involved in the process, Czechia and Ukraine can make sure that their AI policies are aligned with people's values and aspirations.

CONCLUSION

Different studies offer different perspectives regarding how AI affects labor markets. Nevertheless, there is a majority agreement that its impact is balanced – some jobs get destroyed by AI while others are created by it at the same time. There are concerns about automating jobs in sectors such as manufacturing, transportation or retail which might lead to unemployment among workers. As routine tasks become automated, the value of human skills such as logical reasoning, problem-solving, and creativity will increase, emphasizing the need for educational systems to evolve and prioritize STEM skills. If people do not have access to re-skilling opportunities then prolonged unemployment can result leading into social unrest thus widening already existing societal inequalities. On the other hand , history reveals that technology advancement always has directed themselves towards creating new opportunities only with temporary disruptions. Nonetheless, Czechia, being a highly manufacturing country showcases only the beneficial use of AI with examples like Skoda

Understanding Ukraine and Czech Republic's unique approaches to developing AI is crucial in evaluating of artificial intelligence for enhancing economic efficiency.

In Czech Republic where there are big industries like automotive manufacturing and technology adoption of AI could result into efficient production processes including predictive maintenance among others. On the other hand in Ukraine which has a booming IT industry with rich engineering talent pool various AI applications might contribute towards digital transformation quickening economic growth and encouraging entrepreneurial behavior.

In Czech Republic where population ageing along with demographic shift has raised concerns about labor supply trends for future workforce automation driven by AI can help address labor shortages while increasing competitiveness of domestic industries. In Ukraine political instability coupled with inadequate infrastructure hindered economic development since independence but acceleration of digital revolution using AI offers opportunities to jump traditional hurdles thereby modernizing agriculture energy logistics etc. Both countries can become global leaders in Artificial Intelligence through investment into Artificial Intelligence research & development (R&D), promoting digital skills training, fostering public-private partnership collaborations aimed at nurturing an environment that supports its use.

In order to ensure that their workforce can thrive in an AI-driven economy, both Czechia and Ukraine could undertake initiatives targeting worker upskilling and reskilling. To this end, education institutions should collaborate with government agencies and private sector entities so as to create training programs matching ever-evolving demands of a digital economy.

Overall, successful implementation and value creation with respect to AI is a journey that covers various aspects such as technological advances, cultural change and organizational preparedness. In conclusion, by embracing innovation, investing in education and skills development, and fostering cross-sector collaboration, Ukraine and Czech Republic can position themselves as leaders in the global AI landscape, driving sustainable economic growth and societal advancement.

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LIST OF ABBREVIATIONS

4IR - Fourth Industrial Revolution

AI - Artificial Intelligence

AGI - Artificial General Intelligence

AIO&F - Artificial Intelligence Observatory and Forum

EU - European Union

GDP - Gross Domestic Product

HR - Human Resources

LLM - Large Language Model

NAIS - National Artificial Intelligence Strategy

NATO - North Atlantic Treaty Organization

NLQ - Natural Language Querying

OKR - Objectives and Key Results

OSINT - Open-Source Intelligence

R&D - Research and Development

SMEs - Small and Medium-sized Enterprises

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APPENDIX P II: MODEL CODE

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import r2_score
```

```
file_path = '/content/drive/MyDrive/Dataset/Data_Ukraine.csv'

data_ukraine = pd.read_csv(file_path)
```

```
print("Columns:", data_ukraine.columns.tolist())
```

```
data_ukraine['Wages(ann.  var.  %)']  =
pd.to_numeric(data_ukraine['Wages(ann. var. %)'], errors='coerce')
data_ukraine['Unemployment(%  of  active  population,  aop)']  =
pd.to_numeric(data_ukraine['Unemployment(% of active population,
aop)'], errors='coerce')

print(data_ukraine.dtypes)


missing_values = data_ukraine.isnull().sum()

basic_stats = data_ukraine.describe().transpose()

quality_report = pd.DataFrame({
    'Missing Values': missing_values,
}).join(basic_stats.drop(columns=['count', '25%', '50%', '75%']))

print(quality_report)
```

```
X = data_ukraine.drop(['Year', 'GDP(USD bn)', 'GDP per capita(USD)'],
axis=1)
y = data_ukraine['GDP(USD bn)']   'GDP(USD bn)'

X_train,  X_test,  y_train,  y_test  =  train_test_split(X,  y,
test_size=0.2, random_state=42)
```

```
model = LinearRegression()

model.fit(X_train, y_train)

y_pred = model.predict(X_test)

mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)

print("Root Mean Squared Error: {:.3f}".format(rmse))

errors = y_test - y_pred

results_df = pd.DataFrame({'Actual GDP(USD bn)': y_test,
                           'Predicted GDP(USD bn)': y_pred,
                           'Prediction Error': errors})

print("Results Summary:")
print(results_df)
coefficients_rounded  =  np.round(np.concatenate(([model.intercept_],
model.coef_)), 5)

coefficients_df = pd.DataFrame({
    'Feature': ['Intercept'] + list(X_train.columns),
    'Coefficient': coefficients_rounded
})

coefficients_df_sorted                                              =
coefficients_df.reindex(coefficients_df.Coefficient.abs().sort_values
(ascending=False).index)

print("Coefficients in Descending Order:")
print(coefficients_df_sorted)
```

```
coefficients = model.coef_
feature_names = X_train.columns

sorted_indices = np.argsort(np.abs(coefficients))[::-1]
top_10_indices = sorted_indices[:10]

top_10_features = [feature_names[i] for i in top_10_indices]
top_10_coefficients = coefficients[top_10_indices]

plt.figure(figsize=(10, 6))
plt.barh(top_10_features, top_10_coefficients, color='skyblue')
plt.xlabel('Coefficient Value')
```

```
plt.ylabel('Feature')
plt.title('Top 10 Features Affecting GDP Prediction')
plt.gca().invert_yaxis()

for i, coef in enumerate(top_10_coefficients):
    plt.text(coef, i, f'{coef:.3f}', va='center', ha='left')

plt.tight_layout()
plt.show()
```

APPENDIX P II: SURVEY QUESTIONS

Question					
What is your current position?					
How many years of experience do you have in your current field?	0 to 1	1 to 5	6 to 10	10+	
Which country are you currently based in?	Ukraine	Czech Republic			
Are you aware of the applications of AI in your field?	Not at all	Slightly	Moderately	Very	Extremely
How often does your work involve the use of AI or AI-based tools?	Never	Rarely	Sometimes	Always	
How likely are you to recommend the use of AI to a colleague?	Not likely	Somewhat likely	Very likely	Extremely likely	
How would you rate the overall impact of AI on the global economy?	Very poor	Poor	Average	Good	Excellent
Would you be willing to learn about AI if your company decides to implement AI technologies?	Yes	No			
Has AI impacted your work? Please explain briefly					
In your opinion, how can AI help in improving the economics?					
What concerns do you have toward implementing AI?					