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Complementary Competitiveness: Crafting an Employment Policy to Address Technological Unemployment in The Age of Artificial Intelligence

Tamamlayıcı Rekabetçilik: Yapay Zekâ Çağında Teknolojik İşsizlik Problemi ve Bir İstihdam Politikası Önerisi

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Öz

Teknolojik işsizlik, Sanayi Devrimi'nden bu yana tartışılagelen bir konu olmuştur. Son yıllarda bu sorun makine öğrenmesi ve yapay zekâ teknolojilerindeki hızlı ilerlemelerle tekrar gündeme gelmiştir. Fakat, Sanayi Devrimi döneminin aksine, günümüzdeki yapay zekâ kaynaklı işsizlik olgusu farklıdır. Sanayi Devrimi dönemindeki işsizlik, temel ve basit işlerin otomasyonundan kaynaklanıyordu. Fakat, daha önceleri makinelerin becerebileceğinden çok daha karmaşık olan işleri dahi otomatikleştiren yapay zekâ teknolojisiyle birlikte teknolojik işsizlik olgusu daha da karmaşıklaşmıştır. Bu durum, yapay zekâ destekli makinelerin yeni durumlarda öğrenme ve uyum sağlama yeteneğinden kaynaklanmaktadır. Sonuç olarak, bu yeni gelişmeler ışığında, son yüzyılda uygulananlardan farklı bir istihdam politikası ihtiyacı doğmaktadır. Bu çalışmada, "Tamamlayıcı Rekabetçilik" olarak adlandırılan yeni bir politika önerisi geliştirilmiştir. Bu öneri, yapay zekayı sadece olumlu veya olumsuz olarak basit bir şekilde kategorize etmekten kaçınan bir yaklaşım benimsemektedir. Bunun yerine, sektörler arasındaki farklılıklar göz önüne alınırken, firmaların yapay zekâ tercihlerini de dikkate alan ve teknolojik ilerlemeyi destekleyici bir yaklaşım benimsenmiştir. Bu yaklaşım, literatürde sıkça görüldüğü gibi meslekleri ve yetenekleri gerekliliği veya gereksizliği şeklinde sınıflandırmanın ötesine geçerek istihdam politikalarını yapay zekâ çağının evrilen ihtiyaçlarıyla uyumlu hale getirmeyi amaçlar.

Anahtar Kelimeler: Yapay Zekâ, Makine Öğrenmesi, Teknolojik İşsizlik, İstihdam Politikası

Abstract

Technological unemployment has been a concern since the Industrial Revolution. Approximately two centuries later, this issue has reemerged with the rapid advancements in machine learning and artificial intelligence technologies (AI). In contrast to the Industrial Revolution era, the unemployment caused by AI in the present age is different. Unlike earlier times, where unemployment primarily resulted from automating basic manual labor, the current challenge arises from AI automating tasks that were previously considered too complex for machines to handle. This is due to the capacity of AI-powered machines to learn and adapt to new situations. As a result, the evolving job market necessitates a different approach to employment policies compared to those applied over the last century. In this study, a new policy suggestion referred to as "Complementary Competitiveness" is discussed, taking a nuanced stance, avoiding simplistic categorizations of AI as purely beneficial or detrimental. Instead, it concentrates on formulating an employment strategy that distinguishes between sectors, taking into account firms resaons' of AI preferences, all while not impeding technological progress. This approach seeks to align employment policies with the evolving needs of the AI age, which goes beyond the conventional binary classification of professions and competencies as necessary or obsolete as it seen in the literature.

Keywords: Artificial Intelligence, Machine Learning, Technological Unemployment, Employment Policy

Introduction

The concept of "technological unemployment" is used to describe a situation where jobs are replaced by automation and other technological advancements. This topic has generated a lot of discussion and debate among economists, sociologists, and experts in the field. Despite the rapid progress in technology we've seen in recent decades, there is still no clear and definite proof that widespread unemployment is directly caused by technology.

In leading economies like the United States and several other advanced nations, the unemployment rate has generally remained at a low level. Additionally, many industries that heavily use technology have seen an increase in the number of jobs. This happens because technology doesn't just take away some jobs but also helps create new ones and new industries at the same time. However, there have been times when unemployment became a big problem in some countries and at certain times. So, the important question of whether ongoing technological progress will eventually cause a lot of people to be unemployed remains a topic that doesn't have a definite answer yet.

The issue of technological unemployment has been a long-standing concern in industrialized nations. Its historical origins can be traced back to the Industrial Revolution of the 18th and 19th centuries. During this period, the introduction of innovative machinery, such as the steam engine and the cotton gin, led to increased productivity but also resulted in the displacement of workers (Acemoglu and Restrepo, 2018). This perspective has persisted throughout history, and the Luddites of the 19th century provide a notable example. Originating in early 19th-century England, the Luddite movement emerged in response to the replacement of textile workers by new machinery (Stöllinger, 2018).

Some scholars don't believe that technology may cause unemployment. They think that technology usually leads to positive changes in the economy and society. This different opinion is called the Luddite Fallacy, which means having a negative view of technology. In simple terms, it questions the idea that new technologies always bring negative consequences to society, like job loss and economic problems (Danaher, 2017).

In recent years, researchers have become more interested in this topic because of advances in artificial intelligence and automation. These advances have made some people worry about the possibility of losing their jobs. So, even though we're not sure if technology really causes unemployment, a new aspect of the issue has come up. This new aspect is closely linked to the growth of artificial intelligence, which has created new possibilities for the global economy by reducing the need for people in certain jobs and industries.

Based on a study by Frey and Osborne in 2017, almost half of the jobs in the United States are at risk of being taken over by automation soon. Similarly, Autor (2015) argues that automation has caused less demand for certain types of work, especially jobs that involve routine tasks. This change has made workers with problem-solving, adaptability, and creativity skills more valuable. Additionally, the World Economic Forum (WEF) has predicted that by 2022, about 75 million jobs might be replaced by machines, but around 133 million new jobs could be created (WEF, 2018). Some research also suggests that automation and artificial intelligence might not only lead to job loss but also make income inequality worse (Goyal and Aneja, 2020).

As artificial intelligence continues to advance, there is a growing debate among researchers and the public about whether AI might cause a significant increase in unemployment, similar to what happened with machines in the past. However, it's important to understand that there are differences between the possible job losses due to AI and the effects of machines during the industrial revolution.

The age of machinery, which started in the late 18th century, saw a widespread use of machines in factories instead of human workers (Wisman, 2023). This caused a significant number of people to lose their jobs in the manufacturing industry, as machines were faster, cheaper, and more efficient. The primary reason for unemployment during this machine era was the replacement of human labor with machines. Those who were no longer needed had to find new jobs or deal with unemployment (Autor, 2015).

For instance, in the textile industry, there was a significant reduction in the workforce because automated looms

were introduced (Millard, 2017). Similarly, in the agricultural sector, jobs decreased as basic tools like hoes, sickles, and scythes were replaced by horse-powered reapers, harvesters, and plows in the late 19th century. This transition from manual labor continued into the 20th century and eventually led to the use of tractors (Acemoglu and Restrepo, 2018).

The main difference between these two times is how quickly things changed. In the era of machines, the shift to using machines instead of people happened slowly over many decades. Machines slowly took over the work that people used to do. But in the era of artificial intelligence (AI), technology has advanced very fast. Machines have become really good at doing difficult tasks in a short time. This has made people worry that AI might cause many people to lose their jobs much faster than what happened during the era of machines.

During the machine era, job losses were mainly concentrated in the manufacturing sector, where machines replaced human workers in repetitive tasks like weaving and spinning (Acemoglu and Restrepo, 2018). However, the advent of the AI era in the late 20th century introduces a different challenge than the one seen during the Industrial Revolution. Unlike the machine era, AI-driven unemployment arises not only from the automation of basic manual labor but also from automating tasks previously considered too complex for machines to handle. This is because AI-powered machines have the capacity to learn and adapt to new situations. Machine learning systems have wide-ranging applications across various sectors and domains, and they come with built-in mechanisms that enable them to improve their performance independently as new data becomes available over time (Martens and Tolan, 2018). However, in the past, there was a need for someone to program and operate each new machine. In contrast, with artificial intelligence and machine learning today, machines can manage themselves, learn on their own, and update themselves based on changing conditions.

Moreover, in the era of artificial intelligence, unemployment impacts a diverse array of jobs, encompassing both low-skilled tasks like data entry and customer service, and high-skilled professions such as radiology and legal analysis. As a result, job losses have occurred in multiple sectors, including finance, healthcare, and transportation. This increased versatility of AI, enabling it to handle a wider range of tasks, stands as the second and potentially the most substantial distinction between these two periods.

In general, technological unemployment is a complex issue with significant implications for both the economy and society. While we have a fairly good understanding of why technological unemployment happens and what its consequences are, there is an ongoing debate about how to effectively deal with this challenge. This study focuses on technological unemployment in the context of the new AI paradigm. Instead of simplistically discussing whether AI creates or eliminates jobs, this research takes a comprehensive approach to explore various potential outcomes and policy suggestions with consideration of different economic theories and industry-specific economic structures. The primary goal is not just to categorize AI as purely good or bad but to conduct a nuanced analysis of how employment policies can be strategically designed to reduce negative impacts while maximizing the potential positive effects.

This pursuit involves examining not just traditional economic theories but also alternative viewpoints, such as institutional economics, which investigates the impact of power, institutions, and socioeconomic factors on economic outcomes. The perspective of the traditional economic school, which sees competition as a fundamental and necessary aspect for a strong economy, and the viewpoint of the Heterodox schools, which argues for the cooperation of the government in the economy alongside competition, will have different implications. On the other hand, in economies where the government has a significant role in the economy, there is a risk of hindering innovation and creativity, which are crucial for modern economic progress, and this can slow down economic growth. Indeed, in an economic system that relies solely on fierce competition, rapid advancements in the field of artificial intelligence can lead to job losses in certain industries. Conversely, in countries with heavy government control and regulation, it is also apparent that the value added, new job opportunities, and emerging sectors created by artificial intelligence could face disruptions.

In this study, a new concept referred to as "complementary competitiveness" is developed to facilitate the analysis

of a nuanced mechanism for identifying the specific domains in which advancements in artificial intelligence technology should be promoted, rather than adhering to dichotomous paradigms. Additionally, an examination will be conducted on the imperative need for the preservation and enhancement of employment opportunities within distinct sectors by the government. Following this introductory section, the second chapter will delve into a historical analysis of technological employment. Subsequently, the third chapter will comprehensively address the complementary competitiveness approach. In the fourth chapter, conclusions will be presented, and policy recommendations will be articulated.

1. Technological Unemployment

The issue of technological unemployment has been a topic of concern for economists since the Industrial Revolution. With the introduction of machines alongside the Industrial Revolution, discussions regarding the relationship between machines and human employment were initiated. In this section of the study, various approaches to the issue of machine unemployment will first be examined, starting with classical economists. Subsequently, discussions on technological unemployment, particularly those that have been revived with the advent of computer and internet technologies, will be explored in the second subsection closer to the present day.

1.1 Early Views on the Technological Unemployment

Classical economists have traditionally presented a narrow set of views regarding the influence of technological advancements on the labor market. Direct statements concerning the issue did not become more common until the contributions of David Ricardo and Karl Marx. As a result, classical economists often did not explicitly address technological unemployment, but rather focused on technological progress and its broader societal implications, including its impact on different social classes. This section provides a summary of some of the key ideas expressed within this context.

Adam Smith, often considered the father of modern economics and his ideas have been a base to the current body economic thought bot for orthodox and heterodox branches. Probably Adam Smith's most iconic concept that gifted to the science of economics is division of labor. Smith in his book An Inquiry into the Nature and Causes of the Wealth of Nations (1991) wrote that "*the invention of all those machines by which labour is too much facilitated and abridged, seems to have been originally owing to the division of labor.*" (Smith, 1991). In various parts of his book, Smith discusses ideas similar to the passage quoted. He emphasizes that division of labor and specialization, in conjunction with mechanization, can lead to the accomplishment of economic activities with less labor compared to earlier times. Smith also claims that;

"*In consequence of better machinery, of greater dexterity, and of a more proper division and distribution of work, all of which are the natural effects of improvement, a much smaller quantity of labour becomes requisite for executing any particular piece of work; and though, in consequence of the flourishing circumstances of the society*" (Smith, 1991).

Hence, from Smith's statements, it can be inferred that he anticipates that the increased use of machinery, in conjunction with division of labor and specialization, will contribute to the economic well-being of society. Therefore, Smith may view the use of machinery as a key factor contributing to the wealth of nations, as suggested by the title of his book.

Moreover, according to Smith,the more specialized and advanced the economy becomes, the more resources and tools are required to sustain constant employment for the same number of workers, compared to a less developed situation, as it is claimed in the following passage from his book; "*As the division of labour advances, therefore, in order to give constant employment to an equal number of workmen, an equal stock of provisions, and a greater stock of materials and tools than what would have been necessary in a ruder state of things, must be accumulated before-hand*" (Smith, 1991).

Hence, it can be inferred from Smith's viewpoint that machines do not pose a competitive threat to workers. Instead, labor and machines complement each other. This is because increased specialization and division of labor lead to a greater demand for tools, resources, and machines, resulting in both an increase in the total number of workers and the number of machines. While Smith does not explicitly address the concept of technological

unemployment, his overall perspective appears to be optimistic about the role of machines and their contributions to society.

In his earlier ideas, David Ricardo, a well-known classical economist, believed that increased productivity and lower prices, made possible by the use of machines, would benefit all social classes, including laborers. (Hollander, 2019). However, in the third edition of his work "Principles," Ricardo added a chapter titled "On Machinery," where he changed his view and he acknowledged the concept of technological unemployment, recognizing that when technology makes jobs unnecessary, those workers may struggle to find new employment opportunities (Forstater and Murray, 2009).

John Stuart Mill, a student of Ricardo, had different opinions on technological unemployment at different times At first, Mill argued that workers replaced by automation in one sector would easily find equivalent job opportunities in another, but he later changed his stance, recognizing that the introduction and improved efficiency of machinery could actually decrease the total demand for labor (Leontief, 1979). This perspective is most clearly expressed in Mill's own words when he famously stated, "The need for goods does not necessarily mean a need for more workers" (Neisser, 1942).

Karl Marx, a significant figure in classical economics, held a viewpoint similar to Ricardo and Mill regarding the impact of technological advancement on employment, delving extensively into the topic of technological unemployment. However, in contrast to his predecessors, Marx explored the matter more profoundly, focusing on the exploitation of the working class. Marx observes that contrary to the utopian promises of liberation from labor and the assurance of widespread prosperity, machinery has instead resulted in the deprivation of income for a segment of the laboring class and the inhumane exploitation of those who continue to toil within the factory setting (Campa, 2017). Moreover, Marx foresaw that the substantial number of jobless individuals resulting from technological unemployment could potentially lead to uprisings and a revolutionary transformation of the current economic system.

Keynes, the economist who examined the relationship between machines and human employment after all the classical economists mentioned, was the first to clearly define the concept of technological unemployment (Pol and Reveley, 2017). Keynes states that "*We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come – namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour*" Keynes(1930). It's also interesting that Keynes approached the issue of technological unemployment as if none of the previous classical economists had ever addressed it or as if it were an entirely new problem.

Although Keynes (1930) was the first to coin the term technological unemployment and anticipated that it might become more prevalent in the future, he foresaw that automation would result in only a temporary phase of unemployment, seen as a transitional adjustment. In the long term, he predicted that a 15-hour workweek would be sufficient to meet all of society's economic needs and would lead to the resolution of humanity's economic problem.

1.2 Contemporary Views on the Technological Unemployment

Technological unemployment received significant scholarly interest in the classical era. This interest was evident both in direct discussions about the phenomenon and indirectly in conversations about technological progress, mechanization, and their effects on society and the economy. However, this topic has reemerged in modern discussions because of the rapid advancements in computer technologies and artificial intelligence.

Wassily Leontief, one of the early authors to investigate technological unemployment in contemporary times, took a pessimistic perspective. He drew comparisons between the expected displacement of humans by machines in the twenty-first century and the historical shift from horses to automobiles in the twentieth century, a transformation he foresaw (Fiorelli, 2018). However, Leontief noted that the impact of technological progress

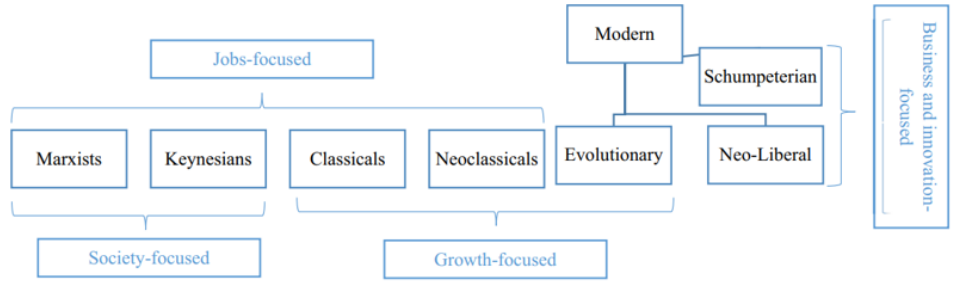
varies across industries and jobs. According to Leontief, the replacement of different types of labor happens at different rates, often beginning with the displacement of less skilled workers, although there are exceptions. Skilled workers are subsequently affected, and the automation of white-collar tasks by computers typically starts with basic cognitive functions and gradually extends to more complex responsibilities (Leontief, 1979).

Another prominent advocate of the idea in the contemporary era that technology gives rise to new industries and job opportunities is the economist, Joseph Schumpeter. In his influential work "Capitalism, Socialism, and Democracy" (2013), Schumpeter argued that technological innovation is the driving force behind economic growth. At the core of Schumpeter's ideas is his famous concept of creative destruction, which emphasizes the crucial role of technological innovation in spurring economic expansion and creating new opportunities in various industries. However, at the same time, this very technological innovation has the potential to render existing industries obsolete, leading to job displacement in those sectors.

A careful analysis of the overall effect, including both job loss and the creation of new job opportunities, reveals that Joseph Schumpeter, despite advocating for innovation and technological progress with his idea of creative destruction, may held a somewhat pessimistic view. Schumpeter argued that the concept of creative destruction introduces complexities in the job market, which can have significant and long-lasting consequences (Feldmann, 2013).

Various economic schools of thought have approached the effects of technological development on society from different perspectives. Some emphasize the impact of technology on employment, while others consider its influence on economic growth more significant and have conducted research in this area. If one desires to comprehensively address all of these theoretical approaches, it may be beneficial to utilize the Figure 1 below, which serves as a useful summary of the approaches presented by various economic schools of thought.

Figure 1: **Diverse Perspectives on Technology** (Gera and Singh,2019).



In addition to all of those theoretical arguments, there have been recent empirical studies that examine the impact of technological development and artificial intelligence on employment. One significant contribution to this discussion is the research conducted by Frey and Osborne (2017). They assessed the possibility of automation in three skill categories: perception and manipulation tasks, creative tasks, and social intelligence. Their analysis showed a surprising finding that 47% of all job positions in the United States are under the threat of being automated.

In a recent academic research, Acemoglu and Restrepo (2020) examined how the increased use of industrial robots affected employment in the United States labor markets between 1990 and 2007. Their study found that for every additional robot per one thousand workers, there was a noticeable decrease in the employment rate, ranging from about 0.18% to 0.34%. Additionally, this technological change was linked to a decrease in wages, ranging from 0.25% to 0.5%.

Similar to the findings of Acemoglu and Restrepo (2020), another study by Aghion, Antonin, and Bunel (2019) explored the consequences of introducing robotics into the labor market in France from 1994 to 2014. Using data from France, they initially observed that the use of robots had a negative impact on overall employment levels, particularly at the level of employment zones. Additionally, the authors noted that people with lower levels of

education experienced a more significant negative effect from the adoption of robotics compared to those with higher levels of education. This highlights the idea that ineffective labor market and educational policies can reduce the positive effects that the introduction of Artificial Intelligence and automation might otherwise have on employment.

Patent applications serve as a critical and valuable dataset for investigations concerning Artificial Intelligence. In this context, Yang (2022) focuses on firm-level patent data from Taiwan's electronics sector between 2002 and 2018. Yang's empirical analysis reveals a positive link between AI technology and improvements in both productivity and employment. What's interesting is that patents not specifically related to AI also have positive effects on productivity and employment, which are similar in magnitude to those associated with AI technology. Additionally, the introduction of AI-driven innovations leads to significant changes in the composition of a company's workforce, with a decrease in the proportion of workers with education levels at or below college.

Besides educational factors, other variables such as gender, can significantly shape the impact of AI on employment, as the effects of AI are not uniformly distributed across society. In this context, Hamaguchi and Kondo (2018) delve into the influence of AI on employment outcomes with a particular focus on gender dynamics. Their investigation centers on the employment susceptibility stemming from emerging technologies, specifically artificial intelligence (AI) and robotics, as inferred from the likelihood of computerization using Japanese employment data. Their research shows that female workers are more vulnerable to being impacted by these technologies compared to male workers. This vulnerability is mainly due to the fact that women are more likely to work in professions that are at higher risk of being automated. This gender-based susceptibility is particularly noticeable in urban areas. The authors suggest that addressing the risks posed by new technologies requires a more nuanced approach beyond just investing in human capital. They argue that policymakers should address deeper structural issues in the job market, such as gender biases affecting career advancement and participation in decision-making roles.

A separate study conducted by Dauth and his colleagues (2017) focused on the manufacturing industry in Germany. Their analysis did not find strong evidence that robots lead to a significant decrease in job opportunities. However, it did show that robots do affect the types of jobs available in the manufacturing sector. According to their findings, for each robot introduced, two jobs in manufacturing were lost. This contributed to almost 23 percent of the overall decline in manufacturing employment in Germany from 1994 to 2014, which amounts to around 275,000 jobs. However, this negative impact is fully offset by an increase in job opportunities in the service sector. Additionally, the research emphasizes that increased use of robots can improve job security for existing workers, but it often comes at the cost of lower wages. This, in turn, results in a smaller portion of the overall income generated from labor in the economy.

While most of the previous research has mainly focused on individual countries, a specific study conducted by Georgieff and Hyee(2021) looked into this issue across 23 OECD nations. Their findings, covering the period from 2012 to 2019, show that employment increased across a range of different jobs. In their comprehensive analysis, they found no clear connection between how much a job was exposed to artificial intelligence (AI) and the direction in which employment was growing. However, in professions where computers were heavily used, they observed a stronger link between encountering AI and higher rates of job growth. On the other hand, in occupations where computer use was limited, they noticed a negative relationship between exposure to AI and an increase in the average number of work hours.

In summary, there are relatively few studies that specifically address the impact of artificial intelligence on employment. However, there is a variety of other studies that examine how the use of robots and automation affects the job market. Both theoretical arguments and empirical studies have produced mixed results. Some argue that these technological advances have a negative impact on employment, some argue for a neutral effect, and others even suggest a positive effect on job opportunities.

For instance, a study by Dauth and his colleagues (2017) found neutral results, concluding that while employment

increased in certain sectors, it declined in others due to the influence of artificial intelligence and robots. Therefore, even in a positive scenario, it's important to have a strong policy framework in place to support workers in the disadvantaged sectors and occupations.

This is because the proposed solution of retraining individuals who have lost their jobs in specific sectors through training and skill development can be challenging, particularly for those who were previously employed in manual and uncomplicated jobs. Furthermore, even if successful, the extended retraining process may result in longer periods of unemployment. For this reason, the next section explains a complementary competitiveness approach and the related policy framework.

2. Complementary Competitiveness

The debate on whether advancements in artificial intelligence and automation will lead to increased global unemployment has been ongoing for many years. Yet, it is essential to consider this question in the context of the existing socio-economic framework before evaluating whether AI technologies present a threat to employment. Traditional economic theories have often overlooked the significance of the socio-economic structure in their fundamental principles. However, it is unrealistic to analyze an economic system and its policy framework without taking into account the underlying social structure, institutions, and political context.

In alignment with this perspective, one of the principal criticisms directed at mainstream economics pertains to its reliance on a narrow and unrealistic portrayal of human behavior. This portrayal presupposes that economic agents are rational, self-interested actors whose decisions are solely motivated by economic considerations (Vatn, 2005). However, numerous studies have shown that human behavior is influenced by a wide range of factors, including, institutions, emotions, social norms, and cultural values, and is much more complex than the rational model of behavior assumes (Keefer and Knack, 2005; Hodgson, 2007). Therefore, claimed problem with the mainstream economic theory is that it ignores the role of power and institutions and other socieconomic factors on economic outcomes. This results in a distorted understanding of the economy and a failure to address the root causes of economic inequality and injustice. Moreover, mainstream economic theory overlooks the impact of culture and values on economic behavior and its impact on the economies (Hodgson, 2007).

Consequently, the mainstream economic perspective that has been established within the framework of economic understanding is deemed scientifically rigorous (Henry, 2008). Whereas policies that are formulated within the context of social norms, institutions, and goals are generally deemed to be normative. Mainstream economic thought, as embodied by the laissez-faire approach, regards a pure free market economy as scientifically sound, and advocates for such policies globally (Henry, 2008). Moreover, it is posited that any policy interventions or regulations aimed at addressing social and economic issues, such as unemployment, would not only be ineffective but also detrimental to the functioning of the economic system**.**

When examined within the context of mainstream economic thought, technology is subject to the observation of various different approaches. These perspectives can be broadly classified into two distinct frameworks that essentially categorize technology as either endogneous, exogenous, or somewhere in between. In exogenous models, technology is seen as a result of unintentional effects stemming from the overall technological environment, whereas in endogenous models, it is regarded as an outcome of intentional investments made by entrepreneurs to build and gather knowledge with the goal of maximizing their profits (Jimenez, 2019).

Technology, in contrast, does not function solely as a neutral force or a tool entirely under the control of business owners for profit maximization, but rather it is shaped by political and social concepts and technological arrangements are not determined by technical component alone, but by the political and social and context in which they are advanced and executed. Technology, therefore, can serve to different purposes and that it is essential to examine the social reflections of technological advancement. Furthermore, it is possible to control and guide technological developments to address societal issues like unemployment through collective societal consensus. Utilizing socially determined values, it becomes possible to delineate and formulate fundamental attributes of technologies, underpinned by the recognition that technologies are inherently imbued with values

rather than being impartial entities, correspondingly, values can similarly function as guiding tenets for design and as inherent traits of institutions (Flanagan, Howe, and Nissenbaum 2008; and Winner, 1980, as cited in, Milchram, et. al., 2019).

Therefore, institutions regarding the technology can be articulated as a manifestation of societal consensus and emerging values in line with the goals that societies aim to achieve; economically speaking, the most pivotal questions posed by this ensemble of values can be fundamentally categorized into three groups throughout human history. These inquiries have predominantly revolved around what should be produced, how it should be produced, and how the produced should be distributed. The matters of what to produce and how to produce are contingent upon the technological level within societies, while the distribution of the produced is determined by social consensus or top-down rules (Zafirovski, 2000; Jackson, 2015). However, in line with the mainstream economic school of thought, it is argued that the allocation of shares to different social classes from the produced output is determined by the marginal contribution each factor provides to production (Colander, 1996; Ekelund and Hébert, 2002). Thereby making the level of technology that determines the productivity of labor crucial in this context. As a result, an increase in the level of technology will enhance labor productivity, thereby indicating that labor income is likely to increase automatically in the long run. Therefore, the level of employment and labor share are regarded purely as technological elements, detached from the influence of the social, cultural, and institutional context.

In the realm of institutional economics, a branch of heterodox economics, there is a significant emphasis on exploring the connection between the socio-economic structure and technological progress, especially in relation to unemployment rates and the labor share in overall production. Within this theoretical framework, the process of technological advancement is seen as a gradual and complex transformation influenced by various societal components and distinct sets of values. These values are categorized into ceremonial and instrumental values.

Ceremonial values are legitimized by the cultural norms and traditions that integrate hierarchical positions and divisive differentiations regarding the inherent "value" of different individuals or societal groups, serving to rationalize prevailing power dynamics and established patterns of authority; in contrast, instrumental values gain validation through the methodical utilization of knowledge, scientific investigation, and technological advancement in the process of problem solving (Bush, 1983).

Hence, within this particular strand of thought, technology is not merely limited to the enhancement of machinery and tools for the purpose of producing more and better goods and services; it also encompasses the utilization of knowledge in the endeavor of addressing challenges and according to Bush's perspective, the implementation of technologies can be driven by motives of safeguarding vested interests rather than being oriented towards the resolution of societal issues (Lacasa, 2014). In such instances, the adoption and dissemination of technologies are not primarily focused on addressing a social concern within a particular community, but rather on effectively accommodating the cultural norms and values of that community, which in turn uphold the established power dynamics (Lacasa, 2014).

The collision of these two sets of values gives rise to the acceptance and applicability of new technological developments within society to a certain degree, a consequence referred to as Ceremonial Encapsulation, which was best articulated by Bush; the institutional structure will embrace new technology as long as its implementation aligns with the prevailing pattern of ceremonial authority within the institution, and modifications in behavior necessitated by the new technology will only be allowed if they can be integrated into the existing framework of ceremonial dominance (Waller, 1987).

In the context of ceremonial values, although it cannot be predicted whether technological advancements will overall create unemployment, it is assumed that sector-specific unemployment scenarios may arise. Within this ceremonial value structure, developments in sectors where technology, especially artificial intelligence, is heavily utilized may not necessarily contribute to improving societal welfare in an instrumental value context, as mentioned by Bush(1983). Instead, they could be driven by motives to protect vested interests and increase profits,

regardless of potential unemployment problem. Hence, if technological advancements like artificial intelligence, which are anticipated to have a positive impact on society, inadvertently worsen significant issues like unemployment, it is plausible to consider that employment policies formed through societal agreement could potentially offer a solution to the unemployment problem without impeding these technological developments.

At this juncture, there exist some plausible approaches that can be pursued. The first involves implementing measures such as basic income guarantee with an instrumental approach to preempt vested interests and address the unemployment that technological advancements might generate. Nevertheless, we have yet to witness the highly optimistic outcomes once expressed by Keynes (1930), who predicted that humanity's economic problems would be solved indefinitely. Since, in his work, Economic Possibilities for our Grandchildren, Keynes (1930) foresaw that while automatization might cause a brief period of unemployment, characterized as a transitory phase of adaptation, in the long run it would mark the first instance in human history where the human's economic challenges would be resolved. He anticipated that a 15-hour workweek would prove ample to address all of society's economic requirements. Likewise, economist Jeremy Rifkin contends in his work "The End of Work" that technological progress will usher in a "post-work" society, characterized by widespread unemployment, wherein government guaranteed income may provide support to the majority of the population (Rifkin, 1995).

The past century has demonstrated that neither has the reduction of weekly working hours to 15, as envisaged by Keynes, materialized nor has labor's share in total GDP been increased. In fact, the worldwide portion of labor income has witnessed a substantial decrease, especially, since the early 1970s and 1980s, and this decline has been evident across the majority of nations and sectors. (Karabarbounis and Neiman, 2014; Autor, et. al., 2020). The decline in the global labor share can be observed in detail in Figure 2. Furthermore, robust implementations of universal basic income or government-guaranteed income have not become widespread. Therefore, while employment policies like basic income guarantee may be recommended as potential solutions, it is observed that such practices have not gained significant popularity.

Figure 2: Global Income Share of Labor (Karabarbounis and Neiman, 2014).

On the other hand, it appears challenging for Employee Training Policies to serve as a solution to the potential unemployment issue that artificial intelligence is likely to create in certain sectors. As articulated by Erik Brynjolfsson and Andrew McAfee (2014) in their influential work The Second Machine Age, the current landscape presents an exceptionally favorable era for workers endowed with specialized skills or possessing appropriate

education, as they can leverage technology to generate and capture value and conversely, it represents an exceedingly unfavorable period for workers who can only offer conventional skills and competencies, as computers, robots, and other digital technologies are rapidly acquiring these very skills and abilities (Autor, 2015). This situation suggests that in the emerging economic landscape where artificial intelligence technologies could prevail, specialized skills or suitable education may become fundamental factors in labor demand.

Hence, assisting individuals who have lost their jobs in low-skilled manual positions due to their lack of advanced skills required in the era of artificial intelligence to move them into emerging job sectors demanding substantial education and experience presents a formidable challenge through training policies. This challenge arises from the fact that the prospects for a successful transition via rigorous training and retraining appear dim for those previously employed in manual and uncomplicated roles. Furthermore, even if success were attainable, the extended retraining process could potentially lead to prolonged unemployment for significant portions of the population. Take, for example, the case of a middle-aged waiter with years of experience in the service sector. If this person were to lose their job due to the introduction of AI-powered robots designed for the restaurant industry, transitioning of this person to fields like programming through training policies might not be a straightforward endeavor.

As a result, traditional employment policies like government-guaranteed income and employee training programs have shown limited effectiveness over the past century or encounter difficulties in addressing the unique issues of technological unemployment, which is distinct from other unemployment types. Consequently, there is a growing need to devise creative employment policies that align with the characteristics of emerging fields such as artificial intelligence and machine learning. This forms the foundational premise for the creation of the "Complementary Competitiveness" policy proposal.

To develop effective employment policies in anticipation of potential technological unemployment in emerging fields like artificial intelligence and machine learning, it is crucial to understand why businesses are adopting artificial intelligence. Existing literature predominantly analyzes how AI affects jobs and industries, considering the characteristics of jobs that may require new skills or jobs could become obsolete due to AI. In contrast, this study investigates the motivations behind employers' decisions to adopt AI. Contrary to common assumptions, companies that embrace AI may not do so solely to increase profits by cutting costs. Rather, they may have various other reasons for doing so.

In many situations, companies choose to use artificial intelligence mainly because of the cost and profit considerations. However, for some other companies, their reasons can be quite different. The table below gives various examples related to these motivations. In some of these cases, artificial intelligence and related technologies can be seen as cost-effective compared to human labor. However, other companies prefer AI not because it's cheaper, but because it complements human workers by adding qualities like stability and security in production, where human workers may have limitations.

Furthermore, it can be observed that supporting artificial intelligence industries in the context of complementariness may also contribute to the economy by increasing the quantity of innovation and value-added products and services in the long term. On the other hand, providing support to competitive professions in the context of Competitiveness could potentially offer a solution to the unemployment problem without impeding the dynamism of the economy and innovation in the relevant sectors.

Table 1: Complementary/Competitiveness Nature of Jobs (TurkStat (2022) and The Author's Contributions)

The Reasons for Companies' Adoption of AI	Nature of Jobs
High labour cost	Competitive
Challenges in recruiting qualified personnel for specific positions	Competitive

Enhancing safety within the enterprise.	Complementary
Ensuring high precision in processes and/or the production of goods and services.	Complementary
Maintaining consistent standards in processes and/or the production of goods and services.	Complementary
Expanding the range of products and services offered by the enterprise.	Complementary
Utilizing tax incentives and other government support mechanisms.	Competitive
Automated Tasks	Competitive
Handling Big Data	Complementary
Client Oriented Product and Service Design	Complementary

This draft classification is not very rigid and can be adapted to different industries and occupational groups. For instance, when labor costs are higher compared to AI, it is desired that government policies implemented in the relevant sectors aim to increase employment. However, it is also expected that these policies do not hinder innovation and dynamism within the sector.

For example, businesses widely use AI to enhance security measures. This is because payment card fraud, which was expected to have a $416 billion economic impact in 2017, serves as a source of funding for terrorism, arms trafficking, and drug-related crimes (Ryman-Tubb, et al., 2018). This threat is exacerbated by the simultaneous emergence of technologies like smartphones, mobile payments, cloud computing, and contactless payments, which have led to an increase in data breaches and the creation of new avenues for fraudulent activities, thereby reducing the effectiveness of traditional detection methods (Ryman-Tubb, et al., 2018).

To address these fraud cases, various artificial intelligence and machine learning techniques are continually being developed and used by businesses and the banking and finance sectors to ensure the security of businesses and customers (Raj, et al., 2011; Alhaddad, 2018; Ryman-Tubb, et al., 2018; Choi and Lee, 2018; Bao, et al., 2022).Furthermore, apart from improving the financial security of businesses, the application of artificial intelligence in the construction and building industry has led to the development of innovative intelligent methods for purposes like fire detection, risk assessment, and fire forecasting (Huang, et al., 2022).

Hence, opting for human labor over artificial intelligence (AI) to improve the security of businesses in these circumstances may not prove highly effective. Labor might not be a suitable substitute for AI within this type of industries. In such scenarios, concentrating AI developments in relevant sectors primarily to boost employment can lead to adverse effects at the micro-level. This includes decreased efficiency and disruptions in production processes within the companies. On a broader scale, it may impede technological progress and innovation processes, thereby curtailing a nation's capacity for value-added production and long-term job opportunities. Nevertheless, as previously mentioned, if labor costs only slightly exceed those of AI, it may be feasible to implement supportive policies promoting the use of labor.

Another example is when companies opt for AI out of necessity due to challenges in recruiting qualified personnel for specific positions, meaning they cannot employ human labor. In this case, a comptetetiveness approach can be taken by implementing the necessary employment policies in the relevant sector to promote the use of labor without impeding technological development, which can create significant employment opportunities. For instance, in any industry facing a shortage of skilled workers, government-supported employee training policies can be provided to encourage the use of labor in these companies instead of AI.

Certain manufacturing processes and the production of goods and services demand precision and consistency that human labor alone may not always achieve. In such cases, labor cannot fully substitute the AI industry. For example, diagnostic applications of AI in healthcare involve using machine learning algorithms to analyze medical images and predict patient outcomes. Shen et al. (2019) conducted a comprehensive review of existing literature, with a particular focus on evaluating the comparative performance of AI systems and human clinicians in the context of disease diagnosis. Their findings revealed that AI's diagnostic performance was on par with that of experienced clinicians and even surpassed that of clinicians with limited experience. As a result, they concluded that the current state of AI development demonstrates diagnostic capabilities comparable to those of medical experts, especially in domains related to image recognition. Therefore, in the future, it may be more beneficial to prioritize artificial intelligence and machine learning technologies in this field rather than increasing healthcare employment, especially if AI continues to improve and achieve error-free disease detection with a high level of accuracy. At this point, labor may not be able to compete with technology effectively. Additionally, in vital sectors like healthcare, implementing complementary policies that enhance service quality might be more important than policies aimed at increasing the labor force, making it a more advantageous approach.

Furthermore, with AI, it becomes possible to expand the range of products and services offered by a business. For example, in the textile industry, where constantly evolving and changing designs are necessary, AI technologies are used in the context of new product development by staying updated with fashion trends and considering customer demands (Thomassey and Zeng, 2018; Noor et al., 2022). This is because AI can generate a variety of unique designs that can differentiate a business in the market. Therefore, supporting the AI industry instead of labor in this context can be advantageous both at the micro and macroeconomic levels.

Moreover, the concepts of competitiveness and complementarity can be evaluated not only concerning the relationship between labor and artificial intelligence but also within the context of market mechanisms. Competitiveness, a fundamental component of standard economic thought, lies at the core of the laissez-faire approach. Studies that assess the impact of artificial intelligence technology on employment predominantly operate within the framework of competitive job markets. Given these conditions, it is reasonable to anticipate that the advancement of artificial intelligence and robotics in markets governed by competitiveness could potentially result in job displacement. This is because, as previously discussed, the adoption of artificial intelligence offers numerous advantages to business owners compared to relying on human labor.

In that perspective Competetiveness Paradigm defines regulation and incentive free fully free market based job market environment that workers have to compete with AI technology in all terms. In contrast, the Complementary Job Market Paradigm encompasses job market conditions that are extensively regulated, controlled, and guided by policymakers to provide workers with job security and to facilitate the integration of human labor and AI and robotic technologies in a complementary work environment. This paradigm may include sector spesific incentives and support mechanism spesifically to the labor incentive sectors.

In the Complementary market scenario, where labor cannot effectively compete with AI technologies, especially in situations demanding high precision, standardization, and security in production, promoting a competitive approach in the labor market can facilitate the advancement of artificial intelligence and related technologies. This can result in both micro and macroeconomic benefits, such as creating higher added value and potential new job opportunities.

Conversely, when labor costs are slightly higher than AI, and firms turn to AI due to challenges in finding qualified workers in the respective sector, labor can serve as an alternative to AI in terms of technical expertise. In such cases, employment policies that encourage labor utilization can be implemented, particularly in sectors where the issues, such as cost differences and the availability of skilled workers, are less costly and easier to address.

However, Atkinson (2018) expressed an important concern about the impact of automation on employment. As automation reduced the need for workers in agriculture, people shifted to jobs in manufacturing. As automation continued, many moved into service-sector employment. However, with the increasing use of robots and artificial

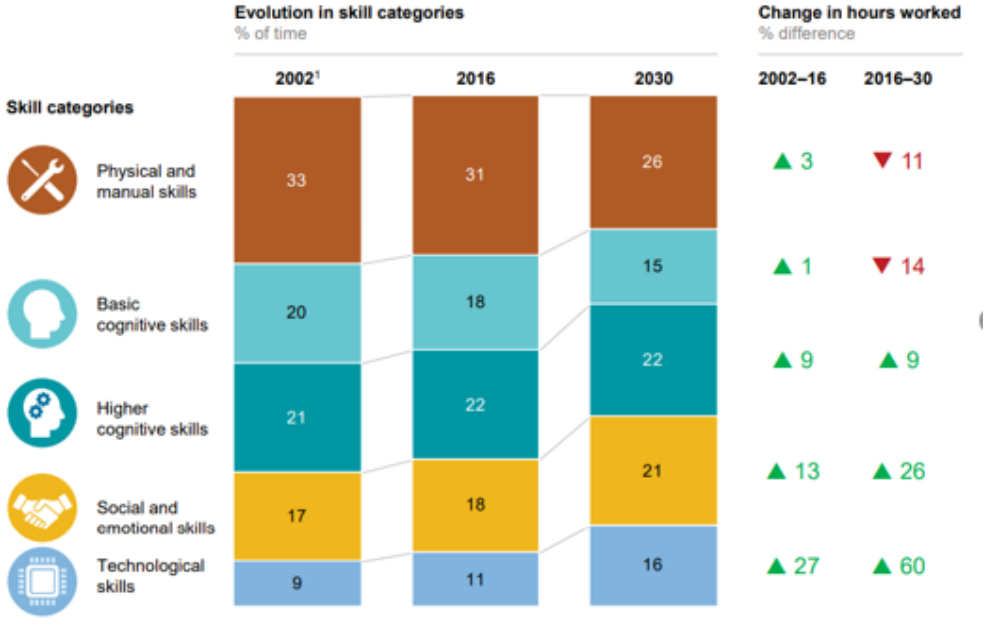
intelligence in the service sector, there might not be new employment sectors available for future transitions (Mutascu, 2021).

Assuming that artificial intelligence and machines are primarily chosen in the service sector due to cost advantages, a solution to this potential unemployment in these sectors can be developed using a competitiveness approach. On the other hand, in industries and agricultural professions where human labor cannot be easily replaced by AI, a complementary approach to open opportunities for artificial intelligence technologies can maximize societal benefits. Hence, if economic policies are to be implemented with the aim of creating jobs, it may be more effective in terms of both employment and economic growth to apply these policies in sectors where labor, due to its higher cost, is less prioritized. It can be labeled the kind of employment conditions that prevail under these market circumstances as a competitive work environment.

Some example of those employment policies might be Life-long learning programs, unemployment benefits, Job Training, sector spesific incentives, governmentally organized employment bureous etc. Another examples might be giving tax incentives to the labor intensive sectors, creating barriers for AI and robotics sectors or creating development plans that prioritizing labor intensive sectors or creating publicly managed or public and privately managed enterprises that is labor intensive, such as in service sectors restorants farms etc.

Furthermore, as indicated in the Figure 3 (Bughin and et. al., 2018) below, there is an estimated increase in demand for jobs falling under the "social and emotional skills" category, which is particularly important for the service sector and labor is more advantageous compared to artificial intelligence and robotics. The forecast suggests a 13% increase in demand during the period from 2002 to 2016, and a more substantial 26% increase from 2016 to 2030 in social and emotional skills. In contrast, a decline or stagnation in demand is expected for other skill categories, except for technological skills. Hence, while implementing state-supported employment policies for the service sector, a focus on jobs requiring social and emotional skills is recommended. At the same time, to foster a workforce equipped with the necessary advanced technological skills, effective employment policies can be formulated through comprehensive training programs for employees.

Figure 3: Skill Demand Evolution (Bughin, et. al., 2018)



In summary, determining whether AI will lead to an increase in unemployment is a challenging question. However, the central concern revolves around whether this new era will contribute to higher GDP and improved income distribution policies. If unemployment rises due to the replacement of jobs that either require skills beyond

human capabilities or jobs where AI generates substantial socio-economic benefits, it can lead to significant economic gains for society. With appropriate income distribution policies, these benefits can be distributed across the entire society.

Additionally, most of the developed and developing nations are already grappling with declining or stagnating populations, which may reduce overall employment demands. Consequently, approaches like universal basic income can be beneficial for society. Nonetheless, if AI threatens jobs in sectors considered competitive and reliant on social and emotional skills, implementing specialized labor-support policies in these sectors could prove beneficial in mitigating unemployment rates.

Conclusion

The history of technological unemployment is a multifaceted subject, encompassing studies and debates spanning from the early 19th century to the present. Some argue that technological progress will enhance productivity and lead to higher wages, while others foresee widespread job displacement and increased income inequality. It is evident that technological advancements have resulted in job displacement in certain sectors but have simultaneously generated new employment opportunities in others.

In contemporary times, the emergence of artificial intelligence technology has introduced a more intricate scenario, differing from the historical narrative of job loss attributed to the adoption of machinery. Beginning in the early 1800s, the era of mechanization initiated the widespread use of machines to replace human labor in factories. Consequently, employment opportunities in the manufacturing sector significantly declined as machines, which were faster and more cost-effective, replaced a substantial portion of the workforce. The primary cause of unemployment during the mechanization era was the substitution of human labor with machinery.

The current use of artificial intelligence and robotics distinguishes itself from past machine employment. These technologies are not limited to speeding up repetitive tasks and reducing costs compared to human labor. While some applications of artificial intelligence aim for cost efficiency, akin to the era of machines, these technologies also function as assistants to human workers. They not only offer cost benefits but also extend into areas that go beyond human capabilities. In this manner, they significantly improve workforce productivity, exemplifying the idea of a complementary job market.

Therefore, it's important for decision-makers to be able to carefully examine and understand the specific job conditions that artificial intelligence creates in the job market. In the job market, decision-makers should take different actions for different industries, considering both how artificial intelligence and human labor work together and how they compete with each other. These actions are needed to avoid widespread unemployment caused by these different market factors.

The identification of viable policy measures must consider the relationship between artificial intelligence and the workforce within the industry of its implementation. In situations where the sole advantage of artificial intelligence over human labor lies in production costs, thereby leading to direct competition with the workforce, policies promoting employment may prove beneficial. Such policies are especially pertinent in contexts where the labor force lacks adequate technical training and education to work in the relevant sector. Conversely, promoting artificial intelligence is of great importance in domains where its application yields substantial social added value, independent of cost advantages, and does not directly compete with human labor. Such policies would be instrumental in bolstering economic growth, dynamism, and elevating societal well-being.

For example, when artificial intelligence and robots are used in risky jobs that offer little job security, or in situations where there's a need for highly standardized and sensitive production processes that human labor can't meet, or in roles involving extensive data analysis that the workforce can't handle alone, or in other areas where AI and robots can boost worker efficiency and effectiveness, such as surgical procedures in healthcare, it's crucial to back the use of AI. While endorsing these sectors and job domains through public policies might result in some unemployment, the substantial value they bring can offset this job loss and enhance overall societal well-being.

When it is reviewed the existing body of knowledge, there is an ongoing discussion regarding the sectors where job opportunities are expected to either rise or fall. Policy recommendations are typically based on the educational qualifications of the unemployed individuals. For example some arguments put forth that individuals with university degrees might experience less disruption from advances in the artificial intelligence field when compared to those with lesser education. The literature also frequently discusses which sectors may experience an increase in unemployment and which ones might see a decrease.

Nonetheless, to create more precise policy suggestions, it is imperative to investigate the specific reasons why

artificial intelligence is favored in particular sectors. Additionally, it is vital to consider the unique interplay of complementary and competitive aspects between human labor and artificial intelligence within each occupational category and within different countries. This comprehensive approach goes beyond merely examining the educational levels of the workforce and sector-based analysis. When conducting such assessments, it is vital to scrutinize the rationale behind companies' decisions to integrate AI and robots. Based on these preferences, policies can be designed to encourage AI adoption in specific sectors while providing support to the labor force in others, aligning with our proposed approach of complementary competitiveness.

Finally, in order to provide insights for future studies in the academic literature, it is vital to investigate the reasons behind companies' preferences for AI in specific sectors and to explore how the cooperation and competition between the workforce and AI and robots interact. This can be accomplished by conducting surveys with companies to examine their labor needs and the qualifications expected from workers, in conjunction with assessing alternative artificial intelligence technologies that may either complement or compete with the required workforce. Additionally, these surveys should investigate the reasons behind firms' choices between AI and human labor for their needs. These surveys and analyses would offer valuable guidance to policymakers in conjunction with the complementary competitiveness approach proposed in this study and help address notable research gaps in the field.

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