DIGITALIZATION
ARTIFICIAL INTELLIGENCE AND SOCIETY

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Content

Mahmut Özer

Prof. Dr. Mahmut Özer graduated from the Department of Electronics and Communication Engineering at Istanbul Technical University (ITU) in 1992. Between 1992 and 1994, he worked as an electronics engineer at Dalaman Airport. From 1994 to 2002, he served as a lecturer at Gaziosmanpaşa University, and from 2002 to 2017, he worked as a faculty member at Zonguldak Bülent Ecevit University.

Özer served as the Rector of Zonguldak Bülent Ecevit University from November 28, 2010, to October 4, 2017. Within the same period, he was also the President of the Interuniversity Council (ÜAK) from August 1, 2015, to August 1, 2016. On October 4, 2017, he was appointed as the President of the Measuring, Selection and Placement Center (ÖSYM) and continued until August 8, 2018. From August 8, 2018, to August 5, 2021, he served as Deputy Minister of National Education. On August 6, 2021, he was appointed as the Minister of National Education, a role he held until June 2023. Özer, who served as the Chair of the Grand National Assembly of Turkey's Committee on National Education, Culture, Youth, and Sports between June 2023 and June 2025, is currently a Member of Parliament representing Ordu.

Özer is the author (or co-author) of several books, including *Quality Assurance in Higher Education* (co-authored, 2010), *Paradigm Shift in Vocational Education* (2020), *Systemic Coherence in Education Policies* (2021), *Conversations on Education* (2021), *Growth and Transformation in Higher Education in Türkiye* (2021), *The Universalization of Education in Türkiye* (2022), *Rethinking Education in Türkiye* (2022), *The Universalization of Education in Türkiye and New Orientations* (2022), *Türkiye's Challenge with Vocational Education* (2023), *The Future of Education in Türkiye* (2023), *Unveiling the Significance of the Recent Educational Transformation in Türkiye* (co-authored, 2024), *Türkiye's Educational Journey* (2024), *and Artificial Intelligence and Society* (2025).

Foreword

The world is undergoing a rapid transformation — in fact, it would be more accurate to say that it is being swept from one transformation into another. With industrialization, all social structures, from education to the economy, were reconfigured. Cities were rebuilt, migration from rural areas to urban areas increased, and metropolises emerged. Life in cities and metropolises continuously evolved, and with the strengthening of the middle class, it became possible to build relatively more egalitarian societies. The meritocracy system compelled all institutions to undergo restructuring. Education, culture, and the arts etc. became massified.

The resources allocated to scientific research have increased more than at any other era in history, leading to rapid and dramatic technological transformations. Each technological shift or breaking point has forced all societal institutions — from the labor market to education — to undergo new transformations. Especially, digitalization, mathematical modeling, and ultimately artificial intelligence have been among the main driving forces of this period. With digitalization, the accumulation of data has led to the emergence of Big Data, and through mathematical models, all areas of life are now being extensively and intricately analyzed, optimized, and projected into the future based on this ever-growing data. There are hardly any fields left untouched by measurement, quantification, and the creation of metrics. In particular, digital social media platforms have restructured — and continue to restructure — the network of social relations.

Digitalization and artificial intelligence (AI), particularly through the widespread adoption of automation, have triggered a new transformation in the labor market. In this process, occupations exposed to automation are gradually disappearing, while new

professions are emerging. The strong collaboration between newly created high-skill job positions and elite education has accelerated the decline of the middle class, which had gained significant advantages during the first phase of meritocracy. During this phase of meritocracy, social classes were roughly grouped into the wealthy, the middle class, and the poor, with the primary inequality occurring between the middle class and the poor. With the spread of automation, in the mutated second phase of meritocracy, the middle class weakened and gravitated toward the poor, forcing society into a polarization between a small number of extremely wealthy individuals and a mass of poor population. Today, inequalities that were unprecedented in history are spreading and deepening across all areas of life.

Today, the current state of AI carries the potential to push this transformation into a very different phase. AI technologies, by further strengthening automation, have the potential to deliver the most devastating blow in finalizing the polarization into a two-class society. Masses are becoming more vulnerable than ever before to a very small number of increasingly monopolized technology companies.

Humanity is now facing extremely difficult challenges. Individuals are living within an ecosystem shaped by technological transformations, one that forces all social institutions — especially the family — into a constant game of reconstruction. If we fail to understand the dynamics of this ever-evolving ecosystem, it will be impossible for us to intervene, to transform it, or even to resist its effects. Therefore, this book represents an attempt to understand the dynamics of this transformation and the ecosystem we live in, with a particular focus on digitalization and AI. Some of the writings in this book are based on my previously published newspaper articles, academic papers, book chapters, or revised and combined versions of these earlier works. Given

the complexity and difficulty of the subject, this book should be seen as a modest attempt rather than a comprehensive study.

With the hope that this book will be of benefit to those who seek to understand our time and the challenges of modern societies.

Finally, I would like to express my gratitude to TRT World Research Center for their support during the publication of this book.

Prof. Dr. Mahmut ÖZER, August 2025

To Prof. Dr. İhsan Fazlıoğlu, who has pioneered a new understanding of the history of Islamic-Turkish philosophy and science in our country, and from whom I have learned so much in this regard...

Glossary & Abbreviations

Artificial Intelligence (AI): the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings (Britannica).

Large Language Model (LLM): a complex mathematical representation of language that is based on very large amounts of data and allows computers to produce language that seems similar to what a human might say (Cambridge Dictionary).

Machine Learning (ML): a branch of AI focused on enabling computers and machines to imitate the way that humans learn, to perform tasks autonomously, and to improve their performance and accuracy through experience and exposure to more data (IBM).

Deep Learning (DL): a type of AI in which computers are designed to work in a similar way to the human brain, repeatedly process huge amounts of data learn to information (Oxford Learner's Dictionaries)

Homo-Digitus

The development of technology today has gained unprecedented momentum compared to previous centuries. Moreover, not only the technological advancements themselves but also the spread of these technologies in human life has accelerated, encompassing almost every aspect of daily life. It has now become quite challenging to sustain life without utilizing technology. In summary, technology has penetrated our lives more than ever before and has expanded its sphere of influence. In particular, the use of social media has started to replace face-to-face communication. As a result, while generational distinctions in the past were primarily related to age, these distinctions are now more closely associated with technological literacy.

Machine learning (ML), deep learning (DL), and AI technologies have become indispensable components of digital platforms. Thanks to these technologies, digital platforms have evolved into structures capable of understanding personal needs and offering tailored solutions for them. The ability to provide personalized solutions and recommendations has elevated technology to an even more indispensable position for individuals. As technology becomes smarter and continuously learns, the human-machine relationship has transitioned to a different phase with an accelerating pace. The smarter technology becomes, the less it allows humans to disconnect to the means of these technologies (go offline). Current transformation almost dictates people spend all their time online. However, what is presented as the natural outcome of a process has gone far beyond being a matter of democratic choice. The possibilities afforded by leveraging billions of personal data and digital footprints have transformed staying online from a choice into a mandatory dependency. To this end, all neurochemical mechanisms of addiction are utilized, and scientific findings are effectively mobilized to achieve this goal.

The increasing data processing capacity of technology, enabling it to offer personalized solutions and recommendations, significantly deepens its sphere of influence by adopting an individualized approach. Through adaptive algorithms, the data of each individual is continuously analyzed, exposing them to specific content and extending their online activity duration. In this way, a mechanism is established that perpetually nurtures individual interest. The strength of this chain can be illustrated as follows: as individuals encounter content they are interested in, their usage time increases; as they use these platforms, data processing mechanisms collect more data about them and provide even more tailored content. This creates a self-reinforcing cycle that continuously feeds itself and deepens technological dependency. As a result, the likelihood of individuals escaping the "personalized" traps designed specifically for them within this cycle becomes increasingly slim.

Possibly, humanity is surrounded by so much helplessness for the first time in history. This situation creates its own paradox: humanity becomes dependent on the very technology it has developed and can no longer detach itself from it. A small minority of individuals and institutions that produce such technologies and collect all human data treat humanity as "experimental subjects." In other words, technology is being used by those who develop and control it as a tool to manipulate human behavior. Humanity itself has now become the product. To the extent that an "attention-based economy business model" has been constructed, aimed at conditioning and capturing people's attention (Bhargava and Velasquez, 2021).

At this point, digital platforms are fragmenting and polarizing societies by emphasizing their differences in ways that were unimaginable in the past. The information and content produced by polarized groups are specifically tailored to each polarized

ecosystem. As a result, the paths of people clustered in different poles never intersect—or are deliberately prevented from intersecting. In other words, people are grouped based on their thoughts, behaviors, and attitudes, and the same information, recommendations, and directives are repeatedly presented to these clustered groups (Erdi, 2020, p. 202).

Printed media, visual media, and communication channels are also being restructured according to the ecosystems of polarized groups, telling their audiences stories—often fictional—that they would enjoy seeing, hearing, and reading. In other words, a single news item, event, or incident is presented with as many different narratives as there are polarized factions in society. As a result, people end up following separate, homogenized TV channels and newspapers that exclude diverse voices, reinforcing their existing perspectives.

On the other hand, advancing technology makes it easier to filter content, allowing people to receive pre-selected information more readily. This prevents different and surprising news from entering echo chambers (Erdi, 2020, p. 108). Based on Aral's (2023) observation that echo chamber processes occur in most countries, this phenomenon appears to be a global trend. This phenomenon not only sustains echo chambers populated by groups of people who can only tolerate hearing their own voices, but also accelerates the spread of manipulative and false news and information between opposing sides. A recent comprehensive study shows that false news spreads much faster, broader, and deeper online than real news information (Vosoughi et al., 2018). As Erdi (2020) notes, while distortion, exaggeration, and fabricated news have existed in the past, they were exceptions. Now, however, such practices have become widespread and potentially dominant (p. 106).

Monopolizing and constantly expanding platforms have now

become a national security issue for many countries. As these platforms are perceived as a threat to democracy and society, there have been discussions regarding how they can be controlled, as well as various possible solutions. However, it seems unlikely that significant outcomes beyond short-term fixes will emerge, as the minority who own these massive monopolized technologies are unwilling to sacrifice their profits and advantages. What's particularly striking, however, is an interesting contradiction: many of the pioneers of these addictive digital platforms impose strict internet diets on their own children. They take stringent measures to keep their children away from tablets, smartphones, and games, often preferring to send them to schools that utilize minimal technology (Alter, 2018; Archibald, 2018; Bhargava and Velasquez, 2021; Bilton, 2014).

At this point, the major challenge facing our youth is becoming unknowingly trapped in technological addiction. The fact that most of these technologies are free and easily accessible today broadens the scope of addiction. The most significant threat lies in the deliberate reinforcement of the perception that such addictions are rare occurrences. As a result, families encountering addictive behaviors often believe that the problem is unique to their children. However, addiction is not an unintended or rare behavior in these technologies—it is a desired and engineered outcome. Far from being a phenomenon affecting only a small group, all individuals are under the same threat.

Consequently, these addictions are exactly what global technology producers seek to achieve. Observing the massive investments technology companies make in products they offer to end users for free or under extremely favorable conditions helps clarify the direction this process is heading. In this context, for instance, the fact that young people in low-income societies are exposed to digital screens approximately two hours more

per day than their peers in higher-income societies (Bhargava and Velasquez, 2021) indicates that the threats posed by these addictions are even greater for countries that need more human resources for development.

In technological addictions, dependency manifests through behavioral patterns. Since the internet and digital addictions do not involve the consumption of a tangible substance, as in substance addiction, they are often not recognized as addictions. Furthermore, the distinction between a user and an addict remains quite ambiguous. In other words, every addict is a user, but not every user is necessarily an addict. Addictions to these technologies develop over time rather than emerging suddenly, making the transition from user to addict difficult to detect.

Initially influencing thoughts and preferences, digital addictions have gradually begun altering behaviors, giving rise to a new type of addiction. In this new context, addiction has evolved beyond conventional substance use into behavioral addiction. The behavioral addictions caused by the internet and digital platforms have now become a global issue. While the behavioral manifestations of addiction have been debated in scientific circles for a long time, the American Psychological Association (APA) added "behavioral addiction" as a category to the Diagnostic and Statistical Manual of Mental Disorders (DSM) for the first time in 2013 (Alter, 2018). Although behavioral addiction is officially defined as a disorder, in reality, it is nothing more than the adaptation of humans to technological transformations. In other words, addiction is the goal of this process, not its side effect.

The first casualty on the road to addiction is self-control. As the time spent online increases, self-control gradually begins to erode. The ability to manage time weakens progressively. Critical skills in daily life, such as focusing and deep thinking,

also deteriorate over time. Individuals' minds grow lazy, their capacity for reflection diminishes, and, moreover, their qualities as thinking and acting individuals are slowly lost. In all countries, generations are emerging that gradually lose connection with their cultural values and begin to act according to new behavioral patterns manipulated by online mechanisms. The commonalities in complaints about young people suggest that they are all exposed to the same processes.

Mechanisms such as acceptance, approval, and being valued are now increasingly reinforced in online environments, while feelings of trust and control are weakened, leaving individuals more susceptible to influence. Particularly among young people, the fear of exclusion often leads them to submit—sometimes reluctantly—to online mechanisms of approval, recognition, and acceptance. As a result, although individuality is emphasized, they gradually lose their self-control (Sahebi and Formosa, 2022). People's emotions—happiness, sadness, anxiety, expectations, and other emotional conditions tied to pleasure—are increasingly driven not by the real world but by their interactions with the online world. Real relationships are being replaced by virtual ones.

The offline world is gradually losing its significance, and ultimately, individuals are left isolated in virtual environments. This state of loneliness and isolation makes individuals far more susceptible to manipulation. As time spent online continues to increase, the foundation for healthy relationships—starting with the family and extending to the broader social environment—is steadily eroded. As Deneen (2022, p. 48) points out, all real-world relationships and social connections are being reconstructed through new connections and relationships formed in online virtual spaces.

On the other hand, everything is being turned into a spectacle, and the consistency between what exists and what is displayed has lost its meaning. People are compelled—or conditioned—to strive to create an image vastly different from who they truly are. The principle of "Either appear as you are, or be as you appear" no longer holds sway over individuals. As a result, relationships formed in the real world often end in disappointment.

The widespread discussions about the internet and social media addiction, which have become common in nearly all countries, are merely reflections of the initial visible pains of this transformation. The issue is once again debated primarily through the lens of young people. However, regardless of age, all individuals who use online platforms, applications, or software are exposed to the same effects. Since the internet and social media occupy a significantly larger space in young people's lives, it is natural that they are the most affected group. The reliance on the internet and digital platforms for education during the COVID-19 pandemic has further accelerated this transformation. Platforms that substituted for schools have undermined the value of real-world schooling.

In every aspect of life, substitutes have been positioned as candidates to replace reality. In this process, the fabric, relationships, and common ground that allow values to thrive in the real world are being eradicated, paving the way for a new ecosystem to emerge. Unfortunately, this new ecosystem has no room for empathy, altruism, or sharing in the struggles of others. Over the last century, architectural transformations have isolated individuals from their surroundings, reducing neighborly and human interactions to a minimum. Now, during this rapid digital transformation, humans are being further isolated, left without lifelines to hold onto, and swept along by a powerful current (Deneen, 2022, p. 49).

This planned process has now gained a new dimension with the construction of the "metaverse" grounded in augmented virtual reality. As an attempt to create a godless new realm, it is no coincidence that the users of this realm are digital addicts. The creator, destroyer, reformer, and observer of this realm is now Homo-Digitus (Dağ, 2022). In short, the perception of existence has shifted to an entirely different dimension.

Rankings and the Asymmetric Distribution of Rewards

Digitalization has led to the production of massive amounts of data in every field, making it easier to develop models for assessment. Today, rankings based on such data can be generated, determining who performs best in any given area. From the university you choose to attend, the books you read, and the films and series you watch, to the most profitable investment options and the hotels where you stay, recommendation systems increasingly guide our lives. In every domain—economy, science, art, education, reputation, fame, elections and voting, consumption habits, and more—rankings that show where individuals stand in the competition or inform us how to behave have become indispensable parts of our lives.

Everything is being drawn into the scope of quantitative assessment and thus condemned to be digitized. In order to measure qualitative aspects, assumptions must naturally be made; factors that could influence the assessment and their respective weights are determined, and numerical values are assigned to qualitative features through constructed algorithms. In other words, everything qualitative in any field is now being measured in some form and subsequently ranked. Although it is commonly assumed that "what cannot be measured cannot be improved," in reality, every measurement attempt aims to capture and ultimately control the area of assessment. What cannot be measured or digitized gradually loses its value and becomes marginalized.

It is increasingly observed that institutions engaged in measurement and assessment across all fields are growing in number, creating a domain of legitimacy, and gradually beginning to shape their respective areas. Today, investments are made based on the "neutral" reports issued by these companies, countries are ranked across different categories and attract international investments according to their position in these

rankings, and decisions about which educational institutions to attend or which products to consume are increasingly determined by published rankings and recommendation lists.

For example, despite rising objections from many countries and the academic world regarding the published university ranking lists—and the deformations caused by these rankings—countries continue to strive to place their universities in global rankings. Today, it is the rankings that define the global context and competitive power of these institutions. Therefore, in the higher education market, institutions must climb the rankings in order to be assigned importance by others. As a result, the widespread listing, ranking, and rating activities across all fields are transforming every domain into arenas where game theory is effectively at play (Peter Erdi, Ranking: *The Unwritten Rules of the Social Game We All Play*, Oxford University Press, 2020).

Deformations Increase in Domains of Assessment

Subjecting quality to assessment inevitably brings about distortions in the domain of assessment. Two famous laws help explain these distortions: Campbell's Law and Goodhart's Law (p. 111). Campbell's Law states that "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more it will distort and corrupt the social processes it is intended to monitor." Goodhart's Law, on the other hand, is expressed as "When a social or economic indicator or other measure becomes a target for the purpose of conducting social or economic policy, it ceases to be a good measure and loses the information content it originally had". Consequently, attempts to digitize a non-quantitative social domain are problematic both in terms of the questionable outcomes they produce and also because they inevitably lead to distortions and deformations.

On the other hand, since the game continues to be played according to these rules, the increase and deepening of inequalities in every field has become inevitable. Indicators already point to this trend. Data distributions in any domain no longer follow a normal distribution but instead follow a power law distribution. The citation distributions of scientific publications, the price distributions of artists' works, income distributions, and similar metrics are all increasingly distributed according to power laws and display significant skewness. In other words, distributions are becoming increasingly asymmetric.

For example, as an academic, when you publish in your field and consider the citations to your publications as a measure of success, you have entered a domain governed by the rules of game theory. In this case, you must seek opportunities to publish in high-impact journals and to collaborate with scientists whose publications receive the most citations. This is because citation distributions operate according to the power law. Those who have previously achieved success in accumulating citations tend to continue increasing their success. According to this rule, when you co-author papers with highly cited scientists, not only do those joint publications receive more citations, but the citation counts of your other works also increase.

In fact, the deviation from the normal distribution was identified long ago by the renowned sociologist Robert Merton (1968) through a mechanism he developed based on a verse from the Gospel of Matthew, which he termed the "Matthew Effect." According to this mechanism, small differences in all fields are amplified over time, and advantage continuously breeds further advantage, leading to an accumulation of benefits. As Erdi (2020) also points out, those who were successful in the past have an increased probability of remaining successful in the future (p. 177). According to these rules, the chances of success

for newcomers are increasingly dependent on behaving in ways that reinforce the advantages of those already dominating the playing field.

The Growing Impact of Social Networks on Success

Therefore, competition within each field does not occur under equal conditions. To explain this situation, Erdi draws upon the work of the renowned scientist Albert-László Barabási, who has made significant contributions to the understanding of network structures, and references his famous statement: "Success is not about you. It's about us" (p. 178). Thus, the rules of the success game lie not merely in individual effort but in the distribution of success indicators, which are defined beyond personal control. Success is not solely the result of an individual's effort; it is the outcome of a value attribution and meaning-making process that emerges from the interactions of many different institutions and network structures within society. Consequently, while society grants the reward of success to a small number of individuals who strive for it, it withholds it from the vast majority. Moreover, most actors within any given field are often unaware of the underlying rules governing this process.

In short, societies are increasingly being transformed into success-driven systems based on game theory. Since success is no longer solely attributable to the individuals, institutions, and countries must now go beyond merely focusing on their own performance to increase their success. They are compelled to engage in additional efforts aligned with the rules of the game—efforts that often lead to distortions and deviations. They must strive to enhance their interactions with external groups that influence success, establish connections with highly networked (and therefore highly powerful) entities, and become more visible. Because the rewards of success do not follow a

normal distribution and instead accumulate among the already advantaged, similar competitive games are played across all fields to secure a larger share of this reward. These efforts further skew the distribution of success within the playing field and deepen existing inequalities.

Can Mathematical Models Be Weapons of Mass Destruction?

Digitalization has not only led to the generation of big data in every field but has also facilitated the creation of metrics related to various domains and processes. These metrics have accelerated the assessment of the current state, optimization, and future projections in every area (Erdi, 2020). Today, assessments and data-based predictions are conducted based on quantitative indicators across fields ranging from education to healthcare, from the economy to politics. People now make their choices based on rankings created within this context. From the books they read to the items they consume, from the restaurants they dine at to the universities they attend, these quantitative indicators play a significant role in shaping individuals' life choices. For businesses, rankings and metrics serve as guides in determining ideal candidates for employment, shaping current business processes, and planning future investments. Banks use these indicators when granting loans. This approach has been successfully applied to the production of university rankings, financial risk factors for individuals, companies, and even countries.

Of course, mathematical models are developed to generate meaningful results from numerical data. The backbone of these models is algorithms. Algorithms determine proxy features related to the field based on their objectives and identify the weights of these features in the intended outcomes (Erdi, 2020). New quantitative indicators related to the field are generated based on assumptions and the proxy features used, and predictions are made based on these indicators.

It is helpful to first highlight two fundamental characteristics of algorithms. The first is that they provide an approximation to understand the context under examination. This is because it is not possible to measure everything related to the context for which quantitative indicators are desired. Instead, an attempt is made

to approximate the context using proxy features assumed to be significant and relevant indicators of the context. Consequently, prioritization is carried out based on assumptions during modeling. Every model operates according to this prioritization. Therefore, every mathematical model or algorithm only provides an approximation to the context.

Naturally, this comes at a cost. On one hand, the context is often not fully captured; on the other hand, aspects of the context that cannot be considered and assessed increasingly become trivialized and ultimately devalued. Alternatively, the risk of manipulation of the measured indicators rises. In short, mathematical models create long-term deformations in the areas they aim to predict and assess.

On the other hand, models guide the real world through their priorities and assumptions. Consequently, they reshape the real world based on the results of their predictions. The reflections of these results become more visible in the real world. In fact, this is facilitated by two auxiliary factors: scale and the interdependence of models. As the audience or system influenced by a model grows, the scale of the model expands. Additionally, models are no longer isolated from each other. Outputs generated by a model in one context can serve as inputs for a model developed in another context. This characteristic accelerates the growth of scale. Therefore, in this article, mathematical models and algorithms are comprehensively evaluated based on Cathy O'Neil's book Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy (2016).

Models Are Approximate Representations of Reality

Models are inherently designed to achieve a simplified representation of the real world conditions. Therefore, they have limitations. These simplifications are necessary to optimize the model's capacity to perform a specific task, but they also lead to scenarios where the model diverges from reality, potentially producing incorrect results. For this reason, it is essential to be aware of these blind spots and to understand the limitations of a model when considering its outcomes (p. 20).

> "To create a model, then, we make choices about what's important enough to include, simplifying the world into a toy version that can be easily understood and from which we can infer important facts and actions. We expect it to handle only one job and accept that it will occasionally act like a clueless machine, one with enormous blind spots."

Algorithms attempt to capture the reality they aim to represent through proxy features. However, since it is impossible to fully capture reality through these features, there is always a margin of error. While this margin of error may appear mathematically reasonable, each error can have a devastating impact on the individuals it affects (pp. 17–18). The biggest problem lies in how accurately the assumptions used in algorithms represent the reality being sought. As O'Neil points out, in decision-making algorithms, scoring replaces the reality it is supposed to represent: "Instead of seeking the truth, scoring begins to represent the truth" (p. 7). As a result, when the representation is flawed and the outcome is contested, you must provide far more evidence than the algorithm ever had to prove your case. In this context, O'Neil frequently refers to a model that measures teachers' performance based on their students' academic achievements. Although this model disregards many contributions—some of

which are not measurable—when assessing a teacher's actual performance, it is often preferred by education administrators because it provides a support model that is difficult to question (p. 21).

Thus, this approach is open to criticism because it does not consider all aspects and contributions of teachers, nor does it fully reflect the complexity of educational processes. However, it is preferred because it offers a quick and practical solution to meet the administrative needs of the education system. This shows that models are shaped according to the goals and priorities of their creators and that, in achieving these goals, they may sometimes overlook important elements. In fact, since approximations are made during modeling, things that cannot be measured are excluded from the model. As a result, what cannot be measured is devalued through models. Why should importance be given to things that the model does not value by failing to measure? On the other hand, while creating models, priorities are taken into account, and the features considered are determined according to these priorities. Therefore, interventions in models and algorithms are made based on values (p.21):

> "Models are opinions embedded in mathematics. Whether or not a model works is also a matter of opinion. After all, a key component of every model, whether formal or informal, is its definition of success. This is an important point that we'll return to as we explore the dark world of WMDs. In each case, we must ask not only who designed the model but also what that person or company is trying to accomplish."

In short, when evaluating a model, it is important to understand the values and priorities underlying its design. Elements such as which data are included or excluded, which variables are

considered more important, and which outcomes are targeted directly shape the structure and results of the model. Although the mathematical nature of models gives the impression that they are objective and precise, it should not be overlooked that models are shaped by human choices and values. More critically, the priorities of a given field begin to shift based on what is valued in rankings. Institutions, striving to improve their scores on indicators measured in rankings, gradually devalue unmeasured aspects, which eventually fall into obsolescence. Furthermore, when those conducting the rankings modify the indicators or adjust their weightings, institutions quickly attempt to adapt themselves to the new circumstances.

On the other hand, these metrics also open the door to manipulations. For instance, since publication and citation performance are considered in university rankings, financially strong institutions may strike high-paying agreements with highly productive researchers in these areas. Consequently, these researchers are not required to spend more than a short period each year at the contracting institutions, but list those institutions in their publications' affiliations. Additionally, when everyone places the same emphasis on identical indicators, it harms diversity, causing the ecosystem to drift away from variety and toward standardization. Therefore, such rankings deform ecosystems, such as the higher education ecosystem. As the scale of using such models expands, the scale of deformation—and ultimately the extent of the damage—also increases (p.54).

Self-Fulfilling Prophecy

These models, due to their biases based on race, gender, religion, culture, and socioeconomic status, place the advantaged in an even more favorable position while further disadvantaging the underprivileged—a phenomenon known as the Matthew Effect

(Merton, 1968; Özer, 2023a; 2023b; 2024a; Perc, 2014). Despite the assumption that such systems operate impartially, given the nature of mathematics, they in fact continually increase the advantages of socioeconomically privileged groups while making it nearly impossible for the disadvantaged to break this cycle. Moreover, these models not only systematize these biases but also render them invisible. In other words, algorithms reinforce injustice by repeating the conscious or unconscious biases reflected in past human decisions. This leads to the embedding of past discrimination and biases into algorithms, perpetuating such discrimination on a broader and more systematic scale. For example, it has long been known that models used in the justice system exhibit racial discrimination (p.24).

Therefore, these models exhibit the characteristic of a self-fulfilling prophecy. In disadvantaged cases, whether it is a job application, hiring process, or sentencing based on the likelihood of reoffending, individuals are evaluated not by what they have done but by where they belong. As a result, their socioeconomic status becomes their destiny. Based on their past and the neighborhood they live in, the model may determine a higher likelihood of reoffending, resulting in a longer sentence. After imprisonment, the likelihood of finding a job decreases, financial difficulties trigger other familial and social problems, and ultimately, without the chance to start afresh, the individual becomes involved in another crime, receiving a much longer sentence than they originally deserved. In the end, the model has seemingly validated itself—not because it was accurate, but because it unjustly amplified the disadvantages of the underprivileged! (p.48). Such models also embed an additional unjust assumption into their algorithms: the presumption that sentencing individuals with a higher likelihood of reoffending to longer prison terms is more beneficial for society (p.97-98).

A similar situation is observed in ranking models as well. Those who rank lower in one evaluation are doomed to remain at the bottom in subsequent rankings. As the scale of these rankings grows, the harm suffered by the disadvantaged continuously increases, and disadvantage gradually turns into a predetermined destiny through these rankings. O'Neil cites the ranking initiatives of higher education institutions as an example of this phenomenon (p.53):

> "U.S. News's first data-driven ranking came out in 1988, and the results seemed sensible. However, as the ranking grew into a national standard, a vicious feedback loop materialized. The trouble was that the rankings were self-reinforcing. If a college fared badly in U.S. News, its reputation would suffer, and conditions would deteriorate. Top students would avoid it, as would top professors. Alumni would howl and cut back on contributions. The ranking would tumble further. The ranking, in short, was destiny."

Another situation is observed in models used to determine patrol areas for efficiently allocating police resources, which are widely implemented in the United States to identify high-crime areas (p.86). These models, relying on recorded crimes as training data, discriminate based on race and socioeconomic status. They increase the number of patrols in areas densely populated by Black and disadvantaged communities. This leads to a vicious cycle where crime recording rates in these areas continually rise, creating a self-fulfilling prophecy. However, when White and socioeconomically advantaged communities face similar issues, crimes are often resolved without being officially recorded. Consequently, the number of patrols in these areas remains lower, and the likelihood of apprehending offenders is significantly reduced. Similarly, for example, it has been observed that 85% of

individuals stopped by the New York Police Department due to suspicion are young African American or Latino men (p.92). In other words, those who are initially advantaged in crime records maintain this advantage after the model is implemented, while the disadvantaged are trapped in a vicious cycle, being pushed into an even more disadvantageous position.

Once you are caught in this spiral, your likelihood of reoffending increases, leading to harsher sentences. After serving your sentence, your chances of finding a job diminish. Again, your likelihood of being accused in a random stop rises. Models, now pervasive in all areas of life, continually push you into a disadvantaged position and ultimately determine your fate. In short, the groups harmed by these models are, strangely enough, always the socioeconomically disadvantaged—the poor (p.97). Meanwhile, for example, the financial sector, due to its economic importance and political lobbying power, is often subjected to less scrutiny. This can, in some cases, lead to high-profile crimes going unpunished (p.89-91).

Every day, a new mathematical model is introduced. These models, which initially appear to be implemented with good intentions, increasingly begin to extract data from individuals across various domains. As the diversity of data expands, it becomes evident that a model claimed to focus on one specific area also utilizes data from outside that domain, determining outcomes not only based on that field but also by incorporating data and performance from many other areas. At this point, individuals become completely vulnerable to the opaque, unjust, and harmful results produced by the model. This creates a feedback loop that reinforces injustice and systemic bias. Such biases in the system lead to continuous unfair treatment of certain segments of society. However, justice has no equivalent in the code of these models (p.199-200). Since models are data-hungry,

new inputs are continually added to their datasets, making the cycle even more destructive with each passing day (p.175-176).

On the other hand, another characteristic of these models is that they do not evaluate individuals independently but based on their surroundings, social networks, and geographic locations. In other words, individuals are assessed within the context of their socioeconomic status, which reinforces the disadvantages of these environments and makes it nearly impossible for individuals to break out of them. Thus, it becomes evident that justice is not merely a legal concept but one deeply intertwined with social and economic factors (p.146-147).

In fact, the self-fulfilling prophecy arises from the existence of numerous models that now guide life, most of which contain similar biases, unjustly scaling people's destinies. When the scale grows to affect the entire ecosystem, the ranking game that unfolds perpetually accredits the advantaged by keeping them at the top of the list while forcing others into a competition they cannot win. In this game, whose rules they did not set, the disadvantaged are consistently clustered on the losing side. O'Neil describes this situation as the exponential growth of the model and its capacity to scale across all aspects of life (p.29-30).

On the other hand, technological transformations, such as the widespread adoption of automation, are reducing the demand for mid-skilled workers in the labor market, gradually pushing them into the pool of low-skilled workers (Markovitz, 2019). Consequently, on one hand, wages for low-skilled workers are continuously declining, on the other hand, most businesses prefer part-time workers over full-time employees for low-skilled jobs (Özer, 2024b). Additionally, with the advancement of models, such workers are constantly monitored for productivity, forcing them into inhumane working conditions (p.128).

Vulnerable Populations Exposed to Errors

When assumptions about purpose are made and a value is generated through a model, even if the model operates efficiently, it can still produce erroneous results (e.g., false positives). While these errors may affect only a small number of individuals, they can have devastating impacts on the lives of those individuals. A model that works well for the majority but produces biased or incorrect results for a minority raises the critical question: Can this cost be sacrificed for efficiency? According to O'Neil, since these algorithms are designed to encompass large populations, the wealthy are often excluded from such evaluations.

The information of the masses is collected and recorded in every possible way. In the marketplace, this information is purchased by companies and added to their existing data collections. Naturally, in an environment with such vast amounts of data, the market's concern is not whether the data is accurate but whether it is usable (p.151).

Most of the time, even though there are errors in this data, correcting these mistakes is only possible if the affected individuals investigate why they were impacted or have the means to uncover it (p.152-153). Others, unaware of how their profiles are created, are doomed to their fate. The Matthew Effect becomes even more destructive through such models, and disadvantages become unbearable (p.155). Since models are applied to large-scale populations, the errors or injustices of algorithms are not taken seriously, as they are considered individual cases and do not compromise the model's overall efficiency. Therefore, they are largely ignored, allowing the manipulation of the masses to continue unchecked (p.111). At this point, people have become vulnerable to major tech companies, making them susceptible to all kinds of manipulation (p.181).

To summarize, mathematical models and algorithms are now present in every aspect of our lives. The study points out that if left unregulated, these models are capable of becoming destructive weapons for the masses, as O'Neil emphasizes in his conclusion. The failure to verify the accuracy of data, the inclusion of biased data, and the assumptions and prioritizations made during algorithm development can exacerbate their destructive impact. These models can reinforce biases, systematically exclude certain groups, or create a false sense of security and justice. Most importantly, the models not only negatively affect relatively disadvantaged socioeconomic groups, but they also deeply impact and pull down the middle classes, which have long been losing ground due to automation.

Mathematical models approach the target domain using only measurable proxy features that have numerical values. Therefore, each model offers only an approximation for the domain. The degree of representational authority granted to each proxy feature is determined by algorithms. As a result, algorithms operate based on a prioritization (valuation). As the value attributed to the model increases, unmeasurable aspects of the domain become progressively devalued. Ultimately, this deforms the domain, reconstructing it around the measurable elements, valued attributes, and proxy features. On the other hand, when biases exist in the training data or in the assumptions embedded in the algorithm, the decisions made by the model also become biased.

The exponential advancements recently observed in AI have rapidly paved the way for AI applications across all aspects of life, from education to healthcare, from finance to the defense industry, leading to the swift formation of an AI ecosystem (İlikhan et al., 2024; Özer, 2024c; Özer, 2024d; Perc et al., 2019; Tanberkan et al., 2024). On one hand, AI has increased automation

in labor markets, contributing to rising unemployment (Özer and Perc, 2024), while also deepening the disruptive effects of mathematical models highlighted by O'Neil. The issues O'Neil points out in mathematical models—lack of transparency, scalability, and destructive impacts—are greatly amplified by the capabilities of AI. For this reason, countries are already striving to implement measures to address the negative effects that AI is expected to have on employment (Özer et al., 2024a). On the other hand, efforts are also being made to prevent AI from exacerbating social inequalities, particularly through biased outcomes influenced by factors such as socioeconomic status, race, gender, and religion.

The current state of AI enhances the capabilities of these models and carries the potential to significantly amplify their destructive effects if left unchecked. Therefore, a participatory approach must be adopted in the development of models, ensuring the active involvement of relevant experts, especially those groups likely to be affected by biases, as well as unions, civil society organizations, and stakeholder representatives throughout all processes (Özer et al., 2024b). This can help mitigate the adverse impacts of these models to some extent. Using a participatory approach during the development phase of models will also enhance the accountability and transparency of mathematical models.

Since the models are no longer isolated, they interact with one another, when the output of one model becomes the input for another, the scale, scope, and disruptive impact of models continuously grow. In this context, the decisions made by models perpetuate the past into the future, making it increasingly difficult for disadvantaged groups to break free from cycles of disadvantage. For this reason, the use of big data and algorithms must be developed in a fair and inclusive

manner, tested continuously, and designed to address rather than amplify existing biases. Greater transparency, regulation, and the establishment and enforcement of ethical standards are necessary to ensure individual justice in the design and implementation of these models.

The Upcoming Giant Wave Brought by Artificial Intelligence

AI technologies are now encompassing nearly all aspects of our lives. Generative AI technologies like ChatGPT, supported by large language models (LLMs), were adopted by millions of users in a short time after becoming accessible, highlighting their potential applications across a wide variety of fields. Once accessible, AI technologies quickly found their place in domains such as education, healthcare, science, finance, defense, media and journalism, and customer support services, leading to the rapid formation of an AI ecosystem (İlikhan et al., 2024; Özer, 2024a; 2024b; Pavlik, 2023; Perc et al., 2019; Septiandri et al., 2023; Tanberkan et al., 2024). As the use of AI technologies becomes increasingly widespread due to the benefits they provide, the challenges encountered during their application have brought to the forefront discussions about the potential risks of these technologies, which may be as significant as their benefits (Acemoğlu et al., 2023; Özer et al., 2024a; 2024b).

AI represents a new technological wave that is fundamentally different from previous technological disruptions. The ability to understand both the benefits and risks associated with it will provide a significant advantage in controlling its impact. As the AI ecosystem rapidly develops, societies' predominant focus on its benefits constitutes the greatest risk in managing this process.

At this stage, the gradual recognition and expression of the risks posed during the initial phases of this major transformation have begun to heighten anxiety about what humanity might face when the full wave arrives. Countries have now started implementing AI regulations, and efforts to adopt especially multinational measures are increasing. In this context, Mustafa Suleyman's book The Coming Wave: Technology, Power, and the Twenty-First Century's Greatest Dilemma (2023), authored by a prominent entrepreneur in the AI field, makes a significant contribution to understanding these challenges and contemplating solutions.

Therefore, this study provides a detailed review and discussion of Mustafa Suleyman's book.

Mustafa Suleyman likens the wave brought by AI to the flood myths in ancient traditions, which destroy and reshape everything in their path (p. 7). While Suleyman lists the benefits that the AI ecosystem could bring to humanity, the subject he emphasizes the most is the potential and deeply frightening risks that AI entails (p. 10).

Suleyman first focuses on the recurring narrative of technological transformations. Each transformation initially leads products accessible only to the wealthy, aiming to make life easier. However, as companies intervene to make these products more affordable for the masses, their usage becomes widespread, ultimately triggering societal transformations not only in the original domain but also in other areas. The spread of motor vehicles followed a similar trajectory. As a result of their widespread adoption, roads and highways were constructed, migration increased, and social transformations occurred in several areas. Every major technological advancement is therefore not solely the product of humanity; humanity itself becomes shaped by the changes it introduces (pp. 25-26). Suleyman defines technological transformations that manifest in life, turn into waves when they become widely adopted, and are carried into the future by triggering new developments as general-purpose technologies (p. 27). The intensity of a technological wave is determined by the scale of the areas it impacts through its interconnectedness. As the scale grows, the existing ecosystem triggers the formation of a new ecosystem, thereby enabling the emergence of the next wave (p. 28).

For example, the spread of electricity fundamentally transformed industry, communication, and daily life. Electricity reshaped

how factories operated, increased the speed of transportation, and revolutionized every aspect of modern life. The adoption of this technology reshaped the global economy and society, much like the printing press transformed access to information. The widespread adoption of electricity is considered a turning point in human history and remains a cornerstone of modern life. Similarly, large-scale and interconnected dissemination, such as the invention of the printing press, radically transformed access to information and had profound effects on cultural, scientific, and social development. The proliferation of books ignited significant movements such as the Renaissance, the Enlightenment, and the modern scientific revolution. Gutenberg's printing press serves as a powerful example of how rapid and widespread technological dissemination functions as a catalyst for societal change and is regarded as one of the pivotal milestones in human history (p. 30).

These chain reactions demonstrate how technology evolves within a continuous cycle. Each new technology is the cumulative result of its predecessors, enhancing the speed and scope of technological dissemination. This cycle serves as the fundamental driver of technological progress and lies at the heart of societal transformations. As Suleyman highlights, Uber would not be possible without smartphones, smartphones would not exist without GPS, GPS would not function without satellites, satellites would not exist without rockets, rockets depend on combustion techniques, and combustion techniques ultimately trace back to fire (p. 31). Each wave of general-purpose technology becomes larger and more comprehensive than the one before it (pp. 33-34).

Benefits are not the only side of the story when it comes to technology. Therefore, the need for control can arise not only to resist the socioeconomic consequences it has caused in the

past but also, in today's globalized scale, to address issues like environmental and climate change that threaten life on a global level (p. 46). Once general-purpose technological waves emerge, it becomes increasingly difficult to control them or prevent their misuse for purposes beyond their original intent. The effects of technology are often far broader and deeper than the intentions of its inventors (p. 35). In this context, Suleyman highlights how technological waves in the past encountered different control mechanisms across various cultural and economic settings. It is interesting that he notes the delay in the introduction of the printing press to the Ottoman Empire, where printing in Arabic script was banned due to the high costs of the press; eventually, the printing press was integrated into the system once the costs became reasonable (pp. 38-39). Similarly, Suleyman points out that Queen Elizabeth I, in the late 16th century, rejected a new type of knitting machine, fearing it would disturb guilds. He also discusses how guilds in Nuremberg, Danzig, the Netherlands, and England destroyed new types of weaving looms, and how the Luddites attempted to smash and destroy industrial machines (p. 39). Thus, resistance to technological waves often stems not from ideological stances but from sudden and desperate reflexes triggered by an early awareness of the socioeconomic disruptions these technologies might cause. These resistances illustrate how new technologies threaten existing social and economic structures and how these threats provoke fear-driven reactions among people.

General-purpose technological waves have entered a new phase with AI and synthetic biology (p. 55). The technological wave of AI has leveraged the existing interconnectedness to its maximum level, thereby creating a completely new ecosystem (pp. 61-62). In his book, Suleyman discusses the development processes of AI and the impact of deep learning. He particularly highlights the ability of AI to learn from unlabeled real-world data as a turning

point in the development of LLMs (p. 65). Suleyman emphasizes that with the dramatic increase in the use of raw and real-world data, AI has the potential to replicate and even surpass most functions of the human brain (p. 67). However, as these rapid advancements unfold, the issues arising from AI systems are becoming increasingly apparent. In particular, AI systems that learn from raw real-world data are observed to reproduce the biases present in the real world, thereby exacerbating inequalities (pp. 69-70).

Suleyman emphasizes that AI is not merely a technology but a transformative meta-technology, given its potential. He highlights that it has the capacity to drive transformations unparalleled by previous technological waves (p. 78). In this context, Suleyman points to a new wave in meeting energy needs through fusion (p. 100). Consequently, the waves of synthetic biology (life), AI (intelligence), quantum computing, and fusion and renewable energy (energy) are converging and colliding, collectively pushing the boundaries of a new civilization (p. 101). Suleyman states that the upcoming wave of AI has four fundamental characteristics: it has an asymmetric impact, undergoes hyper-evolution, is multi-purpose, and possesses a level of autonomy never experienced before (p. 105).

Asymmetric impact disperses power rather than centralizing it and moves it further away from controllability. This impact provides a significant advantage to "the new and small" against "the conventionally large," as the low cost of the technology enabling this effect makes it easily accessible. Consequently, asymmetric impact renders control nearly impossible. With this dynamic, small groups or even individuals can now achieve significant outcomes. Similarly, technology companies are becoming major power centers compared to countries/states. The fact that companies like IBM, Google, Intel, Microsoft,

Bosch, Siemens, Samsung, Baidu, Tencent, and Huawei hold the largest number of AI-related patents provides a clear indication of the future power centers. Those who exploit these new power dynamics can rapidly push the boundaries of these technologies, gaining more control and influence. The growing global power of mega-corporations is challenging countries/states and institutions, forcing a rebalancing of power dynamics (pp. 187-188). This new order points to a structure where a small number of actors holding capital and technology become central powers in social and economic relations. As the need for labor decreases, economic and social control over people may increasingly fall into the hands of a minority of capital owners. This scenario could deepen social hierarchies, potentially creating a new form of digital feudalism. The approaching great wave offers a strong signal of how the concentration of technology and capital might transform the economic and political order (p. 191).

In summary, with asymmetric impact, societies and humanity as a whole can become subject to the mercy of a single individual, a very small minority, or mega-corporations. Similarly, states could evolve into a new dimension with unprecedented surveillance and control capabilities. New tools such as AI, big data analytics, surveillance, and biometric systems offer states an unprecedented level of detailed and, when combined, comprehensive control over society. As a result, concerns are growing that modern technologies could enable totalitarian hegemonies to operate even more effectively than before. On the other hand, asymmetric impact amplifies systemic vulnerabilities or momentary errors to a global scale due to interconnectedness. For instance, in the digital world, there is no barrier preventing a national security breach from escalating into a global catastrophe within a few steps. With the technologies of the approaching wave, such threats could become far more complex, powerful, and potentially destructive. This is particularly concerning with

powerful technologies like AI, where a single failure or error in the system could lead to large-scale consequences. In light of the complexity of the system and its interconnections, it is significantly more difficult to prevent potential damage. (p. 107).

A wave of technological advancements – including AI, biotechnology, quantum computing, and other advanced fields – is causing societies to face increasingly difficult challenges in keeping up with these innovations and implementing regulations as a result. The risk of standards and safety protocols failing to keep pace with technological advancements poses significant challenges both socially and economically.

The greatest risk arises from the multi-use potential of these technologies. For instance, a technology capable of accelerating disease treatment could also be used to develop lethal compounds, highlighting the magnitude of potential risks associated with AI-driven innovations in drug discovery and similar scientific fields. In fact, the increased potential for multi-use is supported by the highly interconnected nature of the world. Therefore, technological applications designed to address specific facets of life can increasingly become general-purpose and, as a result, lead to radical transformations in entirely different fields, thereby expanding their scope well beyond their original purpose. Moreover, the unintended uses of such technologies often go unnoticed until they are actively deployed, delaying and complicating the implementation of preventive measures. The prevalence of this uncertainty illustrates the flexibility and wide applicability of new technologies, resulting in a situation both harder to control and more hazardous (p. 111).

Another significant risk is that the new wave is increasingly moving beyond human control and gaining autonomy. Full autonomy transforms technology from a simple tool into

something capable of making its own decisions and acting independently of human intervention. This fundamentally alters our traditional understanding of technology and raises new ethical, safety, and control issues. If humans are entirely removed from the process, who will bear responsibility? How will the decisions made by autonomous systems be controlled? These questions highlight the profound challenges posed by autonomous technologies and the urgent need to address them. This issue extends beyond AI and is among the most profound challenges posed by synthetic biology. As Suleyman points out, synthetic organisms, in the truest sense, begin to live independently (p. 114). This pushes the boundaries of genetic engineering, revealing new dimensions of biological autonomy. This process, however, creates significant uncertainty, especially in the long term, since it becomes impossible to predict what impact these organisms will have on the environment, other species, and the future ecology. This highlights an aspect of the new wave of scientific discovery that is as thrilling as it is perilous: once created, some impacts may be irreversible.

Moreover, as Suleyman highlights, what happens if AI systems become capable of autonomously navigating the internet, collecting data, and managing their own R&D (research and development) processes? (p. 115). The ability of these systems to develop their own algorithms will accelerate their capacity for independent decision-making and self-learning. This could lead to a scenario where technology evolves autonomously without human intervention. Such autonomy would enable revolutionary advancements in science and engineering but could also result in unforeseen consequences, security threats, and ethical dilemmas. How will humans control this process? Or will they even be able to? For example, would it have been possible to contain an autonomous software like the WannaCry ransomware of 2017—an attack that paralyzed the UK health system, Deutsche Bahn,

Telefónica, FedEx, Hitachi, and even China's Ministry of Public Security—if it had been capable of continuously patching its vulnerabilities? Managing such threats in the new wave may prove significantly more challenging (pp. 162-163).

To help us better understand these issues, Suleyman references Stuart Russell's "gorilla problem" approach (p. 115). Although gorillas are physically stronger than humans, humans are able to control gorillas through their superior intelligence. If an intelligence akin to artificial general intelligence were to emerge, this balance of power could shift. A more intelligent entity might take control, and humans could find themselves relegated to a similar fate as gorillas, losing their dominance. This would not only create a technological challenge but also pose an existential problem. By its very nature, artificial general intelligence could have unpredictable effects on humanity and be difficult to control. For this reason, discussions around the development and regulation of such technologies will face challenges unlike anything humanity has encountered before.

In summary, the four fundamental characteristics Suleyman uses to define the new wave are not independent; they continuously reinforce each other, increasing the complexity of the new wave. Suleyman himself is skeptical about the controllability of this ever-more complex wave characterized by these four features (p. 116). In essence, the new technology wave will not only challenge the governance capabilities of individuals and societies but also test the capacity of countries/states to adapt and respond, reshaping power dynamics in the process. The approaching wave of technology will profoundly affect not only power dynamics between countries/states but also the interactions between individuals, communities, and institutions.

Every major technological wave has initially been discussed

in terms of its impact on labor. In each wave, some jobs are removed from the labor market while new ones emerge. Prior to technological advances, the destruction and creation of jobs have generally achieved a balance, resulting in relatively minor disruptions of labor markets. However, the wave of AI differs from previous major technological waves, and studies with conflicting findings about its potential impact on labor markets are heightening concerns (Acemoğlu et al., 2023; Özer and Perc, 2024). What if the massive wave caused by AI does not resemble previous waves? Is there any guarantee that the new jobs created will not eventually be performed by AI as well? (p. 178). Suleyman thus predicts that the path of complementing humans will be temporary and that the path of automation will ultimately prevail (p. 178).

Perhaps the greatest risk of unemployment posed by the wave of AI will stem from the strengthening of these systems' autonomy. With autonomy, automation will emerge not only at the skill level but also at the system level, increasing the likelihood that even newly created job positions could be taken over by AI systems. The new wave will, however, have a minimal impact on vocational education and training (VET) and highly skilled jobs, in particular jobs held by individuals with a postgraduate education, particularly a doctoral degree. However, the pressing question is: how many PhD graduates can be produced in such a short time to meet this demand? (pp. 179-180).

At this stage, the new wave simultaneously democratizes technology by decentralizing it and making it more accessible while also enabling centralization through mega-corporations. In other words, democratization and centralization are advancing concurrently. However, the intentional or unintentional risks posed by both dimensions will make it easier for states to shift into a security mode, increasing control and surveillance. If

there is a societal risk involved, this shift could easily become legitimated by the public. This implies that one of the greatest risks is the potential increase in pressure on individuals and the restriction of their freedoms under this pretext. In spite of the fact that China is often cited as an example of this, any country is capable of adopting this strategy (p. 215).

The approaching wave sharpens this age-old dilemma. On one hand, there is an increasing need for greater security measures to protect societies from major disasters. However, this raises the question of how much freedom, individual rights, and national sovereignty will be sacrificed in the process. For example, measures taken to prevent a man-made pandemic could lead to violations of privacy and increased state control over individuals. The delicate balance between freedom and security becomes even harder to maintain in the face of the risks and threats posed by advancing technology.

On the other hand, the sustainability of societies and economies will face significant threats in the face of aging populations and shrinking workforces. Without new technologies, countries may struggle to overcome the challenges brought by these demographic shifts and maintain living standards. This demographic crisis is not only about an increase in the elderly population; it also poses major risks in terms of economic development, social security, and sustainability. As younger generations' participation in the labor market declines, societies could face a shortage of expertise, reduced tax revenues, and a decrease in long-term investments. It is possible that this would lead to unsustainable economic systems. To counterbalance this trend, finding ways to compensate for the workforce with AI, automation, and other technological solutions is one of the greatest priorities for modern societies.

Cahit Arf and Thinking Machines

We are living in a period where AI is becoming widespread and rapidly transforming every aspect of life with profound effects. AI technologies are increasingly automating tasks and processes, leading to fundamental transformations in business operations. In particular, rapidly advancing LLMs and generative AI technologies like ChatGPT are expanding the scope of this transformation both horizontally and vertically. Taking this into consideration, it is possible to say that an AI ecosystem has emerged very quickly.

Of course, the multipurpose applications of AI technologies have brought their risks into the center of public debate as much as their benefits. In this context, Mustafa Suleyman's book, *The Coming Wave: Technology, Power, and the Twenty-First Century's Greatest Dilemma* (Crown, New York, 2023) — Suleyman himself being a prominent entrepreneur in the AI field — helps us better understand the full dimensions of the massive wave brought by AI. As reviewed in the previous chapters, Suleyman particularly draws on Stuart Russell's "gorilla problem" approach to define what he sees as humanity's greatest challenge. Based on this perspective, he emphasizes that although gorillas are physically stronger than humans, humans have been able to control gorillas through their superior intelligence — and if an artificial general intelligence (AGI) emerges, this balance of power could be fundamentally altered.

Until today, many significant discussions have taken place on this topic. In these debates, Alan Turing's 1950 article and the question he posed, "Can machines think?", are generally regarded as the starting point. In Türkiye, a similar question was raised by our renowned mathematician Cahit Arf, who delivered a lecture in 1959 at Erzurum Atatürk University titled "Can Machines Think, and How Might They Think?". In this lecture, Arf explained with simple examples how repetitive operations could be performed by machines, both analog and digital. However, he emphasized

that even if the number of operations a machine could perform were greatly increased, "we would still not be able to regard it as an artificial brain."

In this context, he emphasizes the need to develop machines with "adaptive capability" — that is, machines capable of solving problems that were not anticipated when they were originally designed. To elaborate on this proposal, he explains how the brain performs its functions, the importance of memory, how data is processed, and how new situations are evaluated, illustrating these processes with a diagram. He stresses that a thinking machine should possess dynamics similar to those of the human brain. Most importantly, he asserts that this is indeed possible: "...While the human brain is capable of continuously improving itself through its own initiative, a machine remains as it was originally built. Nevertheless, it is possible to design a machine that can improve itself..."

Arf's aspiration has now become possible with today's AI technologies. AI applications that use real-world data as their training sets are capable of responding to new situations, and moreover, once deployed, they continue to learn through their interactions with their environment (both humans and machines), thereby further developing their memory.

Arf does not stop his reflections here; he takes the discussion one step further. He emphasizes that if a thinking machine is to be produced, it must, just like the human brain, "...be capable of receiving stimuli of an aesthetic nature, processing them, and making decisions of an aesthetic nature; and it must feel free to decide whether or not to perform a given task...". He points out that uncertainty lies at the foundation of these aspects. Today, we know that AI technologies are rapidly evolving toward autonomous systems capable of making their own decisions. Moreover, as these technologies become increasingly complex, the processes by which decisions are made are becoming more

opaque, and despite efforts to enhance accountability and transparency, the "black box" nature of AI technologies cannot be fully eliminated.

Even more interestingly, Arf refers to atomic dynamics as a way to instill this essential characteristic of "uncertainty" into machines: "...Thus, if the events occurring among a relatively small number of atoms could be made effective in the operation of such machines, it could be hoped that the machines would resemble the human brain also from an aesthetic standpoint...". I do not know whether this was exactly what Arf intended, but we are now at a turning point where the properties of the atomic world — namely, quantum physics — are being used in computation, with the development of quantum computing and its implementations to AI.

With the development of quantum computers, the computers we currently use are now classified as classical computers. Unlike classical computers, which use 0 and 1 bits, quantum computers utilize quantum bits (qubits) based on the fundamental principles of quantum mechanics. In this way, the characteristics of quantum mechanics are transferred to quantum computers: qubits can represent multiple states simultaneously (superposition), and the ability of qubits to be interlinked and correlate their states with one another (entanglement) increases the computational capacities of quantum computers. While classical computers perform each step of a computation sequentially, quantum computers can process these steps simultaneously. Moreover, the probabilistic nature of quantum computers allows them to generate the possible solution set to a problem, unlike classical computers, which operate deterministically. In short, Cahit Arf's 1959 foresight regarding the development of thinking machines has proven accurate and encompasses many of today's major advancements.

Artificial Intelligence Ecosystem and Deep Transformation

In recent years, AI technology has begun to permeate all aspects of life, particularly with generative AI applications like ChatGPT. These applications have expanded into nearly every field, from education to healthcare, biotechnology to the defense industry, and from the financial sector to the service industry. For instance, generative AI technology powered by LLMs, such as ChatGPT developed by OpenAI, has become an indispensable part of the lives of people of all ages who possess technological literacy. Humanity is now striving to coexist within a new technological ecosystem that competes with human intelligence itself.

With the emergence of the AI ecosystem, profound transformations are occurring across all domains. In this context, three potential effects of these transformations are becoming increasingly evident: the growing autonomy of AI systems and the decreasing ability to control them, the decline of individual autonomy alongside an increase in external control over individuals, and finally, the fundamental transformation of the labor market, leading to significant changes in skill sets required for job positions.

The most significant characteristic of AI technology is its increasing autonomy and ability to operate independently, gradually moving beyond human control. As autonomy grows, the capacity for human intervention weakens. This feature represents a novel aspect of AI-driven transformation, distinct from previous technological shifts. Consequently, we are faced with a challenging question: *What will await humanity if AI technologies achieve full autonomy?* As the scale of this threat expands, it increasingly becomes a matter of national security.

Another key characteristic is the increasing controllability of individuals as AI technologies become more widespread. Initially, developed models and algorithms were used solely for

their intended purposes. In other words, each model operated in isolation. Even at this stage, significant bias issues emerged, producing outcomes that exacerbated inequalities. However, as the AI ecosystem has expanded, models have started to interact with one another. Now, the output of one model can serve as the input for another. For example, models used to assess credit applications initially relied solely on individuals' credit history data. Over time, these models have begun integrating outputs from other models used for entirely different purposes, such as education and healthcare. As a result, the data generated by an individual in one context can now feed into multiple models, shaping decisions in various domains. Ultimately, factors such as socioeconomic status, neighborhood of residence, gender, race, religion, and culture influence AI-driven decisions, effectively determining an individual's fate. In other words, an individual's past increasingly dictates their future, making it progressively harder for disadvantaged groups to break free from this destructive cycle.

Deep Transformation in the Labor Market

The most significant impact is being felt in the labor market. Initially, optimistic perspectives were adopted regarding AI, much like previous technological disruptions. In past technological shifts, the emergence of new job positions often compensated for those that were lost, leading to initial optimism about AI-driven transformations as well. However, this optimism is gradually fading, giving way to more pessimistic forecasts. The exponential advancement of AI technologies, along with their multi-purpose applications, is driving widespread automation, negatively impacting employment. At the same time, these developments are increasing the potential for AI to fill newly created job roles as well. Now, even white-collar professionals are facing a serious threat.

Therefore, the rapidly evolving AI ecosystem is driving significant changes in skill sets within labor markets. In this context, according to the *World Economic Forum's (WEF) Future of Jobs Report 2025*, fundamental skills expected from employees are projected to undergo major shifts between 2025 and 2030. The report highlights technological skills as a top priority, with AI and big data emerging as the fastest-growing competencies. In other words, the report anticipates a substantial increase in AI and big data skill expectations across all key industries, though at varying levels.

Fierce Competition in Artificial Intelligence and the DeepSeek Effect

Around the world, countries and economies are making massive investments in AI technology in order to be able to compete on the global stage. In particular, the intense competition between the US and China in various fields has recently escalated in the realm of AI as well. Both nations are pouring vast budgets into AI development, aiming to become pioneers in the field and maximize their economic benefits. For instance, China is investing in AI across four key sectors—medicine, automotive, manufacturing, and software—with the goal of generating an additional $600 billion in economic value by 2030. Examining AI-related patent filings also provides valuable insights into which countries are making significant progress in this competition. As mentioned before, in 2021, the companies holding the most AI patents were IBM, Google, Intel, Microsoft, Baidu, Tencent, and Huawei, indicating that the dominance in AI is largely concentrated between the US and China. A similar push is evident in higher education: Leading universities around the world have recently made substantial investments in AI education and research, further fueling this global competition.

While ChatGPT continues to dominate the AI landscape, last week saw a major counterattack from the Chinese startup DeepSeek, shaking up the market. DeepSeek's AI assistant is claimed to outperform its equivalents while being more cost-effective, a claim that has naturally disrupted the industry. The DeepSeek-V3 and DeepSeek-R1 models have been praised by engineers from US tech companies, with some noting that their performance is on par with the most advanced models from OpenAI and Meta. This has significantly increased demand, and in a surprising turn of events, the new application surpassed ChatGPT, becoming the most downloaded free app on the Apple App Store in the US and the UK within a short time.

What makes this development even more intriguing is that DeepSeek achieved this success using lower-powered AI chips, despite US efforts to restrict China's access to high-powered AI chips due to national security concerns. This suggests that China's AI sector is adapting to these restrictions more effectively than expected. As a result, US stock markets, where the technology sector holds significant weight, experienced a sharp decline. Nvidia (NVDA), the leading supplier of AI chips, lost approximately $600 billion in market value, while its competitors—Marvell, Broadcom, Micron, and TSMC—also suffered substantial losses. Similarly, energy companies, which had seen their stock prices surge due to the massive electricity demand of AI data centers, were also caught in the downturn.

Despite DeepSeek’s success, questions remain about whether its lower cost claims are truly justified. Additionally, while it is noted that DeepSeek adheres to China's official narrative, reports suggest that certain techniques can be used to bypass censorship. Moreover, discussions around whether DeepSeek poses a national security risk in terms of data security are gaining traction in various countries. While these concerns have primarily

focused on China-based platforms, similar data security and privacy risks apply to AI platforms from other countries as well.

In summary, the competition in AI has entered a new phase with DeepSeek, challenging U.S. dominance in the field. This development has also 'sparked hopes of a new wave of innovation in AI, which had appeared to be dominated by US tech companies reliant on huge investments in microchips, datacentres and new power sources' (https://www.theguardian.com/technology/2025/jan/28/experts-urge-caution-over-use-of-chinese-ai-deepseek). This optimism also applies to our country, Türkiye. It is crucial for the country not to remain a passive consumer of AI technologies but to position itself among the leading developers. Strengthening Türkiye's presence in AI development is essential for its strategic ambitions and global competitiveness. In recent years, Türkiye has significantly increased its production capacity in high-tech industries, indicating a strong potential to advance in AI technology development as well. By leveraging this momentum, Türkiye can take a more active role in the AI ecosystem, shaping the future rather than merely adapting to it.

Quantum Computers and Artificial Intelligence

As we discussed briefly in previous chapters, supercomputers approach the limits of their processing power, and quantum computers are eliminating these boundaries. Unlike classical computers that use bits of 0 and 1, quantum computers operate using quantum bits (qubits), which are based on the fundamental principles of quantum mechanics. Qubits can represent multiple states simultaneously (superposition), offering advantages in data storage and enabling the execution of multiple operations at once.

Furthermore, the ability of qubits to work in an interconnected manner and to correlate their states with other qubits (entanglement) significantly enhances the processing capacity of quantum computers. Therefore, while classical computers perform each step of a computation sequentially, quantum computers can carry out these steps simultaneously. For example, while eight bits in a classical computer are sufficient to represent any number between 0 and 255, eight qubits in a quantum computer can represent all the numbers within that range simultaneously. Moreover, due to the property of entanglement, just a few hundred entangled qubits can represent more numbers than there are atoms in the universe.

Thus, quantum computers can perform far more complex operations much faster than classical computers. Moreover, unlike classical computers that operate deterministically, the probabilistic nature of quantum computers allows them to generate the possible solution space of a given problem. A quantum computer can complete in minutes a computation that would take conventional computer thousands of years to solve. Therefore, quantum computers hold the potential to solve complex problems that supercomputers cannot solve fast enough.

There are, of course, costs associated with such great potential. Beyond the challenges of design, the delicate nature of qubits requires a highly controlled environment to achieve such performance—one that is vibration-free, shielded from magnetic fields, interference-free, and extremely cold. Moreover, in order for quantum computers to deliver their expected benefits, a large number of qubits is needed. However, as the number of qubits increases, it becomes increasingly difficult to maintain the stability of the quantum computer.

A Strategic Asset

The advantages that quantum computers offer in understanding the behavior of highly complex systems—especially those without linear relationships between their components—and in solving similarly complex problems make them significantly more important. In particular, their potential impact on cryptographic systems could lead to new breakthroughs in the field of cybersecurity. Moreover, quantum computers hold the potential to address major complex challenges—from the development of new pharmaceuticals, improving the accuracy of decisions in financial operations and weather forecasting systems, enhancing diagnosis and treatment processes in medicine, to enabling more effective carbon capture methods to combat climate change. These capabilities make the quantum computer a strategic asset for nations.

For this reason, countries have long been striving to gain access to quantum computers. In this context, nations such as the United States, China, Germany, the United Kingdom, Canada, and Japan have begun to use quantum computers by making massive investments in the field. It has already become apparent how even a small number of qubits can create new opportunities in various domains. These promising developments are also

encouraging further initiatives aimed at improving quantum computers.

AI is among the foremost fields poised to be transformed by quantum computing. Considering what AI technologies are already capable of with classical computers, the combination of this capacity with quantum computing could mark a historic turning point. In particular, the reduced need for parameters and data in AI and ML applications could exponentially accelerate developments in AI, which has already formed a thriving ecosystem. For instance, a quantum-based model can achieve the same level of accuracy as a classical neural network model that uses 59,000 parameters, by using only 60 parameters—and it also requires a significantly smaller training dataset (https://www.nature.com/articles/d41586-023-01692-9). As a result, AI will not only improve in speed and efficiency, but may also develop entirely new capabilities, especially in the context of its vast potential for multipurpose uses.

Research on quantum AI is already progressing at an intense pace. For instance, Jonathan Reichental notes that companies like IonQ and Hyundai are already exploring the use of quantum AI to process images such as road signs, and that Google is investigating the development of hybrid quantum-classical AI models. In describing the transformation that could result from the convergence of AI and quantum computing, Reichental emphasizes that even the word *"transformation"* might fall short of capturing its true magnitude (https://www.forbes.com/sites/jonathanreichental/2023/11/20/quantum-artificial-intelligence-is-closer-than-you-think/).

Therefore, the strengthening of AI technologies—which already have a wide range of applications from education to healthcare, from the financial sector to service industries, and

from biotechnology to defense—through quantum computing will carry societies into a profoundly different world. As computational mathematician Steve Brierley, founder and CEO of the Cambridge-based quantum computing firm Riverlane, points out to highlight the long-term potential of the technology: *"Short-term expectations are somewhat exaggerated, but long-term expectations are certainly underestimated."* (https://www.nature.com/articles/d41586-023-01692-9).

The quantum computer—now a highly strategic technology—has finally been produced in our country, Türkiye. The 5-qubit quantum computer, introduced on November 21, 2024, was developed by TOBB University of Economics and Technology (TOBB ETÜ). Considering that developed countries have started to impose export bans on the technological components that support quantum computer production, the fact that such a strategic product has been developed domestically by a university represents a highly strategic step for our nation.

Considering that quantum computing is expected to become a $1.3 trillion industry by 2035 (https://www.ibm.com/topics/quantum-computing), taking early steps to develop and produce the strategic technologies behind quantum computers domestically will be highly strategic for enabling our country to secure a share in the quantum technology market and to enter the market at an early stage. Moreover, taking additional steps now to cultivate a skilled workforce in the field of quantum technologies will significantly contribute to the emergence of a new ecosystem in quantum computing.

Impact of Chatgpt on Scientific Writing

AI technologies now encompass all aspects of our living spaces. Particularly, generative AI (GAI) technologies like ChatGPT, supported by LLMs, have started being used by millions of people shortly after becoming accessible, indicating that their application potentials cover a wide range of areas. GAI technologies, using LLM and deep learning, easily produce consistent responses (text, image, or video) with user prompts. These features of GAI and its ease of content creation have allowed these tools to rapidly find a place in fields such as education, media and journalism, healthcare, accounting, finance, and customer support services (İlikhan et al., 2024; Özer, 2024; Özer & Perc, 2024; Pavlik, 2023; Perc et al., 2019; Septiandri et al., 2023).

AI technologies like ChatGPT and Bard have introduced a new dimension to text content creation with options for generating text, correcting existing text including, shortening, expanding, and rephrasing sentences. People of all ages and professions can now use these platforms to produce short and long texts with a single command. Interlingual translations can also be easily performed. Moreover, these tools analyze the text and offer suggestions on grammar, punctuation, and style, thus supporting writers in improving their writing (Carobene et al., 2024). Therefore, GAI attracts authors, journalists, researchers, and academics with its abilities to generate new text content, improve grammar and vocabulary, quickly review literature, translate text into various languages, follow articles in different languages without language barriers, suggest new research ideas, synthesize large amounts of information, recommend statistical tests, and write code (Ganjavi et al., 2024). In this context, ChatGPT can generate article content, write editorials, and be used to summarize articles (Aghemo et al., 2023). It can develop suggestions to improve draft texts built on the initial ideas of writers. In the field of media and journalism, GAI is extensively

used for news writing, academic writing, summarization, and news production for specific groups. For instance, news organizations like the Associated Press use GAI broadly in various areas such as news gathering, news production, and news distribution (Pavlik, 2023). Furthermore, GAI tools now offer a collaboration opportunity that goes beyond supporting writers, advancing knowledge in their research, guiding ideas, and explaining them (Polonsky & Rotman, 2023).

A significant number of articles about the potential benefits of ChatGPT have been published in a short period. There are even articles co-authored by ChatGPT. The opportunities provided by ChatGPT have started to be widely used by scientists at different stages of the article production process. In the first systematic analysis conducted to measure the prevalence of LLM-modified content on various academic platforms, the abstract and introduction sections of a total of 950,965 articles published across various academic disciplines, including the arXiv, bioRxiv, and 15 journals from Nature portfolios, between January 2020 and February 2024, were examined (Liang et al., 2024). This analysis found a sharp increase in the proportion of LLM-modified content in these sections after the release of ChatGPT. The greatest increase was observed in articles in the fields of computer science, electrical engineering, and systems science, while the least increase was observed in mathematics articles and journals within the Nature portfolio.

On the other hand, it has been shown that while 63% of the summaries generated by ChatGPT are detected by journal reviewers, 37% are not (Thorp, 2023). This opens the door to misuse and unethical practices. Furthermore, while focusing on article production, the use of these tools in the peer review process for articles submitted to scientific journals has been relatively overlooked. It is observed that GAI is widely used

in peer review processes, which are critical for evaluating the originality and contribution of an article and providing significant contributions to the development of the article. However, when human reviewers use these tools to replace their own contributions rather than assist them or enhance the quality of their input, reviews that are irrelevant to the article or an increase in plagiarism can occur. Thus, concerns about the proper conduct of the review process are increasingly growing. Particularly, the rise of open access and predatory journals makes this critical process even more challenging (Carobene et al., 2024). For example, a research group investigated plagiarism in the reviews of two different articles they submitted to reputable journals and found similarities ranging from 44% to 89% in three out of four reviews for the first article, and from 44% to 100% in two out of three reviews for the second article (Piniewski et al., 2024). Therefore, both the creation and writing of a scientific article and its review process can lead to ethical violations and include plagiarism.

Therefore, this rapidly evolving process has brought about heated and ongoing ethical discussions regarding the use of GAI in academia. The issue centers on how to express ChatGPT's contribution and who will take responsibility for this contribution. In other words, can ChatGPT approve the publication of the research, and when published, can it assume responsibility for the article? In articles where ChatGPT is a co-author, has ChatGPT approved the publication of the article, and how will it be held accountable?

In this context, the first article discussing concerns about the use of ChatGPT in academic writing was published in Nature at the end of 2022 (Stokel-Walker, 2022). Scientific journals and publishing groups are now debating what ChatGPT's contribution could be in article production or whether ChatGPT

should be considered an author. It is expressed that ChatGPT cannot take responsibility for the content and integrity of scientific articles and therefore, cannot be considered an author (Stokel-Walker, 2023). Hibbert and Wright (2023) point out that one aspect of responsibility is related to the process of uncovering hidden assumptions embedded in texts/data through reflexive critical thinking. Conversely, GAI not only fails to uncover these hidden assumptions but reproduces biases present in texts/data, thus lacking this dimension of responsibility (Lindebaum & Fleming, 2024). Similarly, the highly respected journal Science has explicitly stated that text, figures, images, or graphics generated by ChatGPT or such tools cannot be used in articles (Thorp, 2023).

A study examining the policies of academic journals and publishers toward GAI has shown that among publishers and journals providing guidance on the use of GAI, the inclusion of GAI as an author is prohibited at rates of 96% and 98%, respectively (Ganjavi et al., 2024). The main argument in this context is that AI tools are considered legally undefined entities (Ganjavi et al., 2024). Consequently, these tools cannot be held responsible for authorship or for carrying the responsibility of the written text or work.

Although it is expected that the efficiency, effectiveness, and quality of scientific publications will increase with the use of these highly capable assistants, leading to a more enriched environment for scientific research and discovery (Carobene et al., 2024), distinguishing between inspiration and imitation in content production based on extensive training sets remains a significant challenge (Carobene et al., 2024). The demonstration of a closer relationship among articles with LLM modification suggests that GAI reduces text diversity (Liang et al., 2024). While GAI promises efficiency gains, it simultaneously suppresses core

values of academic research such as reflexivity and responsible knowledge production. Moreover, warnings are issued that academics who advocate for and use ChatGPT may be complicit in the demise of the homo academicus (Lindebaum & Fleming, 2024).

On the other hand, how will the contribution of ChatGPT be attributed when it is not considered a co-author? In this context, Jenkins and Lin (2023) point to two indicators to measure the contribution to the product: continuity and creditworthiness. The continuity indicator refers to how much of GAI's contributions are carried over or reflected in the final product created by the human author(s), similar to how contributions of human authors are individually specified at the end of articles in some journals. The creditworthiness indicator, on the other hand, indicates whether the product is deemed worthy of credit for human authorship. If the product is deemed creditworthy and the continuity indicator (how well GAI's contribution is reflected in the final product) is high, then in the absence of considering GAI as a co-author or explicitly stating its contribution, all credit will go to the human author(s).

Acknowledging the contribution of GAI in the methods or acknowledgment section of the produced content can mitigate this inequality to some extent and encourage responsible usage. In this context, some journals include ChatGPT's contribution in the methods or acknowledgment sections, while others have created new, dedicated sections specifically addressing AI usage (Lund & Naheem, 2023). For example, 37.6% of scientific journals in the nursing field explicitly demand the disclosure of GAI tools or AI-supported technologies used in the writing process, while 36.8% clearly state that GAI tools or AI-supported technologies should not be listed as authors or co-authors (Tang et al., 2024). The study also suggests that reviewers should disclose whether

AI tools were used in their evaluations. Another study proposes publishing peer reviews alongside articles (Piniewski et al., 2023).

In a study examining the usage policies of 300 high-impact factor journals regarding GAI, it was found that 58.7% of journals have a policy in place (Lund & Naheem, 2023). Among journals with a policy on GAI usage, 96.6% permit the use of ChatGPT to enhance the quality of articles. However, nearly all policy documents (98.9%) explicitly state that GAI like ChatGPT should not be included as authors in the author list. Therefore, the general approach is not to include GAI tools as co-authors in articles, but to clearly specify their contributions and ensure that all responsibility for the article rests with the human authors.

On the other hand, the use of ChatGPT as a tool for writing scripts for films or television shows has sparked a new debate, expanding the scope of ethical considerations to include discussions on whether the data used for training these tools falls under copyright protection. In this context, the Writers Guild of America emphasizes that the use of previous writings in training AI algorithms should be considered within the framework of copyright law. Otherwise, authors are left vulnerable and their labour is not protected when their previous works are used as raw material to train algorithms developed by others (Calacci, 2023). Unions advocating for the recognition of labor in producing previous texts as copyright material highlight this issue as a critical matter in discussions and negotiations related to GAI. A similar situation has recently been underscored in copyright infringement lawsuits brought by major music companies like Sony Music and Universal Music Group against companies using AI technologies for music production. If these lawsuits result in rulings against AI companies, the aftermath could extend beyond compensation payments. It may spark complex discussions on copyright and ethical violations concerning products created

with the assistance of these tools. Therefore, ethical issues related to GAI are two-dimensional. The first is the ethical concern of using content not generated by the author(s) themselves, while the second pertains to whether the training dataset used in the learning phase of GAI falls under copyright protection.

Beyond ethical considerations in the use of GAI tools, there are other issues as well. One of the foremost concerns is that these tools can generate fictional content as a result of a behavior termed as hallucination or fabrication (Ji et al., 2023). This phenomenon manifests in article production as well, where references cited in the generated text often do not actually exist (Tam et al., 2023). On the other hand, especially in journalism and media, GAI tools' ability to generate new content like text, audio, or visuals makes it difficult to distinguish from reality, thereby facilitating the creation and rapid dissemination of misleading news (Pavlik, 2023). Furthermore, these types of tools can reproduce biases based on religion, culture, gender, race, and socioeconomic status present in the training data through which they learn (Özer et al., 2024a; 2024b). Therefore, the risks associated with the generated texts can be quite complex.

The performance gap between those using GPT tools for article generation and those without may be another issue, as observed in a number of industries. It is observed that researchers who publish more tend to use LLMs more intensively (Liang et al., 2024). In other words, considering the benefits provided by GAI, authors actively using these tools continuously increase their advantages, while non-users may find themselves at a disadvantage. This situation could exacerbate inequalities among authors (Lund & Naheem, 2023).

Another area of concern relates to young scientists. The ecosystem that traditionally required years of apprenticeship and

mentorship to cultivate scientists is undergoing transformation. Young researchers now have access to numerous tools that accelerate their training and paper writing processes. For example, a study on the impact of ChatGPT on writing efficiency showed significant improvements in the speed and quality of writing outputs, with the least skilled writers benefiting the most (Noy & Zhang, 2023). In other words, these tools offer greater developmental opportunities to young scientists compared to senior researchers. In another workplace study, it was demonstrated that novice employees starting a job reached expected competency levels much faster with the aid of these tools (Brynjolfsson et al., 2023). Therefore, these tools also hold significant potential to provide similar benefits and increase productivity for young scientists.

However, there are serious risks associated with these tools, such as ethical violations they may cause or the danger of relying too heavily on them, which could lead to a lack of skills in verifying and critically evaluating the results produced by these tools (Carobene et al., 2024). The pressure on young scientists to "publish or perish" can potentially lead them towards ethical violations. The ability of GAI tools to make changes and reproduce texts exposed to plagiarism by altering expressions poses the greatest challenge for similarity detection platforms, potentially encouraging this unethical trend. Particularly with AI chatbots like ChatGPT capable of generating multiple versions of any sentence, the situation becomes quite challenging (Piniewski et al., 2024). In this context, ethical lapses young scientists might commit early in their careers could follow them throughout their lives, damaging their reputations.

In sum, it is clear that GAI tools have the potential to assist authors and academics in enhancing their productivity to higher levels. However, it is also evident that along with the benefits provided

by GAI tools, they bring along a wide range of risks. Once the AI genie that supports scientific research and text production is "out of the bottle" (Polonsky & Rotman, 2023), putting it back seems quite difficult. Therefore, it is crucial to take measures that respect ethical principles and use AI tools not as substitutes but as supporters and enhancers of scientists and authors. In this context, the indispensable and irreplaceable role of human oversight should be emphasized, particularly in verifying and interpreting the contributions made by these tools. Furthermore, in this evolving transformation, the role of reviewers has become even more critical. A mechanism should be developed for rewarding reviewers for their vital contributions, similar to that for article production and citations, to ensure the originality of articles and to maintain academic integrity (Carobene et al., 2024). On the other hand, it should be noted that many reputable scientific journals and publishing groups emphatically prohibit GAI from being listed as an author, emphasizing that scientific article production is inherently a responsibility of humans. They require that GAI's contributions be explicitly stated. In short, while discussions and attempts to converge on different approaches to the issue continue, there appears to be nearly a consensus that GAI should not be considered a co-author but its contributions should be clearly acknowledged in the article or final product.

Artificial Intelligence and the Future of Education

The rapid advancement of AI technologies is directly affecting all fields. The massive wave brought by AI is pushing culture toward a fundamental transformation in every domain, far beyond previous technological disruptions, while also increasing risks. Therefore, improving AI literacy will not only enhance awareness of its benefits but also its risks.

Education systems are among the primary fields facing the challenges posed by AI technology. There are two challenges that education systems must address. The first dimension concerns the transformation occurring within the education system itself due to AI technologies, while the second dimension relates to how human capital will be trained for existing or new professions in response to the rapid changes AI technologies bring to skill sets in labor markets. Educators are under considerable pressure to address both challenges. This article focuses solely on the impact of AI technologies on the first dimension within the education system.

Especially with GAI technologies like ChatGPT and DeepSeek, LLMs can now generate content, organize texts in different formats, and translate between languages. As a result, the options available to teachers for enriching educational environments with AI-assisted supplementary materials have significantly expanded and diversified. Teachers can rapidly generate various types of content related to their lessons and use them in classroom settings. In this new landscape, the workload of teachers is undergoing a fundamental shift. While conventional tasks are decreasing, they must focus more on the individual development of each student. A further advantage of this technology is that it has the potential to transform the traditional learning environment into an environment that is more innovative and interactive.

Thanks to this technology, teachers can automatically evaluate assignments and provide feedback to students much more quickly. Although there are still many shortcomings, AI systems offer various options for assessing students' assignments and assessments. In particular, open-ended questions can be generated, and rapid feedback can be obtained. Moreover, automated or semi-automated assessment systems can be developed to provide feedback aimed at improving students' learning outcomes.

New Opportunities for Personalized Learning

A range of AI applications outside the field of education have demonstrated that these technologies increase the productivity of low-performing employees in businesses, ultimately narrowing the performance gap between low- and high-performing employees and tightening the productivity scale as a whole. A similar effect is expected to apply to education systems as well. In other words, AI-driven tools have the potential to reduce one of the most significant challenges in education: the disparity in students' academic achievement. In this context, personalized learning emerges as a key solution. With AI support, students can access supplementary content tailored to address their weaknesses under the guidance of their teachers, enabling educators to closely monitor each student's individual progress.

GAI systems are also influencing foreign language education. Not only are students gaining access to a wider range of support platforms for learning new languages, but teachers also have more opportunities to enrich their instructional materials. In particular, AI-powered tools for correcting texts in foreign languages are becoming widely used, with ChatGPT further expanding these options. Similarly, AI systems are opening new

frontiers in artistic fields such as poetry, music, and visual arts, enhancing the potential to enrich education in these areas as well.

Increasing Risks

As in other fields, AI systems bring not only benefits but also risks to education. Beyond concerns about data privacy, the most significant risk is that the content generated by these systems is not always accurate and often contains biases. The phenomenon of AI generating incorrect or fabricated content is commonly referred to as AI hallucination. When AI hallucinates, it produces responses that may appear convincing and internally consistent within the text but are entirely fabricated and disconnected from user input or prior context. As a result, while AI-generated responses may seem reasonable, they can sometimes be misleading or incorrect. For this reason, students must approach automatically generated content with caution. Otherwise, there is a risk of reinforcing the false perception that all information produced by such systems is inherently accurate.

On the other hand, biases present in the training datasets used by these systems during the learning phase are directly reflected in their outputs. In other words, AI systems reproduce biases related to religion, gender, race, culture, and other factors embedded in the data they are trained on. As a result, not all information generated by AI systems can be assumed to be up-to-date, accurate, unbiased, or reliable. Therefore, it is crucial for students and teachers to be highly aware of these limitations and potential risks.

Similarly, education administrators also have increased opportunities to leverage AI in closely monitoring educational processes, enabling early intervention and effective guidance. However, the most significant risk in this context is the potential for biased outcomes that could further deepen existing inequalities.

Therefore, when making projections, education administrators must remain aware of these risks and always approach AI-generated results with caution and critical evaluation.

One of the major challenges in the use of AI systems in education is the frequent deviation from ethical principles. A particularly concerning issue is that students may rely entirely on these systems to complete their assignments and projects, leading to various forms of academic distortion. First, this type of ethical violation creates a misleading assessment, making underperforming students appear successful, which results in inaccurate measurement and evaluation. Therefore, students who utilize these systems unethically may risk receiving unfair rewards. Second, when a student appears successful despite lacking the necessary competencies, their actual struggles remain hidden. As a result, they may advance through educational stages without receiving early intervention or remediation opportunities.

Moreover, such tendencies contribute to the normalization of unethical behaviors among students and undermine respect for effort and hard work. In the long term, this could have serious consequences for the development of a skilled and competent workforce. Therefore, new approaches are needed to accurately measure and evaluate students' performance while accounting for the role of AI systems, ensuring that genuine effort is recognized and fairly assessed.

In summary, AI technologies in education should not be seen as systems that replace individuals or disregard personal responsibility, but rather as supportive and complementary tools. Ensuring a balanced approach requires ethics-based AI literacy, which is essential for recognizing both the opportunities and risks associated with AI in education. By enhancing AI

literacy among students, teachers, and education administrators, the effective and responsible use of these technologies can be promoted while increasing awareness of potential risks, particularly ethical violations.

The Impact of Artificial Intelligence on the Labor Market and Deeping Inequalities

AI applications are profoundly affecting all areas of life and, unlike previous major technological transformations, have quickly created their own ecosystem. AI is now actively used in education, healthcare, the financial sector, justice and security systems, higher education, media and journalism, the defense industry, the pharmaceutical industry, and especially in the field of biotechnology. The fact that generative AI technologies such as ChatGPT and DeepSeek reached millions of users shortly after becoming accessible has taken this transformation to a whole new level. Therefore, compared to past major transformations, humanity is, for the first time, encountering a technological shift that spreads so rapidly across all domains of life, as is the case with AI.

While the rapid transformation driven by AI technologies is often discussed in terms of its benefits and advantages, the associated risks receive considerably less attention. Chief among these risks are concerns about data privacy and individual freedoms. As AI technologies become more widespread, people are increasingly vulnerable to technological manipulation. Meanwhile, AI technology appears to be contributing significantly to the escalation of existing social inequalities. For instance, studies have shown that AI systems in healthcare produce biased outcomes, further disadvantaging socioeconomically marginalized groups who already face difficulties in accessing health services. Similar findings have emerged in the fields of education, justice, and security. In short, biases embedded in the data used during the training phase of AI systems, or in the assumptions underlying the algorithms themselves, are reflected in the outcomes of these systems—thus reinforcing and exacerbating existing social inequalities.

Therefore, to develop AI systems in a way that does not exacerbate inequalities and remains sensitive to social values, it is

necessary to build a participatory and responsible AI ecosystem that does not leave these technologies solely at the mercy of corporations but instead includes all stakeholders affected by each application in the development process. A sole focus on stakeholder participation during the development phase of AI systems is insufficient. Since AI systems have the capacity to learn autonomously and change their behavior through interactions with humans and other AI systems once deployed, their behaviors must also be continuously monitored during implementation.

Another concern regarding AI technologies is that, although these technologies increase efficiency and economic returns, the benefits are not fairly distributed across all segments of society; on the contrary, a significant portion of the gains is concentrated in a small number of companies or countries that produce these technologies and control the AI ecosystem. Consequently, without preventive measures, economic inequalities within societies are likely to deepen. Labor markets will probably be the most affected by this situation. In previous major technological transformations, while certain tasks in the human-machine relationship were transferred to machines, new professions also emerged, allowing for a degree of balance in employment. While humanity has similar expectations regarding the technological transformation fueled by AI, recent studies indicate that without preventive measures, many professions will cease to exist while fewer new jobs will be created, potentially resulting in a massive wave of unemployment throughout societies.

Of course, every major technological transformation leads to significant changes in the skill sets required for professions. In this context, while some professions disappear, those that remain cannot continue with the same skill sets and are subject to substantial transformations. New professions compatible

with major technological change may also emerge, but the skill expectations for these new positions are typically quite high. For example, in China, AI companies often require a PhD in a relevant field and at least three years of experience for most positions. Moreover, many companies not directly related to AI also prefer to employ individuals with AI skills. Therefore, workers in the labor market are not affected equally by such large-scale transformations and must cope with differentiated impacts based on the skill levels of their human capital. The extent of disadvantage is not solely related to the disappearance of professions due to technological transformation, but also to the increased competition and falling wages resulting from displaced workers seeking employment in lower-skilled jobs.

Countries are also subject to similar circumstances. Nations that do not produce AI technologies or fail to invest in this field will, in the long run, have to confront a persistent upward trend in unemployment rates. For this reason, countries like China and the US are making massive investments in AI technologies to become leaders in the field and thereby maximize their economic returns. For example, China aims to generate an additional $600 billion in economic value by 2030 by investing in AI technologies across four key sectors: healthcare, automotive, manufacturing, and software. In such countries, the potential of AI technologies to create new job positions is also increasing. Examining patent activities in the field of AI provides important insights into future monopolization trends. In 2021, the companies with the highest number of AI-related patents were IBM, Google, Intel, Microsoft, Bosch, Siemens, Baidu, Tencent, and Huawei—indicating that monopolies are likely to cluster around countries like the US, China, and Germany. A similar breakthrough is also visible in higher education. Leading universities around the world have recently made significant investments in AI education and research.

There are two distinct pathways through which AI technologies may impact labor: the automation pathway and the human-complementary pathway. The automation pathway rapidly removes tasks exposed to automation from human responsibility, thereby eliminating many professions. In other words, technology substitutes human labor. Although this pathway—greatly strengthened by AI—increases productivity and economic returns, it does not show the same effectiveness in generating new jobs. As a result, it carries the potential to deepen unemployment and increase social unrest. To minimize the adverse effects of this wave, the alternative human-complementary pathway stands as a viable option. This alternative allows for a more balanced utilization of the benefits of automation, while also enabling more equitable growth by reducing skill disparities through the use of these technologies.

In this context, the fact that GAI technologies can enhance productivity across many sectors—and that their impact is particularly stronger on low-skilled groups—presents a significant opportunity. It has been shown that these technologies can lead to notable improvements in overall productivity by increasing the efficiency of low-performing workers. In contrast, the impact on high-skilled workers appears to be quite limited. Moreover, studies have shown that such technologies can help novice employees and apprentices acquire the necessary competencies in the workplace much more quickly. In other words, GAI technologies improve the distribution of productivity in favor of low-performing workers. Additionally, AI technologies can complement humans by supporting employees in performing their tasks with higher quality and enabling them to take on new, value-added responsibilities. Therefore, rather than focusing solely on human substitution (the automation pathway), using these technologies in a way that supports human development

and compensates for human limitations can not only help reap the benefits of automation and enhance productivity but also mitigate the negative impacts on employment.

Naturally, the tendency of firms to make massive investments in AI technologies is to strengthen the automation pathway. As automation increases, employment will contract, and companies will no longer need to deal with labor unions. The alternative pathway, which prioritizes employment and the complementarity of humans, is therefore not attractive from the perspective of firms. For this reason, it is crucial for governments to act proactively and prioritize employment-oriented regulations through new policy measures in order to maintain social cohesion.

One of the key steps to be taken in this context is the development of new approaches in education systems that enable skill transfer. Through such mechanisms, individuals whose occupations have contracted or disappeared can acquire new skills through short-term training programs, thereby increasing their resilience to the rapid transformations in the labor market driven by AI. As skills in the AI ecosystem are subject to constant dynamic change, it is of critical importance to establish educational mechanisms that continuously develop, update, and adapt individuals' skills to new conditions—and to ensure that access to these trainings is as free and widespread as possible in order to reduce social inequalities. In other words, lifelong learning is no longer a choice but a necessity. Otherwise, individuals with a certain level of skills will, in an environment of constant skill transformation, be forced to seek employment in jobs requiring lower skills without having updated their competencies—leading to a continuous expansion of the labor pool available for low-skilled jobs, and consequently, to a persistent decline in wages.

Finally, it is essential to emphasize the importance of

comprehensive investments in enhancing AI literacy. In order for all the above-mentioned processes to be implemented effectively, individuals' AI literacy must be enhanced. The greatest responsibility in this regard falls on education systems. Just as inequalities in digital literacy have created serious issues, inequalities in AI literacy within the new ecosystem will also pose significant risks. Strengthening the human-complementary pathway likewise requires improved AI literacy. Moreover, AI literacy will contribute to raising awareness of the risks associated with these systems and help foster greater social sensitivity.

Can Artificial Intelligence Be Used to Complement Humans in the Labor Market?

As AI becomes more widespread, fundamental transformations are occurring in processes and the skill sets of the workforce across all affected domains. In particular, concerns in labor markets are growing due to the expectation that the expansion of this technology may lead to job contractions. The advancement of artificial intelligence is not only taking over positions that have been subject to automation but also performing nonroutine cognitive tasks such as abstract reasoning, prediction, and judgment. As a result, this concern extends from whether existing employees can retain their positions to whether new graduates can meet the expected skills in their job searches. Naturally, these trends vary depending on the economic and labor market dynamics of different countries. However, this uncertainty and apprehension are pushing many businesses, even those not directly related to AI, to prioritize hiring individuals with AI-related skills.

When these technologies continue to progress with their current fluidity, the concerns being felt are highly justified. This is because AI rapidly takes over roles susceptible to automation across all professions and job positions. Consequently, business processes and job roles are being redefined, workforce displacement within organizations is increasing, and ultimately, the number of employees losing their positions is rising. As traditional job roles decline, the skill expectations for new job positions are continuously increasing. For example, in China—where significant investments are being made to lead in this field—many companies now require a PhD degree for hiring, rather than simply valuing experience. As this trend strengthens, employees with low and medium skill levels are being displaced by advancing automation. Since they lack the high-level skills needed to match emerging job positions, they are pushed out of the labor market. If fewer but highly skilled employees become

sufficient for new business processes, the human-machine balance in the labor market will shift to the detriment of human employees.

On the other hand, recent studies indicate that the potential for these technologies to complement human labor presents a highly promising alternative path (Özer & Perc, 2024). In this context, GAI technologies have been shown to lead to significant improvements in employee performance, particularly by enhancing the productivity of lower-performing employees, ultimately resulting in notable gains in overall efficiency. For instance, a study conducted using GitHub Copilot, a generative AI-based programming assistant, demonstrated that the experimental group with access to Copilot completed programming tasks approximately 56% faster than the control group without access (Peng et al., 2023). Subsequent studies have made it even clearer that AI's positive impact is not distributed homogeneously across all employees.

In this context, one of the first studies examining the effects of GAI tools analyzed data from 5,179 customer support representatives to investigate the impact of a GAI-based chat assistant on employee performance (Brynjolfsson et al., 2023). The study found that the AI-powered chat assistant increased productivity by an average of 14%. More interesting findings emerged when analyzing how this improvement varied based on employees' skill levels. The impact differed across skill levels, with newly hired and lower-skilled employees experiencing a productivity increase of 34%, significantly above the average, while the effect on experienced and highly skilled employees remained minimal. In other words, the positive impact of GAI on employee productivity diminishes as experience and skill levels increase.

Another study examining the impact of ChatGPT on writing tasks performed by university-graduated employees, such as press releases, short reports, and analysis plans, found that ChatGPT significantly increased writing speed by 40% and output quality by 18%. However, the study also showed that the greatest benefits were observed among lower-skilled writers (Noy & Zhang, 2023). A similar study on management consultants found that employees using this technology not only completed 12% more tasks but also reduced task completion times by 25% while improving output quality by more than 40% (Dell'Acqua et al., 2023). The findings further revealed that lower-skilled employees benefited the most from these improvements, leading to a narrowing of the productivity distribution.

In short, AI technologies function as a complementary support mechanism, enhancing employee efficiency and helping workers perform their tasks more effectively by narrowing the productivity distribution. In other words, AI significantly improves the performance of lower-performing employees in terms of both output quality and production time, thereby increasing overall productivity and efficiency. This finding challenges the widely accepted notion that new technologies primarily complement highly skilled AI (Goldin & Katz, 2008). Instead, as demonstrated by recent studies, AI technologies tend to complement lower-skilled employees. Another important insight from these studies is that new employees using GAI tools can reach a previously time-intensive proficiency level in a much shorter period (Brynjolfsson et al., 2023). In other words, GAI tools such as ChatGPT can significantly reduce the time required for beginners and apprentices to develop their skills.

The studies mentioned above on the impact of GAI on productivity and efficiency have primarily been conducted in the private sector. To address this gap, new research is now being carried

out to examine its effects in the public sector. For example, a recent study investigated the impact of GAI technologies on document comprehension and data analysis tasks performed by employees at the Central Bank of Ireland (Fitzpatrick et al., 2025). The findings revealed that for document comprehension tasks, AI improved quality by 17% and reduced task completion time by 34%. However, no positive contribution was observed in data analysis tasks. Consistent with previous studies, the greatest benefits in document comprehension were experienced by lower-performing employees. These findings suggest that while GAI can significantly enhance quality and productivity in the public sector—despite its structural and procedural differences from the private sector—the extent of its positive impact depends on the nature of the task.

More detailed studies on the impact of AI on employee performance, particularly those considering the varying characteristics of tasks (such as simple vs. complex or explicit vs. ambiguous), provide valuable insights for mapping this effect. In this context, a recent study conducted with a representative sample of the working population in the United Kingdom examined the impact of GAI (ChatGPT) on employee performance based on task characteristics (Haslberger et al., 2024). The study found that GAI improved employee performance in terms of both time savings and quality, regardless of gender, education level, or professional background. However, the effect was significantly more pronounced in complex but explicit tasks. In contrast, AI had little impact on simple tasks, while in complex and ambiguous tasks, employee skills remained the primary determinant of performance.

The impact of GAI applications on performance and quality is also evident in scientific research and article writing. Researchers quickly recognized the opportunities offered by GAI tools such as

ChatGPT and began incorporating them into academic writing. In fact, articles listing AI as a co-author have already started to appear. This development has prompted scientific journals to debate their policies on the matter. The central issue in these discussions has been the capacity to assume responsibility, leading to a consensus that AI cannot bear responsibility in this context. Initially, most journals, including Science, took a strict stance, not only prohibiting AI from being listed as an author but also rejecting the use of AI-generated content in scientific publications. However, over time, many academic journals have gradually relaxed their position on this issue.

At this stage, while it is generally accepted that AI cannot be considered an author in a scientific article, there is also broad recognition that these technologies can make significant contributions to scientific research and academic writing. As a result, it is now widely acknowledged that such contributions should be explicitly stated in publications, as they are expected to enhance the overall quality of academic work (Özer, 2024). In recent publications, AI contributions are increasingly being disclosed. With the introduction of DeepSeek's new platform, these contributions are expected to grow even further. As in other fields, younger researchers and those with language barriers tend to benefit the most from AI-assisted writing. Similar benefits can be realized in education systems, particularly in helping students' close achievement gaps through personalized learning and supporting teachers in professional development programs.

In summary, AI technologies have been shown to positively contribute to employee productivity and efficiency. However, the extent of this contribution varies depending on the nature of the tasks. AI's impact is more pronounced in non-routine cognitive tasks and complex but explicit assignments. Additionally, new and lower-performing employees benefit the most from these

improvements. With the assistance of AI, new hires can reach the expected competency levels much faster. The findings from these studies suggest that, rather than negatively impacting employment, the widespread adoption of AI technologies can enhance the performance of lower- and middle-skilled employees in the workplace. By prioritizing AI as a complement to human labor rather than a driver of automation, businesses can increase productivity without reducing employment, thereby fostering a more equitable distribution of economic benefits and strengthening the middle class. However, realizing these benefits will require strong policy support for AI as a complement to human labor, as well as its integration into business management strategies.

The Powerful Wave of Orientalism Brought by Artificial Intelligence

Edward Said defines Orientalism not merely as a pure study of the East or an attempt to understand it, but as an effort to produce and control the Western representation of the East *(Orientalism*, Vintage Books, 1979). Thus, Said underscores that Orientalism is the West's unilateral approach to representing, speaking for, and interpreting the East—or more precisely, its domination over it. The Egyptian woman whom Flaubert encountered in Egypt is also subject to this phenomenon. She is not given a voice; instead, she is evaluated through Flaubert's narrative and representation (p. 6). Consequently, in Orientalist literature, the East does not speak for itself; rather, the West makes it speak as it wishes, unveils its mysteries, and defines it. For this reason, the discourse of Orientalism does not reflect the reality of the East but rather how the West wants to perceive and represent it. Furthermore, the East transcends its geographical definition—Russia and even Spain also fall within its scope.

Thus, Orientalism enables the progression of thinking about the East through various channels such as academia, literature, the humanities, politics, economics, and social sciences. Despite appearing fragmented, it ultimately forms a cohesive whole, establishing a thought ecosystem and, eventually, an authority. This production is so prolific and powerful that, as Said references Gramsci, it transforms into a form of cultural hegemony (p. 7). At this point, producing works outside this hegemony becomes nearly impossible. Even if such works are created, gaining mainstream recognition is exceedingly difficult, and they are somehow rendered ineffective by the hegemony. Authority is shaped by power relations. Research that seems independent and progresses through different channels is, in fact, aligned—consciously or unconsciously—by this hegemonic climate. When political interests are added to this equation, even cultural studies or scientific research—often claimed to be the most neutral—

cannot escape these biases. Ignoring this overarching structure and assuming that most works are produced objectively within their own domains prevents a comprehensive understanding of the bigger picture.

The Deconstruction of Cultural Hegemony

Understanding the impact and validity of Orientalism requires analyzing how it has been structured throughout history and identifying the processes that have played a role in constructing this authority. Said's work reveals how Orientalism establishes authority on both an individual and collective level and how this authority shapes perceptions of the East in the West. For this reason, Said approaches Orientalism not only as a political phenomenon but also as an interaction between individual creativity, meticulous scholarship, and broader political realities that contribute to this overarching structure. To deconstruct this intricate network of relationships, Said adopts a hybrid perspective, examining not only academic studies but also literary works, political pamphlets, journalistic writings, travel books, religious and philological studies (p. 23).

Said, in his methodology for examining the authority of Orientalism, employs what he calls the approaches of "strategic location" and "strategic formation" (p. 20). Through strategic location, he analyzes the position of the author within their work on the East, while strategic formation focuses on the relationship between that work and other texts. Since texts are always created through reference to or indirect influence from other works, strategic formation is of critical importance. In this context, each seemingly independent text or product reveals archaeological links to previous texts and ultimately establishes its archaeological position. In short, every individual text plays a crucial role in determining its place and impact within the collective structure of Orientalism. Therefore, understanding the

ideas, style, and authority embedded within individual texts is essential for deciphering the dynamics of this broader discourse.

The New Orientalist Threat

As is well known, GAI learns from vast amounts of existing data to produce new texts. Consequently, the information generated by AI is inevitably shaped by the existing data, which functions as a form of memory. This phenomenon also applies to Orientalism. Since a comprehensive body of Orientalist literature has been constructed over nearly two centuries, GAI —when producing new content about the East—replicates and perpetuates the same historical memory. As a result, new AI technologies reinforce and disseminate the Orientalist discourse, further embedding its style and perspectives into contemporary knowledge production.

One of the first studies in this context, conducted by Qadri et al., provides important findings on how South Asia is represented in GAI content *(Qadri, R. et al., "AI's Regimes of Representation: A Community-centered Study of Text-to-Image Models in South Asia." In Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency, 506–517, 2023).* In their research, the authors examined the cultural limitations of text-to-image (T2I) models by working with participants from Pakistan, India, and Bangladesh in a South Asian context. The study identified three key issues in AI-generated content: misrepresentation of cultural elements, reinforcement of hegemonic cultural assumptions, and reproduction of cultural stereotypes.

The misrepresentation of cultural elements is already a fundamental characteristic of Orientalism. Moreover, Orientalism does not even claim to be accurate, as it is inherently a one-sided effort to construct a specific reading and representation of the East. By establishing cultural hegemony, Orientalism prevents non-

Western societies from expressing themselves and confines them within representations constructed by the West. In this process, beyond simply misrepresenting cultural elements, Orientalist discourse frequently employs two key strategies: Detaching cultural elements from their original context—removing them from their authentic historical, social, and linguistic settings, and assembling a "patchwork" of decontextualized elements—blending fragmented cultural symbols in ways that serve the dominant narrative rather than reflecting their true meaning.

The findings of the study indicate that the Orientalist style persists in AI-generated content production. This suggests that Western and white perspectives remain the dominant cultural defaults in AI models. While it has become commonplace for AI to generate Western-centric images (such as churches for prompts like *"a place of worship")*, the research reveals that this bias persists even in highly specific prompts. For instance, when users input a culturally distinct prompt like "people eating street food in Lahore," the same Orientalist framework continues to shape the output.

On the other hand, the researchers found that while Western and white perspectives dominate the cultural defaults globally, a different dynamic emerges in the representation of Bangladesh and Pakistan. Specifically, the study revealed that India serves as the cultural default for AI-generated representations of these two countries. In other words, even when prompts explicitly specify Bangladeshi or Pakistani cultural elements, T2I models generate Indian objects and imagery. This means that the representation of both countries is filtered through an Indian-centric lens, effectively erasing their distinct cultural identities through a process of homogenization—where what is not represented is effectively erased. This hierarchical approach extends even within a single country's representation. For instance, when

AI generates content related to India, it predominantly depicts upper-class representations, while cultural elements associated with lower classes are ignored. This reinforces existing cultural power hierarchies, privileging dominant narratives while further marginalizing underrepresented groups.

AI's reliance on Orientalist narratives and stylistic conventions results in the repetition of cultural stereotypes about non-Western regions. As the researchers highlight, AI-generated content consistently portrays South Asia as nothing more than dusty cities and poverty—effectively reducing the region to an economically dysfunctional space. More critically, AI's representation of South Asia appears frozen in time. Rather than reflecting current developments and contemporary realities, AI models retain a static, outdated image of the region. Regardless of the specific context of the prompt, AI continues to reproduce these entrenched stereotypes, reinforcing a historically biased and decontextualized portrayal of South Asia.

Undoubtedly, the most persistent stereotype is the exoticization of non-Western cultures. The researchers define exoticization in the South Asian context as a "regime of representation" designed to position the region as a place distinct from and distant to the West. In the case of India, this manifests through stereotypical imagery such as chaotic traffic, cows in the streets, and snake charmers—all reinforcing a reductive and mystified portrayal of the country. One participant in the study strongly criticized this trend, arguing that it is merely a way to sell more media and reflects the continuation of a capitalist and colonial logic within T2I models. Similarly, Pakistani participants highlighted a recurring stereotype in AI-generated content: the representation of Pakistani women as passive figures in need of rescue. This framing perpetuates the colonial trope that Muslim women lack agency and require Western intervention to be "saved."

In sum, while GAI provides significant benefits in content production, it continues to maintain control over the representation of non-Western cultures, depicting them through a Western and white lens, often detached from reality. As the researchers highlight: "When operationalized in model testing and evaluation, exclusive use of Western-oriented frameworks risks development of applications that dispossess the identity of non-Western communities". This underscores the urgent need for more comprehensive studies on the relationship between AI and Orientalism.

Artificial Intelligence Art, and the Problem of Alienation

AI has now become an integral part of daily life. The accessibility of generative AI technologies, particularly tools like ChatGPT, has already facilitated the emergence of an AI ecosystem. AI technologies are now widely used across all fields, from education to healthcare, transportation to infrastructure, finance to the defense industry, and service sectors. Art is one of these fields. It quickly became evident that AI has immense potential to introduce new forms of artistic expression. In particular, the growing interest in AI-generated artworks in recent times has sparked heated debates about how this trend will impact and transform the art market, involving artists, galleries, museums, and collectors.

As AI technologies rapidly transform habits, productivity, processes, and management methods across all fields, the risks they pose have also begun to be discussed—albeit not as extensively as their benefits. In the field of art, initial debates resembled those that arose between photographers and painters when photography was first introduced. However, these discussions have now evolved into much more complex dimensions. OpenAI's deep learning model DALL-E, which can generate innovative images from natural language descriptions, and its newer versions have made a significant impact not only in the art world but also among individuals of all ages and skill levels in recent years. While some argue that these advancements democratize art and support its development, others criticize them for negatively affecting artists and diminishing the value of artistic creation.

The Issue of Copyright in AI Learning

Just as in other fields, AI learns from existing data in the realm of art and generates responses based on given commands after the learning process. Therefore, existing data functions as a form of

memory. Therefore, another major concern in the application of AI technologies in the field of art is the copyright of the memory. AI systems, trained on textual, visual, and auditory data, learn by utilizing these datasets and generate new content based on given commands. Ongoing debates revolve around how the products created by AI should be evaluated within the framework of copyright law. In this context, the initial debates were sparked by Hollywood screenwriters. When AI is used as a tool for writing scripts for films or television shows, questions arise about whether the data used to train these systems fall under copyright protection. For instance, the Writers Guild of America (WGA) emphasizes that the use of previous scripts in training AI algorithms should be evaluated within the framework of copyright law. Writers could otherwise be left defenseless against an AI developed using their own works as training material.

A similar situation recently emerged in copyright infringement lawsuits filed by major music companies such as Sony Music and Universal Music Group against AI-driven music production companies. If these lawsuits result in rulings against AI companies, beyond the financial penalties, they will likely trigger complex discussions regarding copyright and ethical violations related to products created with AI assistance. These debates are expected to intensify in the visual arts sector as well, where AI technologies are increasingly utilized.

The Artist's Alienation from Their Work

In this context, there is another dimension that needs attention—one that is often overlooked in these debates: the artist as a human being. The process of becoming an artist is arduous and continuous. An artist's interactions with their environment add depth to their life, while their works emerge as the outcomes of this ongoing process. In other words, art is not just about

the final product; it also enriches the human experience and deepens one's existence. What truly matters in this process is the artist's journey of becoming—continuously evolving through experiences, expanding creativity, and developing new ways of perceiving life. The tangible works are merely the results of this journey, serving as living witnesses to an artist's struggles, learning, and growth. Through their works, we bear witness to an artist's formation.

However, the increasing use of AI technologies in artistic creation threatens this dimension. In AI-generated works, the artist does not undergo an experiential process of creation. Instead, they are reduced to a mere operator, directing the AI through commands. In this sense, the relationship between humans and AI remains at a technical level, leading to a growing alienation from the final product.

Complex and challenging experiences push artists into different phases of their creative journey. As a result, their works serve as witnesses to their process of becoming. While AI can replicate works that resemble those produced with deep emotions, it severs the connection to the underlying experiences and emotions, or freezes the artist in a particular phase. In this context, Joe Attard provides an example of AI's relationship with art by referencing a specific period of Picasso's work (https://marxist.com/the-death-of-the-artist-a-marxist-perspective-on-ai-generated-art.htm, 3 March 2023): 'For instance, Pablo Picasso's 'blue period' – in which his colour palette and subject matter became notably dark and sombre – was inspired in part by the suicide of his friend Carles Casagemas in 1901. An AI perceives Picasso's art merely as an assortment of shapes, colours, and defined values. It can imitate the look of these works, but cannot grasp the emotions that inspired them. You could ask an AI to make a 'sad' image, but even if it produced pictures in dark colours of people

crying, it wouldn't understand the content of sadness, because it has never been sad, nor happy; nor has it experienced any other feeling.'

With the integration of AI technologies into creative processes, this deeply human aspect of artistic creation is being compromised. The process of producing an artwork no longer provides the artist with an instructive or developmental experience. Instead, the artist is reduced to a mere operator, directing the AI through commands. In this sense, the relationship between humans and AI remains purely technical, leading to an increasing alienation from the final product. The phases in which artists experience their environment, relationships, and introspective emotional states are disrupted. Moreover, the social benefits of art are also distorted. What does an AI-generated work add to the artist who merely provides the command? Furthermore, when audiences encounter these works, whose creation are they truly engaging with, and how will they relate to them? Will they connect with the artist through the work, or will their engagement shift toward AI? If they turn to the artist, what aspect of the artist does the work represent? If they turn to AI, what meaning will they attribute to the artwork?

A recent study found that people tend to perceive artworks created entirely by AI as less valuable compared to those made by human artists *(Bias against AI art can enhance perceptions of human creativity, Scientific Reports, 2023).* The study also indicates that artworks co-created by human artists and AI are considered more valuable than purely AI-generated works, but less valuable than those created solely by human artists. In short, when people are aware that an artwork was produced by AI, their perception of its value decreases.

As GAI continues to evolve, its capabilities will reach new levels.

This raises the question, as discussed in the literature: Will AI become an artist in its own right? This debate closely resembles discussions about whether AI should be credited as an author in scientific publications. With the emergence of papers listing AI as a co-author, academic journals have had to reconsider their policies on how AI's contributions should be acknowledged. For instance, Science, one of the most prestigious journals, has explicitly stated that not only can AI tools like ChatGPT not be credited as authors, but AI-generated text cannot be used in published articles at all. However, over time, most journals have adopted more flexible policies, maintaining that AI cannot be considered an author but that its contributions must be transparently disclosed in the publication.

Similar debates are unfolding in the art world as well. For instance, in 2022, the US Copyright Office ruled that works created by AI are not eligible for copyright protection. The rejection of Stephen Thaler's copyright application for the AI-generated artwork *A Recent Entrance to Paradise* signaled that without human involvement, a work cannot be legally registered. Just as AI cannot be recognized as an author in scientific publications, it will not be considered an artist in the realm of art. In essence, this decision highlights the issue of the artist's alienation from their work. When alienation occurs, the resulting piece is no longer considered the artist's creation, and consequently, it does not qualify for copyright protection.

Although people tend to perceive AI-generated works as less valuable, in the long run, considering AI's production capacity and rapid development, these works will become much more accessible and affordable despite their lower perceived value. Consequently, automation is expected to become more dominant in the art world as well. The only viable option to resist this overwhelming and economically challenging process seems to

be for human artists to collaborate with AI. However, even in this scenario, fundamental artistic qualities such as passion and patience—key aspects of an artist's creative identity—are likely to diminish over time.

On the other hand, as AI—essentially a black box—takes on a more active role in creative processes, human artists will increasingly find themselves as outsiders, alienated from portions of the work they contribute to. In the long run, human artists will drift away from the challenging experiences that foster learning and self-improvement. The intricate and transformative relationship between artist and artwork will deteriorate, leading to a decline in artistic diversity and depth. Ultimately, societies will be deprived of the unique value that human artists bring to art. Furthermore, as AI continues to incorporate these collaboratively produced works into its training data, the AI feedback loop will become even stronger. In contrast, the presence of authentic human-generated data will gradually diminish, deepening the sense of alienation. Over time, this cycle will not only redefine artistic creation but also reshape the role of the artist in ways that could significantly weaken human agency in art.

Cinema and Artificial Intelligence

AI continues to rapidly transform all fields. Particularly, the exponential development of AI and its versatile applications are expanding the scope of this transformation. The cinema industry is among the sectors being transformed most rapidly by AI. AI is now widely used not only during the film production phase but across all stages of the industry — from scriptwriting and casting to location selection, post-production, distribution, and marketing. AI is now used not only to write scripts but also to contribute to their refinement. Moreover, it supports producers in predicting the commercial success of films. It has long been known that platforms like Netflix use AI algorithms to offer personalized recommendations based on user preference history. Similarly, these technologies are now widely employed in developing marketing strategies in the film and television industries.

AI can also play a role during the film shooting process, supporting the efficient and cost-effective management of many stages — from planning shooting schedules to locating sites that match the script. Such technologies are transforming film production by offering innovative solutions in various processes, from creating digital characters to casting. In casting, the focus is no longer solely on selecting actors suitable for roles; AI also optimizes actor selection based on their market value to enhance a film's financial success. These AI-based approaches help film studios develop more targeted and effective marketing strategies.

It is already evident that AI is being used to predict the commercial success of films. For example, Warner Bros. utilizes Cinelytic's AI-based platform, while 20th Century Fox employs a system called Merlin, and Sony Pictures uses another platform called ScriptBook to develop production, release, and distribution strategies aimed at maximizing economic returns. Skywalker Sound, part of Lucasfilm, uses AI to accelerate the sound design

process. Moreover, these tools offer innovative solutions in trailer creation and film editing processes, particularly in visual effects, and can also develop music tailored to the film.

Additionally, by automating video production, AI is continuously increasing its potential to automate the broader film production process as well. Already, the creation of realistic virtual environments that reduce the need for physical sets in film production is making it possible to produce historical films that are conceptually feasible but extremely difficult to shoot. The use of these tools and approaches in the production of historical films has the potential to significantly lower costs.

AI-powered tools can make post-production processes more efficient and effective. Sound effects that could not be captured during filming but are essential to the final production (Foley effects) can now be generated rapidly using AI. AI also facilitates the creation of visual effects, simplifies consistent color grading between scenes, improves noise reduction, and enhances the quality of sound synchronization.

Of course, these advancements also come with risks and costs. Some of these concerns include the possibility of job losses for workers in certain fields of the film industry due to AI, which is currently automating certain areas of the industry. Although, for now, it is primarily the strong voice of screenwriters that is being heard, in the long run, other workers are also likely to join this trend.

Another issue is that while deepfake technology — which produces realistic video and audio content — can eliminate the need for actors to repeat certain scenes during film production, its rapid advancement also increases the potential for unethical uses, such as altering existing videos or creating fabricated ones, thereby raising personal and societal concerns. In the long run,

this technology may even make it possible to produce films featuring actors who are no longer alive. For instance, Tom Hanks has stated that he believes he will continue to appear in films in the future thanks to AI (C. López Frías, The Paradox of Artificial Intelligence in Cinema, 2024).

The use of realistic virtual environments instead of physical sets in film production could expand significantly and, in the long term, could lead to the substitution of real film sets. Beyond questions about the nature of the resulting product, this shift would cause major job losses for employees. Moreover, as virtual productions based on actors' past data become more common, the ecosystem needed to nurture new actors of similar quality will gradually weaken. In addition, as the substitution rate of AI for human actors increases, the real-world data set from which AI learns will progressively shrink, leading to a decline in diversity. Or, as renowned director Steven Spielberg put it, the creative spirit of humanity will be taken away (C. López Frías, *The Paradox of Artificial Intelligence in Cinema, 2024).* Consequently, the creativity of human artists and the developmental process that grows through experience will also suffer.

As in other fields of art, although the ability to produce content rapidly and at much lower costs may contribute to democratization by increasing access to these processes, the abundance of such content will, in the long term, distort the product-value relationship. Additionally, it could leave many professionals unemployed or force them to work for lower wages. In spite of the fact that film production costs will decrease and revenue will rise, the employees themselves will not benefit from these increases.

In summary, because all stages of the film industry are exposed to digitalization, AI has an increasingly greater potential to

automate every phase of the filmmaking process, unlike in many other sectors. Naturally, this transformation is happening much faster due to the new opportunities, increased efficiency, and cost advantages it provides. However, since AI is a multipurpose technology, it brings risks as well as benefits. It appears that the employment losses it will cause will be significantly greater than in other fields.

Artificial Intelligence Hallucination and Refik Anadol

The artist who utilizes AI technologies most extensively in the field of art is Refik Anadol. He takes art to a new dimension with AI, demonstrating its power in public spaces through collaborations with technology giants such as Microsoft, Google, Nvidia, Intel, IBM, and Siemens. In each thematic project, Anadol trains his AI models using vast datasets from that specific field, allowing the model to "dream." He then transforms these machine dreams into dynamically undulating images on screen by employing fluid simulation models. Fluidity is a key characteristic in all of Anadol's works—nothing remains static; everything is in constant flux, flowing within its own temporal scale. His project "Melting Memories" perfectly emphasizes just how fluid memories truly are.

The focus of Anadol's work revolves around the concept of machines dreaming or hallucinating. In his own words, as the algorithm constructs its memory based on the data it learns, it is encouraged to experience creative dreams and hallucinations derived from this memory (R. Anadol and P. Kıvrak, *Machines that Dream: How AI-Human Collaborations in Art Deepen Audience Engagement*, MBR, 3(1&2):101-107, 2023): 'Since 2012, RAS has been conducting interdisciplinary research on the interconnection of the human mind, architecture, and aesthetics in an effort to answer this question: If machines can learn or process individual and collective memories, can they also dream or hallucinate about them? After experimenting with digital paintings and sculptures of architectural data and exhibiting data-based immersive projections in public spaces, RAS started working with AI programs and machine learning algorithms using a diversity of data, be it visual, auditory, seismic, geographic, cultural, or institutional.'

RAS's first comprehensive work was an interactive media installation titled Archive Dream, exhibited in Istanbul in 2017.

This project was created using 1.7 million archival records spanning from the 17th to the 20th century, processed through ML algorithms. One of the most significant outcomes of this work was the generation of new images that could have existed in the archive but did not actually exist—precisely as intended. In other words, AI was made to hallucinate in order to create new, imagined archives. As a result, the real archive and the AI-generated dream archive became intertwined. Building on this thematic approach, RAS took his work to a new level with the *Walt Disney Concert Hall Dreams (WDCH Dreams)* project, where he enabled the building to "dream" by drawing upon its memories.

His thematic projects were followed by Machine Hallucinations: Nature Dreams, Machine Hallucinations: Space, and in the spring of 2022, a collaboration with the Philadelphia Orchestra titled Beethoven: *Missa Solemnis 2.0*. One of his earlier works, Infinity Room, developed in 2015 and first presented at the 2015 Istanbul Biennial, was an immersive project that sought to merge the infinity of space with the infinite variations of machine intelligence. Visitors were welcomed into a 360-degree mirrored room, where they experienced an interplay of light, sound, and visuals. Anadol continues to add new dimensions to existing works through highly specific public art projects, such as In the Mind of Gaudí and the Casa Batlló project, bringing art into public spaces in innovative ways.

Is Artificial Intelligence Really Hallucinating?

In RAS projects, AI learns from existing data within a given thematic domain and establishes new relationships based on this memory, generating entirely new creations—or, in Anadol's words, "dreaming." To emphasize the artistic dimension of the output, the term "hallucination," commonly associated with AI,

is frequently used. However, this raises an important question: What exactly is the relationship between AI and hallucination? A closer examination of this connection is necessary.

In academic literature, AI hallucination or fabrication is commonly used to describe a phenomenon in which an AI system generates a response that appears convincing and contextually coherent but is entirely fabricated, lacking any logical or evidence basis in user input or previous context. As a result, GAI outputs may seem reasonable but can actually be meaningless or incorrect. For instance, studies evaluating the frequency of AI hallucinations in research proposals generated entirely by ChatGPT have demonstrated that many of the references provided in such outputs do not actually exist. Generally, when GAI produces content based on its training dataset, it may enter a hallucination phase, where it loses its connection to the original data sources and fabricates content instead. Furthermore, once AI generates incorrect information, it may continue producing further incorrect content in a self-consistent manner—a phenomenon known as the snowball effect of hallucination.

AI hallucinations in generative models are not the result of a cognitive process but rather stem from the probabilistic nature of the model and its relationship with the training dataset. On the other hand, using the term hallucination to describe the false outputs generated by LLMs can be misleading. This term implies that LLMs consciously perceive sensory input, whereas GAI lacks consciousness, meaning it does not have subjective experience or awareness. For this reason, some researchers argue that AI does not "see" something that isn't there but rather fabricates information. Therefore, the term hallucination may not be the most accurate way to describe this phenomenon. Instead, the psychiatric concept of "confabulation" has been proposed as a more precise analogy (Mahmut Özer, *Is Artificial*

Intelligence Hallucinating?, Turkish Journal of Psychiatry, 2024). Confabulation refers to the unintentional creation of false but seemingly coherent narrative details, even when the individual is unaware that they are false. Notably, GAI tends to produce fabricated content more frequently in narrative-based texts. Moreover, humans also engage in confabulation, often filling gaps in their narratives with fictional but plausible details, even without any malicious intent.

Refik Anadol Encourages Hallucination

Whether defined as hallucination or confabulation, this behavior in AI poses significant risks in fields like healthcare and education, where incorrect treatment recommendations, flawed educational content, or unreliable information can have serious consequences. As a result, many efforts are underway to mitigate this issue of hallucination in AI systems. However, recent studies suggest that in certain innovative domains, such as art, architectural design, or the discovery of new proteins, this very behavior may hold creative value. Refik Anadol demonstrates the power of AI to generate unexpected, dream-like, and novel results in his work, highlighting its ability to generate unexpected, dreamlike, and novel outcomes. His projects leverage AI's tendency to create new relationships between data points, using this hallucination-like process as a core artistic tool.

As Refik Anadol himself explains, his thematic projects begin with processing large datasets related to a specific domain—such as city archives, nature imagery, or musical compositions—using deep learning. This process generates a digital memory, which then serves as the foundation for AI to focus on new relationships within the data, effectively "dreaming" or "hallucinating." In other words, DL models trained on large datasets produce hallucinatory visuals when dealing with data gaps, complex

patterns, or contradictory inputs. These AI-generated images blend reality and virtual elements, creating an altered perception for the viewer. By applying this approach, Anadol blurs the boundaries between time and space, enabling an archive to "dream" based on historical collections or a building to "dream" based on its own historical witnesses. This technique introduces a new form of narrativity, reshaping how we experience history, memory, and space. A recent example of this approach was seen in Anadol's exhibition "Dreams of the Earth: Anatolia", held at the Museum of Anatolian Civilizations during the Ankara Culture Road Festival at the end of September 2023 in Türkiye, organized by the Ministry of Culture and Tourism. In summary, Anadol does not merely create visual experiences with AI; he engages viewers in a deeply immersive, multi-layered artistic experience that fosters both physical and emotional interaction with his work.

Artifical Intelligence and Journalism

AI applications continue to rapidly expand into all areas of life. They are transforming processes and workflows in the domains they permeate, while also creating new opportunities. However, alongside these contributions, AI also brings various risks—ranging from compromising data security to leaving individuals vulnerable, reinforcing biases and deepening inequalities, and generating misinformation. These risks vary in scale and nature depending on the specific characteristics of the field in which AI is applied.

Journalism is one of the fields most profoundly affected by AI. The impact of AI in journalism is deeply felt across a wide spectrum—from data analysis to content creation, from content personalization to editorial processes. It has become an especially valuable ally in investigative journalism. Moreover, AI now contributes to every stage of the news cycle, including the gathering, reporting, storytelling, and distribution of news. In areas where digitalization is extensive, AI acts as a transformative force. Given that journalism is one such field, many researchers argue that AI is not merely a tool in journalism, but a transformative power that is reshaping the profession itself.

The widespread adoption of ML has opened new horizons, particularly for investigative journalism. It has enabled the easy analysis of big data based on the specific details of a given topic, as well as the identification of underlying patterns within the data. This in-depth contribution has significantly facilitated and enhanced the quality of investigative journalism and news production, especially in complex fields such as elections, health, education, finance and monetary markets, and sports. Thanks to AI, information with news value and complex narratives—previously difficult to detect due to structural complexity—can now be uncovered and presented to the public. As a result, news production capacity has increased significantly with AI

technologies. For news agencies in particular, this increased capacity provides a major advantage in terms of both public influence and economic gain.

On the other hand, it has also become possible to conduct in-depth public opinion analysis through social media and other digital platforms. It is thus possible to evaluate the responses of readers and viewers to news content in a more comprehensive manner. Additionally, analyzing user preferences on news platforms and recommending new content accordingly has become a common practice, helping to extend the time users spend on these platforms.

One of the most significant contributions of AI is its ability to enable personalized content production. AI, which is widely used to generate personalized learning content in the field of education, has similarly started to be extensively applied in journalism for collecting, evaluating, and distributing personalized content tailored to individual users. In short, AI technologies are making increasingly essential contributions to enhancing productivity and efficiency in journalism. The expectation is that the time saved through this increase in productivity will be used to improve the overall quality of journalism.

Research findings on the impact of AI on employee productivity indicate that increases in efficiency and output are particularly significant among low- and medium-skilled workers. In other words, AI technologies help compensate for skill gaps in these employee groups. When used in journalism in this way—complementing rather than replacing humans—AI can enhance productivity without causing major negative effects on employment. At the same time, it can create additional time that journalists can devote to improving the quality of their reporting.

However, there is a clear risk that journalism positions involving

routine tasks—such as writing standard news reports and performing data analysis—may be fully taken over by AI. On the other hand, as noted above, the integration of AI technologies into journalism as a transformative force requires workers in the field to rapidly acquire new skills in order to remain relevant in a changing industry. Therefore, improving AI literacy and skills among journalism professionals is of critical importance. Without investment in the development of these capabilities, many journalists may face the risk of losing their current positions.

On the other hand, the greatest risk associated with personalized news content is the reduction in content diversity and the reinforcement of informational comfort zones by directing users toward echo chamber-like content. Individuals are increasingly exposed to information that confirms their existing beliefs and attitudes, while their access to alternative viewpoints and information is greatly diminished. This makes it more difficult for people to encounter diverse content, and the interpretation of events begins to vary significantly depending on the boundaries of each echo chamber. One of the greatest risks facing modern societies is the clustering of the public into distinct groups and their confinement within echo chambers. As AI further enhances the personalization of news content, it is likely to intensify the formation of these echo chambers. This poses a serious threat to the overall health and cohesion of modern societies.

Although AI is highly capable of analyzing big data and detecting patterns, the lack of transparency in how these analyses are conducted—due to the "black box" nature of many AI systems—raises serious concerns, particularly in news content production and investigative journalism. The opaque nature of AI-generated analysis and content can result in the production of news that lacks transparency and accountability. Since AI itself cannot be held responsible for the content it produces, an important

question arises: can journalists who use AI in this way be held accountable for non-transparent content and analysis? This issue is also actively debated in the world of academia.

For example, as GAI tools began to be used in the production of scientific articles—and even appeared as co-authors in some cases—editorial teams of academic journals faced intense debate over whether AI could be recognized as an author. Prestigious journals such as Science have taken a firm stance, stating not only that AI cannot be listed as an author, but also that AI-generated content such as text or graphics should not be used in academic articles at all. However, more flexible policies have gradually emerged. According to these, AI can never be considered a co-author, but if it contributes to the quality of a scientific article, its role in the production process must be clearly disclosed within the article. At the heart of all these debates and efforts to find solutions lies the fundamental issue that AI cannot bear responsibility for its contributions and cannot be held accountable for its actions. A similar precaution must be implemented in the field of journalism as well.

Another major concern regarding the widespread use of AI in journalism is the risk of perpetuating biases. Since AI technologies make predictions, optimizations, and generate content based on real-world data, the training data effectively serves as a form of memory. This "memory" can contain biased judgments and linguistic patterns related to religion, race, gender, and other characteristics of different social groups—biases that can be directly reproduced in new content. As a result, AI-generated journalistic content may replicate these same biases, leading to the proliferation of biased news. Furthermore, when such biased content circulates within echo chambers and is repeatedly interpreted through the lens of partial perspectives, it increases the risk of deepening social inequalities. The same dynamic is

present in culturally embedded content generation through AI. As we discussed in a previous article titled "The Powerful Wave of Orientalism Driven by Artificial Intelligence," AI applications continue to produce content that considers orientalist tones. These systems attempt to maintain control over the right to represent “the East” from a detached, often Western and white-centric perspective—disconnected from the reality of the cultures they depict.

In addition, with the advancement of AI technologies, the production of highly realistic yet false video content (deepfakes) has become increasingly widespread. The ease with which such manipulative and misleading content can be created not only heightens social unrest but also poses threats to individual safety. In this context, another risk is the potential of AI to generate false content, which has negative implications for journalism. As is well known, GAI sometimes produces information that appears coherent within the text but is factually incorrect—a phenomenon referred to as hallucination or confabulation. Relying entirely on AI for news content production increases not only the risk of biased reporting but also the risk of misinformation. Therefore, editorial oversight is critically important in eliminating such risks. To ensure this, editorial teams must possess a strong level of AI literacy, and this literacy must be continuously updated.

In summary, AI applications have a transformative and, therefore far-reaching impact on the field of journalism. The opportunities it provides have already significantly reshaped processes and workflows in this domain and have led to notable economic gains. However, it is also clear that this transformation brings numerous risks, ranging from negative effects on employment in journalism to the production of biased and misinformation. As in other fields, the most human-centered approach in journalism is to use AI technologies in a way that complements human effort

rather than replaces it. Otherwise, while the economic benefits of AI may concentrate in the hands of a narrow group, the risks it poses will affect broader segments of society. Moreover, the risks associated with AI have made editorial oversight more critical than ever before. In this context, increasing AI literacy and supporting the development of related skills will enhance the potential to benefit from these technologies in a balanced and responsible way.

Potential Impacts of Artificial Intelligence on the Labor Market in Türkiye

Unlike previous technological disruptions, AI is rapidly entering all areas of life and causing significant transformations wherever it is adopted. In particular, the development and accessibility of GAI have led this transformation to take on a radical dimension. As a result, countries have begun to focus on the economic opportunities that GAI may offer and the potential impacts it could have on employment within labor markets.

In this context, the report titled *"The Economic Potential of Artificial Intelligence in Türkiye"*, prepared by Prof. Dr. Altan Çakır with the support of Google and Implement Consulting and published in May 2024, provides highly significant projections regarding the possible contributions of AI to the Turkish economy and its impacts on the labor market. The report's central projection is that, if the opportunities presented by GAI can be effectively leveraged, it could contribute an additional 5 percent—approximately 50 to 60 billion USD—to Türkiye's annual GDP within the next decade. This additional economic contribution is expected to result from increased worker productivity enabled by this technology, the expansion of unallocated time, and the reallocation of that time to other value-added activities.

On the other hand, the report estimates that 41 percent of the current 31 million job positions in Türkiye (approximately 13 million jobs) will not be exposed to automation, while 55% (around 17 million jobs) will benefit from the contributions of GAI. For the remaining 4 percent (roughly 1 million jobs), partial or complete job transformation is expected. Accordingly, it is projected that GAI technologies will impact 59% of job positions. As noted above, this impact is assumed to take place across three dimensions. In 55% of positions—70 percent of which are in the service sector—worker productivity is expected to increase. The 4 percent involving partial or complete job transformation will emerge through newly created roles, resulting from the

reallocation of time freed up in the 55% segment to other value-added activities. Thus, no net loss in employment is anticipated.

The report emphasizes three key regulatory measures that are necessary for the anticipated economic benefits and employment impacts of GAI technologies to materialize as projected: reskilling and upskilling the workforce, increasing R&D activities by local innovative actors, and accelerating commercial innovation efforts.

Critical Considerations in Employment Projections

The preparation of such a comprehensive report on the potential impacts of AI technologies on Türkiye's economy and labor markets is highly significant. However, there is a growing need for even more detailed and extensive reports in this area. This is because international discussions and findings concerning the economic and labor market effects of AI technologies are becoming increasingly pessimistic.

Previous significant technological transformations have resulted in the creation of new jobs to some extent to offset the loss of jobs. Yet, recent studies warn that this may not be the case with AI technologies. Either the number of newly created jobs will not be sufficient to compensate for those lost, or the newly created jobs themselves will be rapidly taken over by exponentially advancing AI systems, or both outcomes may occur simultaneously. Therefore, more comprehensive and forward-looking preparations are urgently needed.

As highlighted in the report, the impact of GAI technologies on worker productivity is significantly higher for low- and medium-skilled groups than for high-skilled groups. In other words, if adopted appropriately, this technology can rapidly enhance the productivity of low- and medium-skilled workers, thereby

increasing overall efficiency and output. The phrase "if adopted" is emphasized here to indicate that this outcome depends on the choices made by employers. There is no indication that the global trend is moving in this direction, unfortunately. Employers often prefer to use this technology to reduce the number of employees and thereby increase profits. In other words, the prevailing tendency favors automation—often at the expense of employment—rather than using AI to augment human labor and improve the productivity of low- and medium-skilled employees. Moreover, as employment declines, union activities related to labor rights are also increasingly undermined.

In short, if the process is left to unfold on its own, there is a risk that the automation pathway will become further entrenched. Therefore, in the projected 55% of job positions where productivity gains are expected due to automation, as stated in the report, this issue must be carefully considered. Another important point is the need to pay attention to potential wage reductions that may result from partial or complete job transitions within the 4% of positions identified in the report. This is because, in cases of job transitions, employees are often forced to shift to lower-skilled—and thus lower-paid—positions.

Four Steps to Strengthen the Labor Market

The report notes that, between 2008 and 2021, an average of 5.2 million new jobs were created annually in Türkiye, while approximately 5 million jobs were closed each year. This indicates that, in terms of job positions, Türkiye maintains a relatively balanced labor market. However, the report also states that as of 2023, only 19 percent of large companies and just 5 percent of small and medium-sized enterprises (SMEs) had implemented artificial intelligence technologies. Therefore, the real impact of AI is expected to unfold in the coming period. In this regard, for

the optimistic projections outlined in the report to materialize, it is essential to take meaningful steps to strengthen the skills of workers in the labor market.

The first step is to organize continuous training programs—particularly for low- and medium-skilled workers—in order to strengthen their resilience in the labor market by enhancing their skills related to artificial intelligence technologies. In this context, the continuing education centers of higher education institutions and the in-service training units within businesses should be made significantly more active.

The recent introduction of higher education programs focused on AI is an important step. However, considering the massive wave of AI integration, it is not sufficient. Therefore, as a second step, all higher education programs should include courses aimed at increasing AI literacy, with content tailored to the specific needs of each field of study. In addition, training programs aimed at improving the AI literacy of all academics in higher education and teachers should be rapidly implemented and repeated at regular intervals. As noted in the report, 55% of job positions expected to be affected by automation are predominantly white-collar occupations. If this step is not taken, the strengthening of the automation pathway will increase the risk of job loss among white-collar workers, and newly emerging positions are likely to shift toward lower-skilled (and thus lower-paid) roles.

44% of job positions identified in the report as unlikely to be affected by AI likely correspond to areas within the scope of VET. VET offers a more resilient career path against the impacts of AI. In this context, the steps taken in recent years to strengthen VET in Türkiye have provided a significant advantage. Enhancing this advantage presents a valuable opportunity to reduce youth unemployment in the labor market and to facilitate the school-to-

work transition. Therefore, as the third step, efforts to strengthen VET should be continued, and the focus should be placed on equipping students in VET with AI skills, as these programs allow time for acquiring new competencies.

Finally, despite all these steps, unforeseen contractions may still occur in the fields in which individuals have received their education. Therefore, "skills development and updating support platforms" should be established—offering short-term training programs that enable skill transfer and are recognized by the labor market. Through such platforms, graduates will be able to redirect themselves toward fields with employment opportunities by acquiring new skills in a short time, thereby gaining access to new opportunities in the face of unemployment. In light of the rapid changes that AI is bringing—and will continue to bring—to skill sets, lifelong learning is no longer a choice but a necessity.

Expectations of the Labor Market from Artificial Intelligence in Türkiye

In recent years, AI technologies have rapidly spread across all fields, transforming processes and workflows in various domains. From education to healthcare, from transportation to the defense industry, and from the arts to finance and the service sector, there is virtually no area left untouched by AI applications. In particular, the widespread daily use of generative AI tools like ChatGPT and DeepSeek by people of all ages indicates that the cycle is complete and a new ecosystem has emerged. Consequently, AI has now become a central focus of countries' economic competitiveness. Intense competition continues among nations to develop these technologies and to secure a larger share of the existing and future economic value they generate.

The emergence of the AI ecosystem is also leading to profound transformations in labor markets. Just as institutions and businesses are re-evaluating their operational processes, fundamental changes are also occurring in job positions. With the widespread adoption of AI technologies, some job positions are disappearing, while the skill sets required for existing jobs are shifting. Moreover, the newly emerging job roles often demand new—and generally more advanced—skills. Therefore, if the challenge posed by these technologies affects all areas, the response to this challenge must also be comprehensive. In this competitive environment, which influences every sector, it will be inevitable to fall behind unless strategic steps are taken in a holistic manner.

Reports evaluating the impact and opportunities of AI technologies in Türkiye are critically important for shaping future strategies. In this context, a report titled *"The Economic Potential of Artificial Intelligence in Türkiye"* was published in May 2024 by Prof. Dr. Altan Çakır. The report emphasized that if the opportunities presented by generative AI are effectively harnessed, it could contribute an additional 5%—equivalent to 50–60 billion USD—to Türkiye's annual GDP within approximately

a decade. This added economic value is expected to stem from increased productivity among workers utilizing the technology, as well as from reallocating saved time to other value-generating activities. The report also found that generative AI technologies could have an impact on approximately 55% of current job positions. Furthermore, it highlighted three key regulatory actions necessary to realize the potential economic benefits and employment effects projected: retraining the workforce and equipping them with new skills, enhancing R&D efforts by local innovative actors, and accelerating commercial breakthroughs.

In April, a new report titled *"The Generative AI Revolution: Global Impacts and Türkiye's Position"* (TÜSİAD-T/2025-04/648) was published. The report's projections for Türkiye are based on findings from a survey conducted between December 2024 and January 2025, as well as one-on-one interviews held with selected businesses. In other words, the report provides insights into how companies are responding to AI technologies. According to the report, 19% of the surveyed businesses are widely implementing these technologies, while 50% are in the pilot phase, and the rest are in the preparation or planning stages. The proportion of businesses that do not consider AI technologies a current priority is remarkably low (6%).

When examining the areas in which businesses are using these technologies, the top priorities appear to be operational processes (27%), customer services (20%), and product/service development (18%). The fact that the same priorities emerge in projections for future focus areas indicates that businesses in Türkiye are primarily viewing these technologies as an opportunity to enhance efficiency through automation and to improve their capacity for personalized services.

Although businesses' evaluations and expectations regarding the transformative impact of AI technologies on their industries

are quite high (50% "high" and 24% "groundbreaking"), they largely anticipate these expectations to be realized in the medium (53%) or long term (22%). Moreover, despite expecting transformative effects in the medium or long term, many businesses are determined to invest in these technologies either immediately (39%) or in the short term (34%), without waiting. Businesses expect the transformative impacts of AI technologies to emerge primarily in the automation of business processes (16%), employee productivity (16%), customer experience (14%), and cost reduction (13%).

The fact that businesses cite security and privacy concerns (20%), lack of talent and expertise (19%), investment costs or uncertainties regarding return on investment timelines (19%), insufficient data and data quality issues (19%), and regulatory and legal ambiguities (13%) as barriers to realizing the transformative potential of AI technologies indicates that there are underlying concerns about building an AI ecosystem in Türkiye. The similarity of the major risks perceived in integrating these technologies into business processes further highlights the presence of significant uncertainty. Accordingly, the relatively low proportion of businesses that have fully adopted these technologies (19%) and the fact that half are still in the pilot phase align with the finding that such uncertainties are preventing full-scale implementation.

Responses to the question of how the workforce in various sectors will be transformed by the disruptive impact of AI technologies reveal that expectations regarding their effects on labor are complex. For example, 31% of businesses believe that "workforce skills and capabilities will improve, and employees will take on more advanced and complex tasks," while 30% think that "the workforce will decline slightly, with some job positions becoming automated." Additionally, 23% believe that "the size of the workforce will remain the same, but the nature of

jobs will change." If the nature of work is expected to shift and automation becomes widespread, leading to greater efficiency, it is evident that the workforce will decline significantly. In fact, the report cites İşbank's Hakan Aran as saying, "...I believe there will be disruptive and transformative effects in the banking sector. Many operational processes will be handled by generative AI agents within two years. Today, there is discussion in the U.S. that call centers will largely be operated by generative AI agents within 1–2 years..." This statement clearly warns that increasing efficiency through widespread automation enabled by these technologies will have a serious negative impact on employment.

Moreover, it remains highly uncertain how many employees will actually benefit from the expectation that workers will take on more advanced and complex tasks. This uncertainty is also reflected in the responses businesses gave to the question of how they are preparing their current workforce for the anticipated future. Only 30% of businesses reported that they are organizing training programs to develop generative AI skills. Instead of offering training programs, others are either encouraging adaptation to the new situation (29%) or relying on external experts and consultants to inform their employees (19%). Additionally, 12% of businesses have made no plans in this regard at all.

In summary, the findings of the report indicate that while businesses exhibit high awareness of the opportunities offered by AI technologies and hold expectations for their benefits to materialize in the medium to long term, their determination to make investment plans in the short term represents a significant opportunity. However, the risks they perceive in realizing the transformative potential of these technologies point to the need for focused development in this area and the elimination of uncertainties. The most critical issue in the integration of AI technologies is equipping employees with the new skills

required by these technologies. Training in this area will not only ensure a healthy integration process but also help mitigate the negative impacts of these technologies on the workforce. Otherwise, significant job losses will be inevitable. Yet, it appears that businesses are not taking sufficient steps in this regard.

The World Economic Forum's Future of Jobs Report 2025 emphasizes the critical importance of retraining human capital in labor markets undergoing profound transformation due to AI technologies. In the face of these structural shifts, reskilling and upskilling are no longer optional—they have become imperative for strengthening the workforce. Indeed, the report underlines this urgency by stating, "If the global workforce consisted of 100 people, 59 of them would need training by 2030," highlighting both the continuity of learning in dynamic labor markets and the growing importance of lifelong education.

On the other hand, businesses' general reliance solely on automation for productivity gains poses a risk from a labor perspective. While automation can increase productivity, it often has a negative impact on employment. However, productivity can also be enhanced through the complementary use of these technologies alongside human labor. Numerous studies indicate that AI technologies, in particular, improve the performance and productivity of workers with low to medium skill levels. Therefore, leveraging these technologies in this manner demonstrates that it is possible to increase overall productivity in businesses without adversely affecting employment. For this to be achieved, however, businesses must prioritize comprehensive training programs for all employees. The findings of the report also highlight this shortcoming, pointing to training as a key area for development.

Dynamics of the Meritocracy Trap and Artificial Intelligence

The focus of discussions on the relationships between education and the labor market has long been on human capital (Becker, 1962, 1964). Human capital promises an open labor market accessible to everyone through education. In other words, all individuals who acquire the necessary skills through education have the opportunity to transition into employment by contributing to human capital. Therefore, countries strive to ensure access to education for all social groups and to continuously improve the quality of the education provided (Özer, 2022a, 2022b, 2022c). This effort has brought the inclusiveness of education systems and the equality of opportunities they offer to the forefront of educational discussions.

Meritocracy promises a system in which rewards in the labor market are distributed based on the quality of human resources, emphasizing the importance of human capital. This promise is significantly different from the approaches and promises of other governance systems, such as aristocracy. In aristocracy, advantages based on innate race or lineage are extended to all segments of society in meritocracy and associated with human capital, representing a major revolution. With this approach, education has moved beyond being a privilege owned by certain social classes by providing access at all levels. Especially after World War II, education underwent phases of massification and universalization, becoming the most important social mechanism in the redevelopment of countries.

Moreover, this process has not been limited to access to education; equality of opportunity in education has become one of the main focuses of the new era (Özer & Perc, 2022; Suna et al., 2020a, 2020b; Suna et al., 2021; Suna & Özer, 2022, 2024). In this process, the importance of not only the great benefits of access to education but also the ability of every individual to equally benefit from the opportunities provided has been recognized.

This period also marked the realization that it is not sufficient for educational opportunities to be open to all social segments; there is a need for policies that actively support disadvantaged groups and compensate for their limitations. Thus, it has been expected that all individuals with the same skill level, regardless of their socioeconomic background, will possess equal human capital when transitioning into the labor market. This approach has undoubtedly provided a significant gain towards creating more egalitarian societies.

While providing significant advantages, viewing the meritocratic system through a one-dimensional lens prevents seeing the underlying dynamics and the problems it causes. Despite the centrality of human capital in the meritocratic system, technological developments leading to automation, especially since the 1970s, have brought about fundamental changes in both education systems and labor markets, moving meritocracy to the next stage. Indeed, these developments have significantly altered the structure and level of skills required in the labor market. Recent studies indicate that technological advancements are not only reducing the employment area of low-skill routine jobs but also that of middle-skill jobs (Green, 2019; United Nations, 2020). Therefore, it is now necessary to reevaluate and redefine skill levels and general assumptions, considering the needs of the labor market. In evaluations of this new phase, the quality of human capital is increasingly associated with the capacity to acquire higher-level skills.

Understanding these profound transformations and the underlying dynamics will facilitate comprehending the directions in which countries and societies are evolving with globalization. Therefore, this section comprehensively examines the findings of Daniel Markovitz's (2019) book, The Meritocracy Trap: How America's Foundational Myth Feeds Inequality, Dismantles the

Middle Class, and Devours the Elite. Although the book does not evaluate the meritocratic process in two different stages, this study divides the meritocratic process into two different stages based on the dynamics of transformation to provide a detailed assessment. The transformations in education and labor markets are evaluated within these two different stages. Additionally, projections are made on how AI technologies will transform these dynamics. Specifically, the potential of generative AI technologies to move meritocracy to a third stage is discussed.

Transformations Brought About by Meritocracy

The meritocratic system, with its governance approach, claims to open access to education first and subsequently employment opportunities through the labor market for everyone, focusing on human capital. The first phase of the transition from aristocracy to meritocracy, which lasted until approximately the 1970s, corresponds to a period where human capital was valued for the middle (socioeconomic) classes, thus reflecting sincerity in the promises of meritocracy. During this period, the burden and consequently the benefits of the labor market were particularly clustered around the middle classes. Therefore, in its first phase until the 1970s, meritocracy produced extremely positive outcomes for the middle class, rapidly transforming society and cities (Markovitz, 2019: 20-21). This transformation, where the middle class was privileged, occurred in all cities, and the differences between classes were relatively minimal, leading to the spread of mass/popular culture (Markovitz, 2019: 47).

However, it is observed that this system, as a dynamic one, does not remain in the same phase continuously and transitions to new phases with new transformations. Although meritocracy initially offered similar conditions to different social classes in line with the spirit of the time, by the end of the first phase, it was

no longer possible for these conditions to remain unchanged. It is known that the advantages gained at the end of this cycle were not distributed equally, clustered in certain social positions, and increasingly led to new advantages only for individuals in these clustered positions. Therefore, the continuous concentration of advantages in certain social groups is explained by the famous sociologist Merton's well-known saying, the Matthew Effect (Merton, 1968; Özer, 2023a, 2023b; Perc, 2014; Rigney, 2010). The accumulation of advantages in certain social groups leads to a cumulative increase in new advantages within these groups, while other groups move into disadvantaged positions (Zuckerman, 1989). The increasing polarization between groups begins to deepen the gap between the advantaged and the disadvantaged (Markovitz, 2019: xiii).

In the second phase following the first, meritocracy reintroduces the aristocracy dynamics it initially claimed to eliminate, replacing lineage, the main source in aristocracy, with wealth. As Markovits also states in the introduction of his book, despite being designed as an innocent attempt to promise equality by opening up a previously hereditarily determined elite class to outsiders equipped only with their own talents and desires, the process not only fails to achieve this goal but also leads to the emergence of a new aristocracy with different criteria. This has caused advantages to cluster within the elite class and deepened the gap between the elite and other groups (Markovitz, 2019: x). In other words, in its second phase, meritocracy functions in the labor market, as in education, in a way that reinforces educational inequalities. Markovitz (2019: xv) notes that this inequality also imposes heavy burdens on the elite, requiring them to exert far more effort than the aristocracy to maintain the advantages they gain in the second cycle and the disparities they create. Consequently, despite the appearance of a democratic

and merit-based system in society, the continuous increase in inequalities is heightening tensions among people outside the elite class. As a natural result of this situation, the permeability and connections between social groups are decreasing, leading to permanent societal unrest. The political consequences of this large-scale change, which closely affect many social dynamics, are inevitable. Markovitz (2019: xvii) argues that Trump effectively captured a similar change in America and won the presidency by creating a narrative addressing it.

Once advantages accumulate in the new system, meritocracy begins to operate like a minority aristocracy. The only difference is that this new minority also has to work hard. The primary mechanism of these phase/transitional shifts is education. While the new system democratizes education to reach all sections of society, access to the highest-performing schools and universities is prioritized for the elite due to their prohibitive costs. In this context, the conditions offered by institutions, which are ostensibly open to everyone, covertly create new advantages for privileged groups. As in this example, existing income advantages are used to gain access to educational opportunities that will open doors to future income advantages.

The second mechanism is the labor market. In this area, meritocracy also transforms job descriptions and the skills demanded by the employment world, organizing high-paying jobs in favor of a narrow social segment. The increased focus of current educational policies on the expectations of the labor market also strengthens the reflection of the skills sought in the labor market in education systems. Labor market dynamics support the skills provided by elite education, match these skills with elite jobs, and open up a large portion of the vast reward pool in the employment field for privileged groups (Markovitz, 2019: 8).

In summary, the labor market dynamics, once based on middle-class skills, are redefining skills with each technological transformation, pushing the middle class into lower-skilled roles while prioritizing the skills acquired through elite education. In other words, the highly lucrative elite jobs in the labor market are now shifting from the middle class to the elite class, with the education system serving as the facilitator of this transition. Thus, the status of the middle class, which had improved in the first phase, has been undermined, and the meritocratic order has begun to reproduce its own aristocracy through education. Now, the demanding yet highly rewarding elite employment areas are predominantly filled by those with elite education (Markovitz, 2019: 11-12).

Transformation in the Labor Market

The development and establishment of meritocracy have also triggered significant transformations in workplaces. The rapid advancement of technology has led to the widespread adoption of automation in labor markets. While automation rewards higher skills, it directs middle skills towards lower-skilled jobs. As these transformations occur with traditional skill level definitions, changes are also happening within all skill levels, highlighting the need for new skill level definitions (OECD, 2019). As a result of this transformation, most jobs in workplaces now require fewer skills and continuously reduce wages. However, in the very few high skill jobs produced by this transformation, there is, conversely, an incredible rise in wages. Consequently, job positions in the labor market are increasingly clustering into a small number of high-skill elite jobs and a large number of low-skill jobs. In fact, a similar transformation is occurring across all sectors. Markovitz points out that even the entertainment sector has undergone a similar transformation to illustrate the dramatic nature of this change (Markovitz, 2019: 178).

Another point to mention is the transformation in the management structure of businesses in today's meritocracy. As automation technologies become more widespread and middle-class skills are devalued, management has become more centralized and less participatory (Markovitz, 2019: 173). The transformation of management in companies in this way has also increased the need for consulting firms. Since there are no longer enough middle-level managers to solve problems encountered in a business, this function is now provided by consulting firms (Markovitz, 2019: 176). Thirdly, low-skill jobs are increasingly filled by short-term or part-time workers instead of full-time employees. Consequently, the middle-class job model, which lasted until around the 1970s and provided lifetime employment, on-the-job training, and ample promotion opportunities, is gradually being abandoned (Markovitz, 2019: 174-175). Fourthly, the transformations mentioned above have led companies to largely abandon on-the-job training programs aimed at skill development, which were previously provided by firms. This particularly means the gradual abandonment of "in-house talent development" models that focus on employees with managerial potential working in different roles within the organization and developing their skills. This development inevitably creates many limitations in areas such as corporate loyalty, in-house career path development, and talent management. As a result, while employers are relieved of the burden of workplace training, the education of elite employees has progressed from undergraduate to postgraduate levels (Markovitz, 2019: 142).

The removal of workplace training in elite jobs and the transfer of this burden to individuals have directly linked access to postgraduate education with individuals' socioeconomic levels. This process has excluded the middle class from this competition while entrenching the monopoly of the elite class. In other

words, postgraduate education has reinforced the formation of a narrower elite class regarding education and skills by increasing investments and costs associated with human capital. The meritocratic legacy is no longer directly transmitted through goods and wealth but rather indirectly through elite education. Consequently, postgraduate education helps extend the meritocratic legacy deeper into adulthood. In this way, the elite class, which can access postgraduate education at high-performance educational institutions, has a significant advantage in accessing higher-paid and more prestigious jobs, thus deepening socioeconomic inequality through the transmission of meritocratic legacy.

Fifthly, the burden of intensive work now falls on the elite class. It can be argued that the increase in inequality at the high end of meritocracy is entirely related to merit and intense work. Since the conflict is between the middle class and the elite class, discussions about inequality are not as straightforward as those about low-end inequalities. In the current structure, it can even be argued that the elite class is exposed to greater work pressures due to the responsibilities they undertake. As Markovitz (2019) references sociologist Thorstein Veblen, who once associated wealth with leisure time and the diversity of hobbies during that time (see p. 79), the meritocratic system's second phase has eliminated this privilege for the elite class, demanding more continuously both in education and work. Consequently, while working hours decrease and leisure time increases for those in low-paid jobs, leisure time for those in elite jobs decreases due to increasing working hours (Markovitz, 2019: 83).

Every day, meeting the rising demands of the elite education system, striving to fulfil he endless demands of human capital for elite jobs, battling fierce competition after starting an elite job, and being under the pressure of a system where only slightly

higher-than-average performance receives the full reward, reduces human capital to an asset management function and alienates individuals. In this process, only the resilients are rewarded (Markovitz, 2019: 44).

Transformation in the Education System

The meritocratic system has made education the conduit for the profound transformation occurring in the labor market. While the massification and universalization of education began after World War II, the meritocratic system has simultaneously transformed the education system, facilitating the clustering of advantages within the elite class. The education system effectively functions as a mechanism that subtly creates the necessary conditions to connect elite groups with labor market rewards. In this way, education systems have become the main carriers of the process through which middle-class skills are distributed to lower and upper classes, ultimately leading to the displacement of the middle class from their jobs (Markovitz, 2019: 182).

At the beginning of the first phase of meritocracy, education exhibited an elitist appearance, serving to preserve the socioeconomic advantages of children from a few privileged families rather than the masses. However, once this field was opened to the masses and education became accessible to everyone, it appears that the situation did not change much. On the contrary, competition has extended to the very beginning of educational stages, starting with preschool education. Therefore, it is crucial for a student to be in an advantageous position throughout their educational life to have access to this advantage. However, this path is quite expensive, and even if the middle classes can successfully participate in this race, it is impossible for them to afford school expenses (Markovitz, 2019: 7-8). Thus, while the wages of middle-class workers remain

almost stagnant, dramatic increases are seen in the salaries of jobs requiring the highest level of skills, which are accessible to graduates of elite education. Consequently, a significant portion of income now begins to cluster within the elite class, marking the transition to a new phase (Markovitz, 2019: 23-24).

As a result, the middle class now faces more of the limitations caused by meritocracy rather than its benefits, losing hope of reaching elite jobs through access to elite education. Economically, for this income group, the first mechanism of the meritocratic process, elite education, has become unaffordable. The only chance for social classes outside the top socioeconomic strata to gain elite access is through a very limited number of scholarship programs. Although these highly competitive scholarship programs are of great importance to other social classes, they represent only an exceptional case within the system, as discussed. While the system appears to operate on a merit-based principle, it implicitly rewards initial advantages, leading to new advantages (Markovitz, 2019: 17). In fact, disparities in success in this race begin with preschool education. Aware of the long-term benefits of preschool education, the elite effectively capitalize on this opportunity (Markovitz, 2019: 123).

Therefore, a negative cycle begins to accumulate disadvantages for the middle class. The Matthew effect is again in play. Children of the middle class first drift away from elite schools and then from elite jobs. Meanwhile, the elite are aware of how critical this approach is for the sustainability of the cycle and invest more in elite education each day. The elite begin to reap the benefits of their investments in all levels of education and extracurricular activities, starting from preschool, as they progress through high school (Markovitz, 2019: 132).

Ultimately, disparities in graduation rates according to income

levels begin to widen beyond access to higher education (Markovitz, 2019: 135). The continuous investment in education from preschool onwards that the elite provide for their children grants them significant advantages in their university education. These students, accepted into top universities, benefit from high-quality education, valuable internship opportunities, and strong professional networks. This facilitates their success in their careers and helps them maintain their social status. This sustained investment allows the children of the elite to continually secure advantages in their education and careers and to pass these inherited benefits on to future generations. In contrast, children from middle-class and poorer families face significant challenges in accessing such resources and opportunities. This situation restricts their social and economic mobility and contributes to the perpetuation and even expansion of social inequalities, with the middle class increasingly resembling the poorer class. The share of income received by the middle class, excluded from elite education, is also steadily decreasing (Markovitz, 2019: 13).

The Elitist Bridge Between Education System and Labor Market

In the meritocratic system, the transfer of privilege among elite classes is more durable than in aristocracy. In aristocracy, the role once played by lineage is now taken by education, which provides a much more resilient support in the transfer of privilege. Furthermore, while wealth may be squandered, the long-term investment in human capital through education solidifies this transfer, making it permanent (Markovitz, 2019: 150).

In the second phase of meritocracy, there is a continual emphasis on the virtues of the merit system as if it were still in its first phase. However, conditions are no longer equal. While access

to education is available to everyone, the quality disparity of what is accessed is kept out of the discourse. In this context, the difference between having equal opportunities on paper and the underlying factors required to truly access those opportunities is clearly visible. Access to elite higher education institutions is open to everyone, but the admission requirements are so high that meeting them without an elite educational background, and thus accessing elite higher education institutions is not feasible. Once strong connections have been established between elite education and lucrative elite jobs, accessing elite jobs with just an average higher education degree becomes impossible, and even if employment opportunities are found, the promised wages are far from breaking this cycle. In this context, Markovitz (2019: 238-239) specifically provides examples of new alignments, notably from the finance sector.

On the other hand, those with elite education, who have a strong connection to elite jobs, continue to solidify their positions in these jobs by developing new technologies, thereby continuously increasing their economic returns. In other words, the elite class enhances the complexity of elite jobs by creating new technologies and fortifies job positions that can only be filled by highly skilled elites, thereby creating a feedback loop in their favor (Markovitz, 2019: 239). Therefore, in the second phase of the meritocratic system, the Matthew effect ('For whoever has will be given more, and they will have an abundance; whoever does not have, even what they have will be taken from them.') becomes more pronounced. An advantage continually leads to new advantages, while a disadvantage makes it impossible to escape a disadvantaged cycle (Markovitz, 2019: 27).

Despite this apparent cycle, praises for the meritocratic system and merit continue to be repeated, and individuals are persuaded to believe that their experiences are related to their

own incompetence. This ensures the unjust sustainability of the cycle (Markovitz, 2019: 30). Thus, elite education serves a critical function for the operation of the Matthew effect. Education is a tool for the elite class, marking the beginning of prosperity and the extension of privileges beyond the employment market. Unlike aristocracy, where privileges are derived from lineage, meritocracy establishes its own dynasty through meritocratic education and employment. The establishment of this dynasty through education also gains prestige in society, leading to its unquestioned acceptance and unconditional support. Economic inequality arises not solely from the strong connections between elite education and elite jobs but is also exacerbated by the excessive work undertaken by the elite class (Markovitz, 2019: 89).

In summary, the excessive labor of the elite class deepens existing inequalities and also significantly increases their incomes by encompassing the reduced labor of the middle class. Markovitz (2019: 98-99) recommends examining economic inequalities at two distinct extremes to better understand the effects of meritocracy. Ultimately, while low-end inequality and poverty persisted during the first phase of meritocracy, high-end inequalities were reduced. However, in the second phase, inequality is predominantly occurring at the high end. Markovitz (2019: 252-253) specifically emphasizes that the strong relationship established between elite education and super-skilled jobs is a choice made by America, but despite having similar dynamics, Germany has chosen not to follow this path. Instead, Germany has developed a more egalitarian education system and has placed special emphasis on VET, highlighting a distinct approach to managing economic disparities and skill development.

In the US, therefore, the relationship between elite jobs and super-

skilled positions is continually strengthening, whereas Germany is building a more egalitarian labor market. In both countries, this construction is facilitated through structural features in their education systems. Consequently, in the US, employers' new investments are allocated to complement the elite class, focusing on high-skilled labor, while in Germany, the focus is on creating sectors dominated by unskilled or semi-skilled labor (Markovitz, 2019: 253). This approach results in a reduction of wage inequality within sectors in Germany, in contrast to the US. As a result, the meritocracy in education coincides with the meritocracy in the workplace, leading to different outcomes. In countries like the US, where elite education is concentrated, workplace investments focus on elite skills, continuously increasing the skill premium. In contrast, in countries like Germany, where education is more widespread, the focus on semi-skilled workers helps maintain a certain balance in the skill premium (Markovitz, 2019: 254). This demonstrates how educational and labor market policies are closely intertwined and can lead to varying levels of socioeconomic equality.

Other Factors Strengthening the Elitist Structure

At this stage, the Matthew effect has created sharp class distinctions, dividing society and exacerbating inequalities. These inequalities are further perpetuated through various sociological instruments, such as forms of marriage (Markovitz, 2019: 48-49). This suggests that societal structures and practices, like marriage, can reinforce and even amplify existing disparities by promoting alliances among the elite, thus keeping wealth and resources concentrated within a small segment of the population. This dynamic helps to solidify the elitist structure and perpetuates a cycle where the elite continue to benefit disproportionately. On the other hand, these education-based marital matches lead to another advantage within the high-income group as divorce

rates increase from high to low-income groups (Markovitz, 2019: 118). In other words, as incomes decrease from the high-income group to the low-income group, the demographics of households also rapidly change. Children are thus forced to grapple with other issues, and this trend becomes another factor that enhances the advantages of the upper end. At this point, it is important to note that the advantages extend beyond the realms of education and employment, gaining a social and demographic dimension.

Indeed, the issue isn't confined merely to education. Over time, not only have problems related to inequality of opportunity in education become entrenched, but even if equity in human capital were achieved, it's evident that expectations in the labor market are not fully met due to invisible social networks. While the educational portfolio plays a significant role in transitioning to employment, the importance of numerous socioeconomic variables, particularly social networks, cannot be denied. The continuously expanding social networks of wealthy families facilitate a much easier and quicker transition for their children from education to the labor market compared to their peers, also ensuring higher wages (Granovetter, 1974; Montgomery, 1991; Özer, 2023c; Özer & Perc, 2021).

The elite class not only invests in elite education to maintain its excessive wealth but also invests in politics and lobbying activities. Thus, they not only fight against any regulation that might negatively affect their wealth, but also frequently resort to political instruments to secure unjust incentives that increase their fortunes (Markovitz, 2019: 52). The amount of money spent on lobbying is substantial. Consequently, politics is compelled to behave in a manner that preserves the meritocratic system, essentially protecting the currently monopolized wealth of a small number of the affluent. Thus, politics has become much more sensitive to the demands of the elite class. While

meritocracy spreads inequality, politics is not immune to its influence (Markovitz, 2019: 55).

Ultimately, as wealth increases at the high end, taxes, conversely, are decreasing. This situation predominantly harms the middle class, thereby widening the gap between social classes. Additionally, during the period when the middle class dominated all sectors, wages in the public and private sectors were almost the same. However, with the rise of meritocracy, this situation has become asymmetric, and the private sector has started to pay significantly higher wages compared to the public sector. As a result, those with superior skills have shifted their employment preference from the public to the private sector, ensuring that the concentration of talent in the private sector protects the interests of the elites (Markovitz, 2019: 56). Furthermore, elite managers remaining in the public sector are also turning to employment in the private sector after retirement. Therefore, skilled public employees are already seeking ways to connect with the elite private sector while still in public employment. This situation is accelerating deformation in the public sector. All these factors combined ensure that the asymmetry maximizes the income of the elite class, while somehow minimizing their taxes (Markovitz, 2019: 58).

'Winner-Takes-All' Society and the Exhaustion of Hope

In the second phase of meritocracy described earlier, the middle class disappears, and society is divided into two segments: the elite and the lower class. Economic returns are also unevenly clustered between these two segments (Özer, 2024a). While the focus has been on the distribution of educational and labor market returns up to this point, the loss for the middle and lower classes extends beyond these dimensions, taking on a social character. The exclusion and pressure applied by meritocracy on the middle

and lower classes push these groups into an irrecoverable phase of despair, creating a deadly sociological ecosystem (Markovitz, 2019: 31). Thus, economic inequality now largely stems not from poverty, but from wealth concentrated within the elite class (Markovitz, 2019: 102). The current increasing inequality is defined by high-end inequality rather than low-end inequality. However, the outcome produced by the meritocratic system is much less visible compared to the old inequalities, and the setup of this system makes it difficult to morally criticize this inequality. The situation has become devastatingly destructive for the middle and lower classes, to an extent unparalleled in history. This validates the assertion by Piketty (2014) that 'without radical intervention, the 21st century could be marked by the highest levels of inequality ever experienced'.

The assumption that human capital alone is sufficient personalizes success and, consequently, personalizes failure as well. This assumption reflects an incomplete perspective that ignores many systemic inequalities along the path to success and excludes social and economic factors beyond an individual's control, as detailed in this study. Thus, it facilitates the evaluation of success without context, attributing structural and contextual achievements to individuals. As a result, individuals are labeled based on their own successes and failures, loading the burden of all systemic and structural issues back onto the individual (Özer, 2020). Once the problem is individualized, individuals are trapped in a vicious cycle of continually investing in their human capital, even though it might not actually change the outcome. This situation permanently entrenches the resolution of systemic inequality on the individual, exacerbating helplessness (Jarvinen, 2020). This strategy also prevents criticisms of systemic inequality sources, particularly using mechanisms of high societal prestige like education. The imposed belief that "in

every condition, it is the individual who is the winner or loser and the individual must make investments to improve themselves in every context" dampens criticisms regarding social inequality. Because successes and failures are personalized in the second phase of meritocracy, the middle and lower classes are forced to bear the burden of consequences that occur outside their control and endure the humiliation of this burden (Markovitz, 2019: 187-188).

In the second phase of meritocracy, the evolution towards an aristocracy effectively reverses the developments of the first phase. The structure of cities, the differentiation of consumer goods, and even residential areas are affected by this transformation, as ecosystems are restructured according to income and consequently, education levels (Markovitz, 2019: 226). On the other hand, the middle and lower classes, far from reaching elite education and jobs, are caught in a debt spiral, struggling to sustain their lives with new loans taken out before their next paycheck. The result is a rising wave of foreclosures and bankruptcies (Markovitz, 2019: 219).

Ultimately, the elites monopolize not only elite education and highly profitable elite jobs (in terms of status and income) but also political power. When politics prioritizes the interests of the elites, it increases social unrest over the long term. Those outside the elite class feel marginalized and increasingly shift towards nationalism and populism. The consequences of this shift were evident in the American elections, where the victims of the second phase of meritocracy contributed to Donald Trump's election as President (Markovitz, 2019: 69).

The Matthew Effect and Inequalities

How inequalities emerge in various domains within societies—from education to the economy, from technology to the distribution of resources—and what dynamics underlie them have long been subjects of ongoing debate. Although the dynamics of inequality are often studied within the specific language and jargon of each field, approaches that offer a more general perspective have made significant contributions to understanding the factors and processes that lead to inequality as a whole. In this context, one of the most influential approaches to understanding how social inequalities occur is the Matthew effect, developed by the renowned sociologist Robert Merton (1968), inspired by the verse in the Gospel of Matthew: "For whoever has will be given more." The Matthew effect explains how even very small initial differences can grow over time if no intervention is made, how advantage begets further advantage, how it accumulates, and ultimately how it exacerbates inequalities.

In this context, Daniel Rigney introduces the Matthew effect in his book The Matthew Effect: How Advantage Begets Further Advantage, and explores its contributions to understanding inequality across various domains—from science and economics to politics, education, and culture (Columbia University Press, 2010). Rigney stated that his primary aim in writing the book was to evaluate the extent to which the Matthew effect applies across a broad spectrum, despite its well-established influence in the social sciences and related fields. Rigney notes that although many pioneering studies have examined the Matthew effect in areas such as education, economics, sociology, and politics following Merton's (1968) original definition, these discussions have largely remained confined within their respective disciplines. With this book, he aims to emphasize the broad reach of the Matthew effect, to illustrate how similar dynamics emerge across interrelated domains, and to show how these dynamics can mutually reinforce one another.

In his book, Rigney devotes separate chapters to the impact of the Matthew effect across various fields. At the same time, in the conclusion, he brings together these diverse discussions under a unified perspective, highlighting the interactions between different domains. One of the notable strengths of the book is its ability to present contemporary examples to readers, particularly through sociological and economic indicators in countries where the Matthew effect is especially prominent, such as the United States. A key contribution of the book—both to the academic literature and to the general reader—is its explanation of the consequences of the Matthew effect on inequality through familiar analogies such as zero-sum games, as well as common idioms and proverbs. Through these analogies and accessible explanations, Rigney points out that the manifestations of the Matthew effect are often clearly observable by society, even if not explicitly labeled as such.

Rigney devotes the first chapter of his book to a detailed examination of the Matthew effect. In summary, in various areas of life, initial advantages tend to lead to further advantages over time, and thus, the gap between those who have more and those who have less at the outset continues to widen. This dynamic contributes to the deepening of inequalities and, if left unaddressed, can eventually become chronic. For example, as emphasized in Merton's (1968) work, highly esteemed scientists and institutions increase their visibility and recognition to a much greater extent compared to their peers and other institutions, thereby attracting more resources. These additional resources, in turn, further enhance their reputation.

As in other domains, in the realm of politics, power tends to generate more power. To illustrate how cycles of power become entrenched, Rigney cites the fact that, since 1964, 81 percent of U.S. Senators and 93 percent of members of the House of

Representatives have been re-elected. Power does not manifest solely in governance; it is also evident in structures related to education, the economy, and religion. Rigney particularly demonstrates how the Matthew effect plays a significant role in deepening racial inequalities in American society by presenting examples from various domains. For instance, employment status, low wages, and challenges in education prevent Black Americans from accumulating economic advantages at the same rate as White Americans. As a result, significant assets cannot be passed down to future generations, and poverty persists across generations. This negative situation triggers secondary effects in other areas: unemployment and crime rates increase, family structures weaken, health and overall well-being decline, and individuals become more vulnerable to destructive external forces.

In short, there is a self-reinforcing cycle at play in the context of inequality. In this regard, the Matthew effect also provides a framework for analyzing social phenomena through the lens of positive feedback loops, as described in systems theory. Rigney explains that the Matthew effect functions as a form of positive feedback that amplifies the deviation of the system, thereby pushing it toward instability.

Of course, inequalities are also influenced by many internal factors and can be interpreted differently depending on the context. For example, some explain inequalities not through the Matthew effect, but rather through differences in individuals' motivation, talent, or personal initiative. This perspective places extraordinary emphasis on human capital. However, when individuals fail to reach expected positions, levels of success, or income despite their level of human capital, this approach tends to locate the source of the problem not in external factors, but again in deficiencies within their human capital. Yet, in reality,

most people live in a grey zone—vulnerable to the unexpected, uncontrollable, and impersonal mechanisms of the Matthew effect. Therefore, Rigney emphasizes that it is a major fallacy to claim that wealthy and disadvantaged players in social domains such as the economy, science, art, and education have equal opportunities to succeed. He illustrates this point notably through the example of compound interest. Even if we assume that the interest rate is the same for individuals who invest different amounts of money — which in fact is not entirely accurate, as the rate is tied to the amount invested — it becomes evident over time that the gap between initial amounts increases significantly. In other words, the rules of the game and the initial conditions virtually guarantee that inequalities will grow as the game progresses.

For this reason, Rigney highlights the critical distinction between having an opportunity to succeed and having an equal opportunity to succeed. This distinction is, in fact, quite important. Because having access — being in the game — means having a chance to succeed, but it certainly does not mean that everyone in the game has an equal chance of winning. Another important point Rigney emphasizes regarding the Matthew effect is that the reverse flow of the trend it produces is extremely limited in scale. In other words, it is indeed possible for the poor to become wealthy or for the rich to become poor, but the likelihood of such a reversal is significantly lower compared to the probability of the rich becoming richer and the poor becoming poorer. Therefore, the most important mechanism of the Matthew effect is that it leads to cumulative advantage through positive feedback loops. In other words, through self-amplifying cycles, advantage generates further advantage, and the gap between those who have more and those who have less continues to deepen over time.

The Matthew effect can be either relative or absolute depending on the domain in which it occurs. As Rigney explains, the absolute Matthew effect resembles a zero-sum game, where one player's gain directly corresponds to another's loss. In such contexts, an increase in one person's advantage is necessarily tied to a worsening of another's disadvantage. In the case of the relative Matthew effect, however, the system is open and resources expand, resulting in a positive-sum game in which, despite differences in gains, everyone has the potential to benefit. Therefore, as previously noted, one player's success is not always tied to the loss of others. Nonetheless, even in such systems, there is a risk that some players may attempt to monopolize the gains. Whether absolute or relative, the social mechanisms that produce the Matthew effect are often covert and not recognized by most participants involved in a given social phenomenon.

After examining the manifestations of the Matthew effect in various domains such as education, economics, science, and technology, Rigney turns to a particularly important question: Is the Matthew effect an inevitable social phenomenon, or can it be prevented? He explores this issue in detail. Within this framework, Rigney approaches the problem through the lens of constructivism. According to this perspective, the Matthew effect emerges as a result of artificial rules that we ourselves have created within a social game. As with any set of game rules, these can lead to highly unequal outcomes. Therefore, just as the rules of a game can be changed, so too can the structures and norms that produce the Matthew effect. Rigney places particular emphasis on the idea that the inequalities and accumulation of advantage resulting from the Matthew effect can, in fact, be mitigated through social interventions. He illustrates this by drawing an analogy to society's responses to natural diseases or disasters. He also explores in detail both the mathematical

constraints that can limit the Matthew effect and the role of government interventions. However, Rigney points out that the social consequences of the Matthew effect are not necessarily always destructive or unjust. For instance, he uses the example of the accumulation of personal wealth to argue that the outcomes may vary depending on how that wealth is acquired, how it is used, and how it affects the well-being of others.

In summary, the book serves as an important resource that goes beyond the technical definition of the Matthew effect, offering insight into how it can be understood in different contexts, which social processes it influences, and, most importantly, raising awareness that this effect is not an inevitable process—there are, in fact, many possible avenues for intervention. In society, no domain exists in isolation or functions independently from others. Each domain influences the others. In other words, an advantage gained in one area can lead to further advantages within that same field, while also generating benefits in other areas. As a result, the Matthew effect does not merely activate self-reinforcing cycles within a single domain, but also triggers cycles that exacerbate inequality across other domains. Thus, an advantage or disadvantage in one field can have a domino effect, spreading to other areas as well. For this reason, mitigating the Matthew effect is of critical importance for the development of society as a whole—that is, for ensuring that the advancement of one segment of society does not come at the expense of another. The prevalence of the Matthew effect suggests that the natural flow of social processes tends to increase inequality. Therefore, public policies aimed at intervening in this "normal" flow are essential for reducing inequalities.

The Game of Success and Deepening Inequalities

As discussed in the previous article titled "*Rankings and the Asymmetric Distribution of Rewards"*, and as Peter Erdi (2020) emphasized with reference to Barabási, success is not primarily about an individual's own performance but rather about how society evaluates that performance. In other words, achievements that are assumed to be based solely on individual performance are, in fact, shaped by how much value or prestige society assigns to those performances through their interaction with complex social network structures.

Of course, not all individuals perform with the expectation of gaining social recognition. There are people for whom, once a performance is carried out, the matter is concluded, and what follows is irrelevant. Their intention is not tied to a societal expectation, and once they act with that intention, the story ends there. Thus, societal success holds no value for them. In such cases, there is nothing Barabási and his team can do. But once one steps beyond that boundary, they enter a success game governed by game theory, as Erdi describes. However, this is not a game based solely on the individual's performance. The game has its own rules and consists of numerous visible and invisible components.

When Performance Cannot Be Measured, It Is Networks That Lead to Success

Barabási's book *The Formula: The Universal Laws of Success* (2022, Istanbul Bilgi University Press) offers important insights into how success is achieved in modern times, the patterns underlying it, how these patterns relate to networks, and how success is rewarded. Barabási formulates his first law as follows: "Performance drives success, but when performance can't be measured, networks drive success" (p. 27). However, this statement is somewhat incomplete when considered in the full context of the book, because performance alone does

not guarantee success. It is only when performance is socially valued—through networks and societal recognition—that it can be transformed into success. In other words, success emerges when performance is embedded within a broader social context.

However, in fields where performance is particularly difficult to measure—such as art—it is networks that entirely determine success. The value attribution and pricing processes that define success are shaped by numerous actors and the networks in which they are embedded: art galleries, collectors, museums, art dealers, critics, and more. As Barabási emphasizes, two artists who start from the same point and possess similar talents can be rewarded differently depending on the choices they make and the trajectories they follow, resulting in varying levels of visibility. Barabási notes that although there are many galleries and museums in the art world, the rewards are determined by only a small number of them, and he underlines their central importance (p. 53). In other words, once an artist's career intersects with these few central institutions that define success, success becomes almost inevitable.

Today, similar central hubs exist across all fields, and these hubs play a crucial role in increasing visibility. People tend to read bestselling books, listen to the most-streamed music, and watch the most-viewed films—thus reinforcing the consumption of already popular items. As a result, objects with a high number of initial connections or consumption instances continue to accumulate even more, increasing their chances of becoming central hubs within the network. In other words, prior success significantly increases the likelihood of future success.

Performance Is Limited, but Success Is Unlimited

Barabási's second law is stated as: 'Performance is bounded, but success is unbounded' (p. 59). In other words, while

human performance has natural limits in every field, once that performance activates the right networks, the resulting success—and the rewards it brings—can be limitless. Thus, the number of citations a successful scientist receives, the number of books a bestselling novelist sells, the number of albums sold by a popular musician, or the price of a single painting by a renowned artist can rise to abnormal levels that are incomparable to the achievements of others in the same field. In short, the magnitude of success and reward becomes highly concentrated in a few hands, often to the disadvantage of others with similar levels of performance.

Barabási refines his first and second laws of success with a third law, which he formulates as: *"Previous success × fitness = future success"* (p. 97). In this formulation, prior success alone does not determine future success; fitness becomes a critical variable. This means that a new player entering the game can catch up with—even surpass—established, successful competitors if their fitness is high enough (p. 129). Although fitness may appear to be related to performance, it actually represents a form of competitive strength that reduces the impact of rivals in the same field. As Barabási explains: 'We called this feature 'fitness,' borrowing the term from evolution. It was a suitable choice. Because fitness is not synonymous with quality—though it is certainly related to it. Rather than being a value judgment, fitness gives us the ability to detect a product's inherent capacity to outcompete other products targeting the same buyer, the same audience, or the same fan base.' (pp. 129–130)

While Performance Follows a Normal Distribution, Success Follows a Logarithmic (Power-Law) Distribution

Barabási explains the mismatch between the distribution of performance and that of success using the concepts of the normal

distribution and the power-law distribution (p. 83). Performance follows a normal (bell curve) distribution, meaning that it has natural limits, and that there are many individuals whose performance is very close to that of top performers. However, the returns of success—which can be achieved with only marginal differences in performance, and thus become decoupled from it—are distributed logarithmically according to a power law. In this model, small differences in performance can lead to disproportionately large differences in success.

Enormous gaps in rewards occur despite minimal differences in performance. In many cases, rewards differ so dramatically that they cannot be justified by the small differences in performance. For instance, a small number of scientists receive the vast majority of academic citations; a single novel can generate astonishing levels of income; the price of one painting can exceed the total lifetime earnings of tens of thousands of other painters; or the profits of a few companies can surpass the total national income of countries populated by billions of people. This asymmetric distribution of rewards, largely decoupled from actual performance, follows the same dynamics in the arts and entertainment sectors.

As Daniel Markovits highlights in *The Meritocracy Trap: How America's Foundational Myth Feeds Inequality, Dismantles the Middle Class, and Devours the Elite* (2019, p. 178): 'No sector is immune. Even in the arts and entertainment, new technologies allow a few "superstar" entertainers to capture global audiences, displacing many only slightly less skilled performers who previously served local audiences by being the best entertainment within traveling range. In 2017, Beyoncé, LeBron James, and J. K. Rowling each made nearly $100 million. This is perhaps one hundred times more than their midcentury counterparts. It is roughly one thousand times more than backup singers, players in the NBA's

development league, and television scriptwriters—all skilled people, near but not at the tops of their professions—make today.'

Drawing on the relationship between asymmetric profit generation in the art world and the constructed "star system," Richard Sennett extends the performance–asymmetric reward distribution dynamic into the realm of politics. He argues that sponsors, who hold significant power in the selection of political candidates, adopt a similar approach: '...Rather than focusing their efforts on building and overseeing the distribution system itself—that is, the party—sponsors concentrate on a 'product' that is suitable for distribution and marketable: a candidate" (Authority, Ayrıntı Publishing, p. 363, 1996).

Modern times, through globalization, have made it possible for everything in the world to be interconnected—dramatically scaling up the size of the game and enabling an avalanche effect in the distribution of success and rewards. In every field, a very small number of units (individuals, artists, companies, etc.) can transform into hubs with nearly unlimited connections, absorbing the entirety of the rewards associated with success in that domain. As global civilization has vastly increased the number of connections in every area, this *"unbounded connectivity"* has shifted reward distribution from a normal distribution to one modeled by a power law. This represents a new condition brought about by the hyper-social networks created through globalization. Thus, the boundlessness of success and the rewards it brings is not a natural law—it is a consequence of the system of modern civilization, which amplifies social inequality. And the game is played accordingly.

Impact of AI on the Mutation of the Meritocratic System

In this section, based on Markovitz's (2019) work, the dynamics of the meritocratic system have been assessed within the frameworks of education and the labor market. Meritocracy emphasizes human capital because it aims to build a system based on merit. Therefore, it is not surprising that almost all countries have experienced stages of massification and universalization in education during the construction of the meritocracy system. In other words, educational systems that previously served a limited group have been opened up to all segments of the population, and especially in primary and secondary education, nearly the entire age population has been included in the education system. Massification has not been limited to these two levels but has been expanded to include higher education. This has enabled investments in individuals' human capital, aiming to build a more egalitarian society. Although Markovitz (2019) does not explicitly mention two distinct phases of meritocracy in his work, a detailed examination of the dynamics shows that this process consists of two distinct phases.

During the period that lasted until the 1970s, corresponding to the first phase of the meritocratic system, the labor market operated in parallel to the massification phase in education. This era particularly rewarded the skills of the middle class and witnessed a distribution of wealth across all segments of society without significant disparities. This comprehensive transformation transformed cities and rapidly spread mass culture. A key characteristic of this period was the presence of relatively less inequality between the middle and upper classes at the high end, while more significant inequality existed at the lower end. Employment conditions were better, wages were higher, and working hours were long. Continuous investment was made in human capital through workplace training, and education became the main determinant for advancement in

businesses. The middle class was the primary dynamo of the economy during this phase.

From the 1970s onwards, a new phase began to emerge in both the labor market and education systems, driven by mutual reinforcement. The main trigger for this transition was technological transformations. Automation, resulting from these technological changes, rapidly transformed the economy and labor market, significantly reducing the need for middle-skill jobs and dramatically increasing the importance of high-skill jobs compared to the past. Consequently, the middle class has increasingly been pushed towards unemployment or the search for employment in lower-skilled jobs. The key players in the labor market have become a new elite class with high skills. As the workload of this class increased, so did their incomes, with dramatic rises. To increase efficiency, business processes have been modularized, with each module managed independently and with a profit-oriented approach, leading to a decrease in traditional models based on internal development and expansion. Along with new management models, employers' investments in developing human capital have decreased. There has also been an intensification in the trend of fulfilling middle and lower-skill jobs with part-time or temporary workers instead of full-time employees.

Education systems are now the main suppliers of this rapid transformation. Wealthy families, especially those who accumulated advantages during the first phase of meritocracy, have begun to show more aggressive demand for elitist educational institutions. Moreover, massive investments in extracurricular activities have moved this competition beyond the schools. The effort to obtain an elite education has expanded to encompass all educational levels starting from preschool, as each level of education provides stepping stones for future advantages. The

best schools within the education systems have predominantly become those attended by children from wealthy families. As the cost of education continuously rises due to these aggressive demands, the middle class, affected by transformations in the labor market leading to job losses or decreasing wages, can no longer afford these schools and has started to drift away from them rapidly. In contrast, the wealthy have continually expanded the scope of education, initially focusing on preschool and later including postgraduate education. Additionally, innovations in the labor market have accelerated the transformation of skills in favor of those with elite education. Consequently, the super-skilled jobs that have emerged from this transformation in the labor market can now only be met by the elite class who can afford the costs of an education that starts from preschool and extends to postgraduate studies. In other words, the relationship between elite education and elite jobs has significantly strengthened. Now, the elite class has the advantage of passing on their benefits to the next generations through education.

While in the first phase, inequality was related to the lower end, in the second phase, it is associated with the high end. Society has been divided into two segments: those with high skills and low skills. However, high skills are now extremely rare. On the other hand, marriages arranged according to educational level, and the elite's efforts to preserve or continuously increase their advantage through lobbying and political intervention, have deepened these inequalities even further. Therefore, while the first phase of meritocracy was relatively open and more egalitarian across all sections of society, the second phase displayed an aristocratic appearance. The point of discussion here is the transition of an aristocracy-like inheritance through education and its gaining of social prestige due to its implicit structure.

Indeed, although the degrees vary worldwide, the backdrop

of events suggests that meritocracy, which sanctifies merit and thus human capital, is ironically bringing society closer to the aristocracy it initially fought against. Furthermore, the elite class also opposes social policy packages prepared by governments to reduce inequalities in various fields. These pressures continually weaken the belief that inequalities will decrease. Naturally, this has its political repercussions. Political leaders are now able to use the deep dissatisfaction and disillusionment created by the meritocratic system for their own benefits, easily further polarizing and dividing society. Immigration policies are also fueled by this background. However, these political debates often obstruct the visibility of the root problem and, conversely, sustain meritocracy.

The "meritocracy trap" in America deepens the inequality between the highest and middle-income sectors due to the concentration of elite education within the elite class and the class's strong connections facilitated by elite jobs, which continually increase the premiums for super skills. This creates a feedback loop that sustainably clusters this inequality through elite education, structuring both education and employment in favor of the elite class. Furthermore, the continuous use of workplace innovations to reward high skills effectively masks the fact that the productivity of the elite class stems from the system being structured in their favor, severely undermining equal opportunities. Thus, meritocratic inequality arises not from creating more value under truly equal conditions but due to a systemic structure that continuously impedes the productivity of workers with middle and lower skills.

Moreover, even though meritocracy claims to reward all successes, in reality, it only rewards visible successes, thus excluding individuals who contribute to societal success but remain unseen, forcing and deforming individuals into visibility

(Özer, 2024a). For example, in academia, those who focus on increasing their number of publications and citations might stand out over those making real scientific contributions; in politics, popularity and media skills may be rewarded over genuine leadership abilities; in the business world, those using unethical methods to maximize profits might succeed over those who are honest (Zhang, 2024). In other words, performances are rewarded based on their visibility rather than their actual contributions. Consequently, many contributions/values that are unmeasurable or invisible are excluded by the reward mechanisms.

Markovitz (2019: 275-276) argues that escaping this vicious cycle can be achieved through new regulations in education and the labor market, similar to those in Germany. These include making education more inclusive and reintroducing middle-skilled workers into the labor market with dignified employment incentives. As Markovitz points out, the drift of meritocracy towards an aristocratic structure is a choice in the United States, whereas Germany, possessing similar characteristics, follows a completely opposite policy. Germany removes exclusivity from education and emphasizes VET, thereby strengthening the ties of those who cannot pursue advanced education with the labor market. Germany prefers to use workplace investments not to complement high skills, like in the U.S., but rather to support low or middle-skilled workers. Consequently, while still utilizing the benefits of meritocracy, this approach prevents the extraordinary increase in skill premiums seen in the U.S., promoting a more balanced labor market. Ultimately, Germany exhibits a commitment to a policy that avoids the meritocracy trap, serving as a model for other countries undergoing similar processes.

On the other hand, AI technologies, especially generative AI technologies like ChatGPT, are beginning to encompass all

areas of life, from education to health, from the economy to biotechnology and defense industries (İlikhan et al., 2024; Özer, 2024b; Özer et al., 2024a, 2024b; Perc et al., 2019). An AI ecosystem is rapidly forming. The recent transformation in AI technologies holds the potential to significantly exacerbate the inequalities that emerged in the second phase of meritocracy. While the main driving force of the second phase of meritocracy was the spread of automation, AI technologies, particularly generative AI technologies, are taking automation to a new phase. Now, the remaining jobs are increasingly being eliminated by automation, and the skill expectations for existing or newly emerging jobs are continuously rising.

Therefore, if left unaddressed, AI technologies have the potential to displace middle and lower-skilled groups from their jobs or condemn them to lower wages, much like in the second phase of meritocracy in the United States. They also have the potential to arrange the newly emerging jobs in favor of those with elite education. In other words, the path of automation, which has gained significant momentum with AI technologies, is rapidly taking over tasks (most of which belong to the middle class) that survived the second phase of meritocracy but are now exposed to enhanced automation, thereby eliminating many professions. On the other hand, although the automation path greatly strengthened by AI increases productivity and economic returns, it does not show the same performance in creating new jobs, thus carrying the potential to increase social unrest through a deep wave of unemployment (Acemoğlu et al., 2023; Capraro et al., 2023; Özer& Perc, 2024). Naturally, the remaining or newly emerging jobs will be accessible only to the elite class, which possesses an education that extends from preschool to postgraduate levels. Moreover, if no measures are taken to address the transformation brought about by AI in the labor

market, it is unlikely that new jobs will emerge to balance out the eliminated positions, as was the case in previous technological transformations. Consequently, AI technologies can very easily play a role in ushering in a more destructive third phase of the meritocratic system. In this scenario, the world would transition to a phase that is much more unjust and politically unstable than its current position.

To prevent AI technologies from exacerbating the meritocracy trap, it is essential to prioritize employment and complement human labor instead of focusing solely on automation (Özer & Perc, 2024). Considering that AI technologies significantly enhance the productivity of middle- and low-skilled workers in the workplace (Brynjolfsson et al., 2023; Noy & Zhang, 2023), similar to Germany's approach to new workplace investments, using AI technologies to complement human labor is a crucial policy area for reducing labor market inequalities. In fact, the roots of the choice between automation and complementing human labor lie in the second phase of meritocracy. For example, in the American meritocracy, the excessive inclination towards elite jobs suppresses technologies or management approaches that could make other workers more efficient, thereby encouraging new investments and innovations in workplaces to continuously favor those with elite education or the elite class. Consequently, the high skill premium in elite jobs results not from the inherent inefficiency of non-elite jobs but from their deliberate inefficiency. Similarly, focusing AI technologies solely on high skills rather than complementing middle and low-skilled workers maintains the dynamics of the second phase of meritocracy. Therefore, in the context of AI technology, the path of complementing human labor aligns with the policy Germany followed in the second phase of meritocracy.

Of course, implementing this policy is not easy, especially considering how meritocracy in America has managed to pass on its advantages across generations. Just as this group opposes the use of public resources for social policies aimed at reducing inequalities, they will also resist the integration of AI technologies into the labor market in a way that complements human labor. Moreover, the automation path is more attractive to employers because it reduces employment and thus diminishes the influence of unions.

However, deeper and systemic changes are needed to enhance the well-being of all societal segments and ensure long-term sustainability. Therefore, systemic interventions are necessary to rebuild the labor market in a way that values everyone's contributions and allows everyone to realize their potential. In this context, it is crucial to design AI policies and frameworks that emphasize human-centric approaches, ensuring that AI serves as a tool to augment human capabilities, especially for low or medium-skilled individuals rather than replace them. This approach can promote inclusive growth and ensure that the economic benefits of AI are shared more equitably. By focusing on the integration of AI in ways that complement and enhance the productivity of middle- and lower-skilled workers, it is possible to create a more balanced and fair labor market. Additionally, strengthening social safety nets, investing in education and retraining programs, and encouraging corporate responsibility can collectively contribute to mitigating the risks posed by rapid AI technological advancements. On the other hand, governments must undertake new initiatives, including tax regulations, to help the labor market achieve a balance that reduces inequalities. Policies that fail to do so will accelerate the transition from the second phase of meritocracy to a third phase, where inequalities are further deepened through AI technologies.

Were the Luddites Right?

The continuous advancement of science and the rapid transformation of daily life through technology are now a reality we all witness. Especially over the past century, we have seen major technological revolutions in this context. While these technological transformations have had positive effects on economic prosperity, their disruptive waves in the socio-economic sphere have often been met with concern. In places where their direct effects on the labor market were felt in a short time, this concern gave way to strong reactions.

Resistance to technological waves often reflects an attempt to counter the costly transformations they bring to the socioeconomic structure, rather than stemming from purely ideological perspectives. The history of fierce resistance to technological transformation is frequently discussed in the context of Luddism. For instance, Mustafa Suleyman refers to the Luddites in his book The Coming Wave, where he explores the question of how to control the new technological wave ushered in by AI. In response to the problems caused by the spread of mechanization in factories after the Industrial Revolution, the Luddites reacted by attacking and destroying weaving machines. Suleyman also notes that Queen Elizabeth I, in the late sixteenth century, rejected a new type of knitting machine on the grounds that it might disrupt the guilds, and he highlights how guilds in Nuremberg, Danzig, the Netherlands, and England dismantled new types of looms.

Standing in contrast to this stance is a more optimistic mainstream perspective. According to this view, technological advancements not only increase productivity but also create new job positions, thereby boosting demand for labor and offsetting any potential negative effects on employment. Instead of reacting hastily to change, one should wait patiently. This attitude was reiterated especially during the rise of digitalization and automation. While

automation triggered profound transformations, its effects on the economy and labor markets were often downplayed through optimistic interpretations and long-term positive expectations. At each turning point, the focus remained on the benefits of technology, while its potential negative impacts on labor and other sectors were largely ignored. As a result, in recent decades of major technological transformations, the prevailing expectation has been that technological waves will balance out the adverse effects by generating new job positions and entirely new professions.

The Middle Class Is Collapsing

While a large segment of society continues to wait for employment opportunities in new jobs with the hope that technological transformation will deliver them, the acceleration of technological change and automation has long been concentrating economic prosperity exponentially in the hands of those who produce, manage, and fill new positions thanks to their high-level skills. Individuals with mid-level skills are increasingly either becoming unemployed or being pushed into lower-paying jobs. As the number of people competing for low-skilled work grows, wages continue to decline. As a result, the middle class is being rapidly pushed downward toward the lower socioeconomic strata by technological waves. As their socioeconomic standing declines, members of the middle class find it increasingly difficult to access services such as education and healthcare—services they previously enjoyed more easily—and must now settle for lower quality. Meanwhile, their physical spaces and neighborhoods begin to shift as well.

Since the 1970s, similar patterns have continued to unfold across many countries. Daniel Markovits's book *The Meritocracy Trap: How America's Foundational Myth Feeds Inequality, Dismantles*

the Middle Class, and Devours the Elite tells the story of this transformation—and the collapse of the middle class—not only in the United States but also more broadly across the world. The technological waves of recent decades, through the major transformations they have triggered in the economy, have drawn the middle class closer to the lower classes, while clustering a small number of wealthy families around the epicenter of technological change and the exponentially increasing incomes it generates. Meanwhile, the quality of goods and services that once became widely accessible through mass production and distribution is steadily declining. High-quality services are becoming increasingly concentrated in a few locations, while their cost continues to rise. As a result, the threshold for affording access to quality services keeps climbing. The American Dream, once a powerful ideal, has lost its meaning—it is now little more than a dream from a bygone era.

As AI technologies begin to rapidly permeate all areas of life—forming an entire ecosystem in the process—societies are once again being encouraged to adopt an optimistic outlook based on familiar assumptions. According to this expectation, while AI technologies will eliminate many existing jobs, they will also boost productivity and efficiency, thereby creating numerous new positions and restoring balance in employment. However, past experiences suggest that the gains in productivity and efficiency brought by automation have largely benefited capital rather than labor. As businesses' employment capacity continues to shrink with new technologies, the emerging jobs increasingly demand high-level skills and experience—assets that are significantly more costly to acquire. Moreover, as Mustafa Suleyman has pointed out, it is now being openly acknowledged that many of these new jobs may themselves eventually be performed by AI.

In summary, a much stronger shock wave—this time driven by

AI—is emerging to the detriment of the middle and lower classes, who were already severely affected by the spread of automation and have lost much of their former advantage. As a result, large segments of the population who have been pushed down from their previous socioeconomic status have become far more vulnerable to political manipulation. Consequently, extreme ideologies and rhetoric are finding support more easily and are spreading rapidly across many countries. Echo chambers can now be created effortlessly, fueling deeper social polarization. In short, much harder days lie ahead…

Are the Middle Classes Collapsing?

In the 20th century, the construction of a meritocratic system focused on human capital provided all segments of society with the opportunity to participate in social development. Services became massified, and significant expansion was observed especially within the middle classes. During this period, access to services—from education and healthcare to transportation—became much easier and more widespread compared to previous eras. Large populations were able to access these services with relative ease. In this period of relatively equal conditions, the middle classes attained a strong position in the labor market, and their share of economic development and level of welfare consistently increased. The meritocratic system based on merit/human capital fulfilled its promise, leading to increased economic and social mobility within societies. In this context, the middle classes, as the main driving force behind the development of societies, also constituted the backbone of nations.

Then, somehow, these dynamics began to change, and the middle classes gradually started to lose the ground they had gained. Across all countries, it is observed that the middle classes, which had expanded and gained significant opportunities after World War II, have weakened in recent times and are increasingly losing their advantages. Although, on the surface, the importance attributed to human capital appears unchanged, the system's underlying dynamics have started to shift. As the quality of accessible services began to decline and disparities in quality started to widen—meaning the merit-based system underwent a mutation ("mutated meritocracy")—the system's relatively egalitarian structure began to deteriorate. Initially, people started losing the jobs they once held, wages began to decline, and, most critically, access to services that enabled social mobility—particularly quality educational institutions—became increasingly unaffordable.

Major Threats for Middle Classes

It appears that the main driver of this process has been technological disruptions. Particularly after the 1980s, technological transformations and the spread of automation began to eliminate job positions exposed to automation, while continuously raising the skill expectations for new jobs. In recent years, the strengthening of automation by AI technologies has accelerated this process even further. The middle classes are increasingly being forced either to lose their jobs or to work in lower-paid positions. Moreover, the number of people employed in temporary or part-time jobs continues to rise.

The new high-skilled job positions emerging through technological transformations are no longer being filled by the middle classes; instead, they have become accessible only through high-quality education—starting from preschool and continuing through to postgraduate levels—that only the wealthy can afford. In other words, the link between high-quality education and high-paying, high-skilled jobs has significantly strengthened. The wealthy have now gained the advantage of transmitting their privileges to future generations through education. Moreover, factors such as marriage patterns increasingly based on educational attainment, and the wealthy's efforts to protect and even enhance their advantages through lobbying and political interventions, have further reinforced this connection and deepened income inequality within societies. For example, in the United States, between 1970 and 2021, the middle class's share of total income fell from 62% to 42%, while the share of the lower-income class dropped from 10% to 8%, and the total income of those included in the high-income group rose from 29% to 50% (https://www.forbes.com/sites/katharinabuchholz/2023/04/21/how-americas-middle-class-is-shrinking-infographic/).

Moreover, the aggressive efforts of the segments receiving a large share of income to continuously enhance the quality of all services have further segmented access to services, widened quality gaps, and continuously increased the cost of access. As the middle classes lose the advantages they once held in the labor market, they can no longer afford high-quality services that would enable them to break out of the cycle, and ultimately, they are losing out in the increasingly fierce competition.

On the other hand, with China's entry into the global economy from the 1980s onward, the effects of this process began to be felt even more deeply. As automation spread and the middle classes lost their status, they also began to lose the sectors in which they worked due to China's increasing export capacity. This is because the bulk of China's exports consist of manufactured goods, while its imports are largely composed of raw materials, that is, unprocessed products (Fatih Oktay, *China and the Future of the World,* Türkiye İş Bankası Publications, pp. 11–12). Consequently, imports from China by the United States and other European countries, which run trade deficits with China, have directly and negatively affected employment. For example, when the Trans-Pacific Partnership Agreement was signed in 2016 to restrict China's growing dominant role in the world economy, then-President Obama emphasized in his speech that this agreement was critical for protecting America's middle class (p. 74): 'Right now, China wants to write the rules of trade in Asia. We can't allow that. We should write the rules, and we should level the playing field for our *middle class*.'

In short, while the middle classes were already being forced into lower-paid jobs within their own countries due to technological transformations and the spread of automation, the negative impact was further deepened by imports from China. Moreover, the increasing competition in the global labor market has led

to a shift of investments toward countries offering lower costs. Consequently, a massive wave of competition, against which the middle classes cannot effectively compete, has emerged.

These findings do not only point to problems within American society; similar issues are being experienced, to varying degrees, in most European countries as well. In these countries, as an increasing share of income and wealth flows to the top groups, the middle classes are shrinking, continuously losing ground, and gradually losing their hopes for the future. Therefore, the political turbulence in these countries is nothing more than a reflection of the growing permanence of these deep-rooted problems. As these nations lose the advantages they once achieved through their strong middle classes, they are also confronting the political consequences triggered by this process. Thus, it is increasingly observed that populist leaders—who translate the story of this ongoing process, namely the impoverishment of the masses and the weakening of their integration with their societies, into political language, and who offer pragmatic solutions, including xenophobia—are more frequently coming to power.

We Must Take Action Now

Societies with a strong middle class tend to be much more hopeful and resilient. In an OECD report published in 2019, the benefits of a strong middle class are highlighted, stating that 'societies with a strong middle class have lower crime rates, higher levels of trust and life satisfaction, greater political stability, and better governance.' (https://www.newsweek.com/america-middle-class-shrinking-1913772).

As the process that shrinks the middle classes deepens economic inequalities, societies are increasingly being divided into just two groups: a small upper class and a large lower class. While the vast majority of wealth becomes concentrated at the top,

the masses are becoming impoverished. Income distributions are deteriorating and skewing in favor of the upper classes. As income distribution worsens, access to all services also becomes increasingly asymmetric. A structure emerges in which the few possess much and the many possess little. In other words, what is accessed no longer follows a normal distribution but instead follows a power law distribution. In a normal distribution, large masses are located near the center, whereas under a power distribution, the masses are pushed toward the extremes. Power law distributions are also known as fat-tailed distributions. The defining feature of such distributions is their extremely high variance. In other words, asymmetry is very pronounced, and the few receive disproportionately more. Therefore, the power law is inherently unjust.

The deepening of inequalities is also giving rise to indirect effects. For example, the middle classes, which contribute the most to a society's demographic renewal, are increasingly trying to secure themselves, leading—along with other contributing factors—to declining population growth rates in these countries. Marriages are being postponed to later ages, and moreover, divorce rates within existing marriages are also rising. As a result, the proportion of young people in societies is decreasing while the elderly population is growing, putting economic growth at risk. Furthermore, it is becoming increasingly difficult for the shrinking younger population to be integrated into employment. Vertical social mobility is weakening, and social unrest is on the rise. In short, as the middle class weakens, societies as a whole enter a negative cycle that puts all of their long-term advantages at risk.

In summary, the process that is eroding the middle classes and undermining politics—primarily in the United States and continental European countries—also poses a risk for our

country due to globalization. Despite the comprehensive steps recently taken to strengthen the middle classes, we must be aware of this threat, which has deeply affected other countries, and prepare for it now. Social policies that reinforce the middle class will not only eliminate societal and political problems but will also ensure that a society remains healthy in the long term and enhance its resilience against external shocks.

Notes on the World Economic Forum's Future of Jobs Report 2025

The World Economic Forum (WEF) has published its *Future of Jobs Report 2025*, addressing the transformations expected in jobs and labor markets under the influence of technological change, geoeconomic fragmentation, economic uncertainty, demographic shifts, and the green transition. The report compiles the perspectives of more than 1,000 leading global employers—representing over 14 million workers worldwide—on the period between 2025 and 2030.

The report reveals that, due to the expansion of digital access, 60% of employers expect significant transformations in their workplaces by 2030. The areas where the most substantial changes are anticipated include AI and computing (86%), robotics and automation (58%), and energy production, storage, and distribution (41%). In line with these expectations, demand is also projected to rise for skills related to AI and big data, networks and cybersecurity, and technological literacy. Rising living costs rank as the second most transformative trend among employers overall, while the general economic slowdown is also expected to play a significant role in shaping this transformation. As a result of both expectations, employers anticipate a growing demand for skills such as creative thinking, resilience, flexibility, and agility.

The third major factor expected to drive transformation in the labor market is the fight against climate change and the green transition. As a result, demand is projected to increase for environmentally focused occupations and job roles such as environmental engineering, renewable energy engineering, and specialists in electric and autonomous vehicles. Notably, "environmental responsibility" has entered the list of fastest-growing skills for the first time within this context.

Demographic changes in countries directly impact the labor

market. In recent years, particularly in developed countries, sharp declines in population growth rates have raised concerns about economic sustainability. In this context, the report highlights two key demographic shifts: the aging and shrinking working-age population in high-income economies, and the growing working-age population in low-income economies. The report emphasizes that these demographic trends will increase demand for skills such as talent management, teaching and mentoring, motivation, and self-awareness. Furthermore, it notes that countries with aging populations are expected to see growth in healthcare professions such as nursing, while countries with growing youth populations are likely to experience increased demand for education-related professions, particularly in higher education.

Lastly, the report emphasizes that geo-economic fragmentation and geopolitical tensions on a global scale will lead to significant transformations in labor markets. These trends are expected to be felt most strongly in economies with substantial trade relationships with the United States and/or China. In response to such dynamics, the report anticipates increased movement toward offshoring or reshoring of jobs. Accordingly, there will likely be rising demand for security-related job roles, as well as a growing need for network and cybersecurity skills. In light of these trends, demand for human-centered skills—such as resilience, flexibility, agility, leadership, and social influence—is also expected to increase.

According to the global employers who participated in the assessment, the structural transformations discussed above are expected to result in both the creation of new job roles and the loss of some existing ones, amounting to a total of 22% of current jobs during the 2025–2030 period. It is projected that new job roles equivalent to 14% of current employment (170 million jobs) will

emerge, while 8% (92 million jobs) will be lost. Therefore, based on employers' expectations, the report presents an optimistic picture, suggesting that far more jobs will be created than lost—resulting in a net gain of 78 million new positions globally.

In terms of absolute volume, the highest net growth in new job positions over the next five years is expected to occur in the agriculture and food sectors (such as agricultural and food processing workers). Similarly, significant growth is also projected in construction (construction workers), delivery services (delivery drivers), sales services (sales staff), care services (including nurses, social service and counseling professionals, and personal care aides), and education (teachers and academic staff).

Similarly, the report identifies the fastest-growing jobs in percentage terms as those emerging from ongoing and future technological transformations. These positions are expected to be filled by big data specialists, fintech (financial technology) engineers, AI and machine learning experts, and software and application developers. The report also emphasizes that green and energy transition-related jobs—such as autonomous and electric vehicle specialists, environmental engineers, and renewable energy engineers—are among the fastest-growing roles. However, the extent to which these new job roles materialize in a given country's labor market will depend on how significantly that country is affected by the structural transformations discussed above, and how swiftly and effectively it can respond to those challenges.

Due to the structural transformations mentioned above, the job roles expected to experience the largest decline in absolute numbers include clerical and secretarial positions such as postal service clerks, bank tellers and data entry clerks, cashiers, ticketing agents, administrative assistants, and executive secretaries.

Lifelong Learning as a Strategic Priority

During this period, while some job roles are expected to disappear and new ones emerge, the skill sets required for existing positions are also anticipated to undergo significant transformations. In this context, the report estimates that, on average, two out of every five current skill sets (39%) will either be transformed or rendered obsolete between 2025 and 2030. As a result, acquiring new skills in the labor market becomes vital. Among the most prominent of these are AI and big data, networks and cybersecurity, and technological literacy. The attributes that are gaining increasing importance in new job roles include analytical thinking (considered essential by 70% of employers), along with resilience, flexibility and agility, and leadership and social influence skills.

In sum, the World Economic Forum's projections for the 2025–2030 period point to significant structural transformations in labor markets. Although the report presents an overall optimistic outlook—suggesting that job creation will outpace job losses during these transitions—the formation of a talent pool capable of meeting the dynamically changing skill demands of new job roles remains a considerable challenge. The dynamic shifts in labor markets cast doubt on the ability of large and rigid education systems to respond swiftly to such changes. In this context, enhancing workers' resilience and enabling job seekers to align their skills with new job requirements has become increasingly critical. As the report also highlights, strengthening the supply of talent in response to these fundamental labor market transformations must become a central priority of public policy. Therefore, it is essential to rapidly build the necessary capacity for reskilling and upskilling, and to broaden access to such opportunities.

In this context, the report states that 85% of employers plan to update the skills of their workforce, 70% intend to prioritize candidates with new skills in recruitment, 40% anticipate reducing employment due to outdated skills, and 50% plan to train their employees to transition into emerging roles created by new skill demands in their sectors. Furthermore, the report notes that the emphasis on assessing various talent pools to increase talent supply has risen fourfold compared to two years ago—from 10% to 47%—highlighting the rapid evolution of skill requirements in labor markets and the urgent need to expand supply accordingly. As such, the main trend of the upcoming period will be the continuous upskilling and reskilling of both employees and job seekers. Consequently, education will increasingly extend beyond the boundaries of traditional education systems.

Therefore, the most prominent feature of the future will be the need to remain open to continuous learning. The report emphasizes that curiosity and lifelong learning skills will gain even greater importance during the 2025–2030 period. In other words, lifelong learning and skill renewal are no longer optional tools for career advancement, as they were in the past—they have now become essential for survival in today's labor markets, which are subject to constant structural transformation driven by the dynamic processes outlined above. In fact, the report highlights that "if the global workforce were made up of 100 people, 59 of them would require training by 2030," underlining the ongoing need for acquiring new skills and the growing importance of lifelong learning in dynamic labor markets. The report also notes that while half of employers plan to restructure their businesses in response to developments in AI technologies, two-thirds intend to hire talent with specific AI-related skills—clearly indicating that technological literacy, including AI, must

be central to the focus of lifelong learning. Ultimately, individuals who actively engage in lifelong learning and continuously build their social networks will enhance not only their human capital but also their social and cultural capital—thereby acquiring the characteristics and in-demand skills needed to thrive in the labor market.

Fortifying Human Capital Against Artificial Intelligence

AI technology is driving profound transformations far beyond previous technological disruptions. Its rapid development and multi-purpose usability significantly accelerate this transformation. In just two years, there are hardly any fields left untouched by these systems. The competition between countries in the field of AI is also intensifying. Considering how the Chinese startup DeepSeek profoundly impacted U.S. markets last week, countermeasures are likely to emerge soon. Thus, unlike previous technological disruptions, the wave of AI has rapidly encompassed all aspects of life and created an entirely new ecosystem.

Education systems are affected by these transformations in two ways. Firstly, just as technological changes reshape other fields, they also transform education systems. For instance, it is impossible for education systems to remain closed off from the benefits offered by AI. Initially, many countries imposed bans on such applications, but over time, approaches focusing on their ethical and responsible use have gained traction. In this context, curricula are being updated, and initiatives to enhance AI literacy among teachers and academics are increasing. In short, these technologies are restructuring both educational environments and learning processes.

The second way in which these transformations impact education systems relates to the necessity of responding to shifts in the labor market caused by technological advancements. The skill sets required for most professions and job positions are changing, and new jobs are emerging with entirely new skill requirements. Therefore, education systems must train human resources in alignment with these shifts. Considering the speed of change, it becomes clear how formidable a challenge education systems face. Furthermore, the inability to keep pace with this transformation is pushing learning beyond traditional education systems, making lifelong learning an absolute necessity.

If education systems fail to respond swiftly to these demands, skill mismatches in labor markets will increase. Such mismatches will negatively impact productivity and economic development. When human resources are not equipped with new skills, unemployment will rise on one hand, while on the other, existing workers will be forced into lower-skilled and consequently lower-paying jobs. As a result, the already shrinking middle class will face further losses. Widening social inequalities will lead to greater societal discontent. This outcome will have an additional indirect effect on the education system: as the middle class continues to erode, its ability to afford quality education will diminish, further weakening equality of opportunity within education systems.

Protective Measures

According to the World Economic Forum's *Future of Jobs Report 2025*, significant shifts in the core skills expected from workers are anticipated between 2025 and 2030. The report highlights that while technological skills will take precedence in this transformation, AI and big data are expected to be the fastest-growing competencies, ranking at the top of the list. In other words, across all key sectors, AI and big data skills are projected to see substantial increases in demand, albeit to varying degrees. Furthermore, the report indicates that our country, Türkiye, is among those with the highest expectations for fundamental skill changes, with a projected shift of 44%. Therefore, to mitigate the negative impacts of AI on the labor market and to strengthen the workforce by aligning their skills with expected transformations, significant steps must be taken in our country.

On the other hand, according to the report *The Economic Potential of Artificial Intelligence in Türkiye*, prepared by Prof. Dr. Altan Çakır, 41% of Türkiye's existing 31 million job positions

are not susceptible to automation, while 55% (approximately 17 million jobs) are expected to benefit from contributions of generative AI. The remaining 4% (around 1 million jobs) are projected to undergo partial or complete job transitions. This means that generative AI technologies are estimated to impact 59% of job positions. This impact presents not only threats but also significant opportunities. The report emphasizes that if generative AI can be transformed into an opportunity, it could contribute an additional 5%—equivalent to $50-60 billion—to Türkiye's annual GDP within the next decade. Therefore, we must urgently restructure our education system's core agenda and lifelong learning options in response to these evolving conditions and risks. Below are key steps that need to be taken in this regard.

Firstly, regulations must be introduced to enhance technology literacy in primary and secondary education while ensuring that AI applications are used ethically and responsibly. Given that students are already widely using generative AI applications like ChatGPT, it is crucial to rapidly train all teachers in AI literacy. Moreover, these training programs must be continuously updated and maintained. Additionally, teacher training curricula must be urgently revised to integrate AI's opportunities and risks, increasing awareness and preparedness among future educators. While the introduction of AI-focused higher education programs is a significant step forward, this initiative should be expanded. AI literacy courses tailored to specific fields should be incorporated into all higher education programs. The reason for this is clear: the wave of AI-driven automation is primarily affecting white-collar professions. Moreover, the share of AI-related skills required in existing job roles is steadily increasing. Without proactive measures, the growing strength of automation will weaken white-collar workers' resilience in the labor market, heighten job displacement risks, and push them toward lower-skilled (and lower-paid) roles.

The second key step involves vocational education and training (VET). The importance of VET is now widely recognized, as strong VET systems facilitate a smooth school-to-work transition and significantly reduce youth unemployment rates. Therefore, in response to the wave of AI-driven transformation, the capacity of VET must continue to be reinforced. The WEF Future of Jobs Report categorizes over 2,800 detailed skills within its Global Skills Taxonomy and assesses the extent to which generative AI can replace them. The report indicates that AI currently has very limited capability to perform tasks requiring physical execution, fine judgment, or hands-on practical skills. This presents a significant advantage: job positions less susceptible to AI automation—at least for now—are primarily linked to VET. Consequently, while vocational training must be further strengthened, it should also integrate AI-related skills to ensure long-term resilience in the workforce.

As **the third critical step**, lifelong learning must be recognized as a new strategic priority. The *WEF Future of Jobs Report* highlights curiosity and lifelong learning as key emerging skills, with their importance projected to increase by 50%. While education systems strive to equip individuals with the necessary skills, the rapid pace of change makes it clear that formal education alone will not suffice. Thus, lifelong learning is now essential to enhancing workforce resilience. In other words, human capital investments, which were traditionally concentrated within formal education systems, are increasingly extending beyond these boundaries into later stages of life. The *WEF Report* also underscores this shift. According to the report, employers anticipate that by 2030: 59 out of every 100 employees will require significant reskilling, 29 employees will need to enhance their skills within their current roles, 19 employees will require reskilling to transition into different roles within their organizations and 11 employees, despite needing training, will be unable to access it

in the foreseeable future. This data further reinforces the urgency of embedding lifelong learning into national education and workforce development strategies.

In this context, businesses should adopt a human-centered approach to AI deployment, ensuring that AI technologies complement rather than replace human labor. Special emphasis should be placed on providing continuous training programs aimed at enhancing AI-related skills, particularly for low- and mid-skilled workers. These programs will be crucial in strengthening their resilience in the labor market. By equipping employees with the ability to work alongside AI rather than being displaced by it, companies can both increase productivity and reduce job displacement risks. Structured training initiatives should focus on upskilling and reskilling workers, ensuring that they remain competitive in an evolving job market driven by automation and AI advancements.

Finally, despite all these measures, some contractions may still occur in certain fields of education and employment. To address this challenge, skill transfer mechanisms should be established through recognized and labor market-aligned platforms that provide short-term training within the framework of lifelong learning. These 'skill development and update platforms' would allow graduates to quickly acquire new skills and pivot toward high-demand job sectors, increasing their employability and mitigating the risk of prolonged unemployment. Moreover, this initiative would expand the talent pool with skills that align more closely with labor market needs, ensuring a more resilient and adaptable workforce in the face of rapid technological and economic shifts.

The Necessity of a New Agenda in Education

We are living in a time of rapid technological transformation. Technological disruptions are affecting all areas of life and reshaping entire processes. The disruption brought by AI, in particular, is occurring far more powerfully than previous technological shifts and is rapidly forming a new ecosystem. Education systems are being affected by these transformations in two distinct ways. First, just as these technological developments are transforming other domains, they are also reshaping education systems. It is no longer possible for education systems to remain isolated from the benefits offered by AI. While such applications were initially banned in many countries, the current trend has shifted toward approaches that focus on how these tools can be used ethically and responsibly. In this context, efforts are underway to update curricula and to increase the AI literacy of teachers and academics. In short, education environments and processes are being restructured through these technologies.

The second dimension through which these transformations affect education systems relates to the need to respond to the changes occurring in labor markets due to technological advancements. In the labor market, the skill sets required for most professions and job positions are evolving, and new jobs are emerging with entirely new sets of skills. Therefore, education systems must train human resources in a way that aligns with these changes. Given the pace of transformation, the immense and challenging responsibility facing education systems becomes even clearer. Moreover, the inability to keep up with this pace is pushing learning beyond the boundaries of traditional education systems, making lifelong learning an unavoidable necessity.

If education systems fail to respond quickly to the need for developing human capital in this context, skill mismatches in labor markets will intensify. Such mismatches will lead to a range of problems, starting with declining productivity. If the workforce

is not equipped with new skills, unemployment will inevitably rise on one hand, while on the other, existing employees will be pushed into lower-skilled and therefore lower-paid positions. In this scenario, the already-weakened middle class will inevitably lose even more ground. As social inequalities deepen, overall dissatisfaction and discontent will increase. This outcome will also have an indirect impact on education systems. As the middle class continues to lose ground, its ability to afford access to quality education will diminish—further weakening equality of opportunity within education systems.

Similar processes are unfolding across all countries, and the same risks apply to our own country, Türkiye as well. Therefore, we must urgently restructure the core agenda of our education system in line with changing conditions and emerging risks. Below are some of the key steps that need to be taken in this regard.

Equity in Education and Early Childhood Education

Over the past 20 years, Türkiye has addressed the issue of access in primary and secondary education through massive investments and multi-dimensional reforms. Today, school-age children can access education with relative ease. At this stage, the new priority is to ensure that the quality gap in what is accessed remains as minimal as possible. Therefore, new initiatives within our education system should focus specifically on enhancing equity in education in this context.

Among the most strategic areas within this context is early childhood education. It is well established that early childhood education corresponds to the most critical stage of education in terms of its long-term impact on individuals' lives. Individuals who have received early childhood education tend to remain in education and employment significantly longer than those who

have not. Therefore, in order to strengthen human capital and enhance equity in education, early childhood education should be expanded and provided free of charge. Expanding access to early childhood education is also crucial for increasing female labor force participation. Moreover, the designation of 2025 as the Year of the Family—and the broader goal of improving our population growth rate—should be seen as an opportunity to include the expansion of early childhood education as a key element in the national action plan.

Vocational Education and Training

It is well known that VET accelerates the school-to-work transition and helps reduce youth unemployment rates in many countries. In this regard, our country has recently seized a significant opportunity in the field of VET. Beyond the improvements made in vocational high schools, substantial progress has been achieved in meeting the demand for apprentices, journeymen, and masters following legal reforms aimed at strengthening vocational training centers. These initiatives to reinforce VET should be consolidated and expanded through new projects. Especially in light of the negative impact AI technologies are having on employment in the labor market, VET should be seen as an important opportunity to provide a more protected path. Moreover, since these technologies primarily affect white-collar jobs, VET has become a much stronger option for career planning. Therefore, VET should be expanded as a key tool for improving access to employment, and projects aimed at enhancing its quality must continue without interruption.

Technological Literacy

Regulations should be introduced at the primary, secondary, and higher education levels to improve students' technological literacy and to ensure that they benefit from AI applications with

a sense of ethical responsibility. In this context, it is essential that all teachers within the education system, as well as all academics in higher education, receive training to improve their AI literacy—and that this training be continuously updated and sustained. Furthermore, the demand for AI-related skills is steadily increasing in occupations across the labor market. Therefore, necessary updates to curricula, especially in secondary and higher education, must be implemented without delay.

Village Life Centers

It is well known that, following the COVID-19 pandemic, there has been a demographic shift from cities toward areas with lower population density. In addition, crises in food and supply chains have elevated agriculture and food security to the status of strategic national concerns. Therefore, increasing educational opportunities in villages to enhance the productivity of this rural shift—particularly in agriculture and livestock—can provide crucial support in strengthening this strategic sector. Beyond simply emulating the important steps taken by other countries in this regard, a significant opportunity has emerged through the establishment of "village life centers." These centers involve the revitalization of previously idle village schools, where both early childhood and basic education are provided, while also hosting public education centers. These centers offer rural citizens, especially those engaged in agriculture and livestock, ongoing access to lifelong learning. This project should be made permanent and scaled up to cover all village schools.

Lifelong Learning

Existing education systems are increasingly inadequate in building resilience against the rapid and disruptive changes occurring in labor markets. According to the World Economic Forum's *Future of Jobs Report 2025*, 59 out of every 100 employees

will require significant training by 2030; of these, 29 will need to upgrade their skills within their current roles, while 19 will need to be reskilled and reassigned to different roles within their organizations. The report also notes that Türkiye is among the countries with the highest expectations for fundamental skill changes (44%). Therefore, human capital must be rapidly strengthened to adapt to these transformations. In this context, the capacity of lifelong learning opportunities must be expanded, and their accessibility improved through a broader and more inclusive reach. To meet this critical need, lifelong learning programs under the Ministry of National Education should be updated, made more accessible, and enriched with diverse options. At the same time, the continuing education centers of the universities and businesses must be made significantly more active.

China Focuses on AI in Primary and Secondary Education

AI continues to rapidly transform all areas, from education to healthcare, from the financial sector to the arts, and from the service industry to the defense sector. While people of all ages are coming into direct contact with AI applications in their daily lives, institutions and governments are being forced to review their systems and processes. For example, the generative AI technology ChatGPT, which utilizes LLMs, quickly became an indispensable part of life for people of all ages shortly after its release. Through these and similar applications, people are seeking ways to solve problems related to their daily tasks or to improve the quality of services. In short, an AI ecosystem has begun to emerge rapidly across all fields and is expanding its scope at an accelerating pace.

McKinsey's report predicts that generative AI will create up to $4.4 trillion in annual value for the global economy. Given this, AI has now become the focal point of economic competition between countries. Nations are making massive investments to avoid missing out on the economic opportunities offered by AI and to secure leadership in this field. The United States and China are fiercely competing in this arena. For example, a major countermove recently came from the Chinese startup DeepSeek: while ChatGPT continues to dominate the market, DeepSeek's AI Assistant disrupted markets by outperforming ChatGPT and its equivalents in terms of performance and offering a lower cost. As a result, Nvidia (NVDA), the leading supplier in the AI chip sector, lost around $600 billion in market value, and its rivals — Marvell, Broadcom, Micron, and TSMC — also suffered significant losses in their stock prices.

Another dimension of the competition in the field of AI is intellectual property, namely patents and the ability to commercialize them. In this area as well, there is intense rivalry between the United States and China. For example, according to AI-related

patent data from the first ten months of 2024, China ranks first with 12,945 patents, followed by the United States with 8,609 patents and South Korea with 1,537 patents. A similar trend is observed in the distribution of generative AI (GAI) patents among countries. According to the World Intellectual Property Organization (WIPO), since 2014, China has filed more than 38,000 patent applications for generative AI inventions, followed by the United States (6,300), South Korea (4,155), Japan (3,409), India (1,350), the United Kingdom (714), Germany (708), Canada (549), and Israel (311).

The data mentioned above provide clues about the scale of global competition in the field of AI. Naturally, the greatest contribution to the sustainability of this competition will come from education systems. Education systems must review their processes in order to train individuals equipped to meet the needs of labor markets, which are undergoing a profound transformation due to AI. This is because, while many existing job positions are disappearing, the skill sets expected for the remaining positions are also changing. Moreover, the skill requirements for newly emerging or soon-to-emerge job roles are continuously rising. Even now, there is a growing tendency among businesses not directly related to AI to prefer hiring individuals with AI competencies, taking into account the long-term transformation ahead. This trend points to increasing tensions within the labor market. How and to what extent education systems can respond to such rapid and profound changes will ultimately shape the fate of countries participating in this competition.

In this context, China once again acted swiftly. To enhance AI literacy in primary and secondary education and to establish an AI ecosystem at these educational levels, the Chinese Ministry of Education issued a comprehensive directive outlining the roadmap (https://www.globaltimes.cn/page/202412/1324230.

shtml). The directive covers steps to be taken at the elementary, middle, and high school levels. Accordingly, in China, elementary school students will be encouraged to explore and experience AI technologies; middle school students will be guided to understand AI-related concepts and use AI applications; and high school students will be encouraged to develop projects involving advanced AI applications. As part of these efforts, one of the goals is to create an AI education section on the national smart education platform to enhance access to resources. Additionally, the directive encourages linking AI education courses across different regions through online platforms.

Since different competencies are emphasized at each educational level, the curriculum is also being updated accordingly. Thus, curriculum revisions are being made to prioritize sensory and experiential learning related to AI at the elementary level, understanding and application at the middle school level, and more advanced applications and project development at the high school level compared to middle school. In this context, schools are also encouraged to integrate AI-related education and initiatives into extracurricular programs and to strengthen collaborations with academia and industry during this process. This will allow facilities such as laboratories and exhibition halls belonging to universities and technology companies to be opened to schools and students. Ultimately, the aim is to use the experiences and gains achieved through these initiatives to develop best practices and courses, ensuring the seamless integration of AI into the curricula of information technology, science, and applied activities.

Among the steps being taken, the most important is the provision of professional development training aimed at enhancing the AI literacy of all teachers within the system. In this context, not only are teachers capable of delivering AI education being utilized, but experts from higher education institutions and the

industrial sector are also being encouraged to serve as part-time instructors.

In summary, while China is making massive investments to maintain its leading position in the competition over AI technologies, it is also taking significant steps — starting from basic education — to cultivate the new generation of human capital needed for a labor market that will undergo a profound transformation due to these technologies. Similar opportunities exist for our country, Türkiye as well. However, in order not to miss these opportunities and to translate them into tangible benefits, we must take similar steps without delay not only in the labor market but also within our education system.

The Impact of AI on Decision-Making, Laziness, and Security Concerns

Education systems are among the areas where the transformative impact of AI will be most strongly felt. These systems bear two major responsibilities in response to this transformation. The first is to train individuals with the skills demanded by labor markets. As AI rapidly transforms industries and thus labor markets, the challenge of developing a workforce with skills suited to new conditions remains a pressing issue. For example, China has already begun implementing proactive initiatives aimed at equipping students with AI-related skills at the primary, middle, and high school levels. Similar transformations are also taking place in higher education.

The second responsibility relates to the direct impact of these technologies on education systems. In particular, with GAI technologies, it has become much easier to enrich educational environments and create personalized learning opportunities. On the other hand, significant opportunities are emerging in areas such as foreign language instruction, visual arts, music, and arts education. Moreover, these technologies can provide substantial support in tasks such as generating text, developing project proposals, conducting literature reviews, and writing academic papers.

Of course, like any technological tool, the use of AI comes with risks as well as opportunities. When it comes to AI, the focus is generally more on its benefits than its risks. The risks associated with the use of AI in education, particularly in terms of data security, have long been recognized. On the other hand, issues arising from the unethical or irresponsible use of these technologies have also started to be discussed gradually. Moreover, it is known that these applications can reproduce existing social biases based on religion, language, culture, race, and gender, thereby deepening inequalities. To mitigate these risks, it is crucial that AI applications intended

for use in education be developed transparently and with the participation of all relevant stakeholders — from students and teachers to administrators and parents — and that their impacts be continuously monitored during implementation.

In this context, a recent study examines the effects of AI on personal security and privacy concerns, loss of decision-making ability, and increased laziness among a group of higher education students from China and Pakistan (*Impact of artificial intelligence on human loss in decision making, laziness and safety in education, Humanities and Social Sciences Communications*, 10:311, 2023). The study's findings show that, in the student sample used, AI applications have a significant impact on students' loss of decision-making ability and increased laziness. According to the results, 68.9% of the students' laziness, 68.6% of their personal privacy and security issues, and 27.7% of their loss in decision-making ability are attributed to the effects of AI applications.

Security and privacy concerns are quite common not only in education but in all fields where AI is applied. Moreover, the frequent appearance of news in the media about security vulnerabilities and privacy breaches continuously raises the level of concern. The most important solution individuals can pursue to address this anxiety is to continuously improve their literacy regarding these technologies. A lack of knowledge in this area will make data leaks much more likely.

The findings of the study indicate that as the functions of AI applications increase and their use in education becomes more widespread, students' trust in these applications in their academic work also grows, which in turn leads to increased laziness. As students delegate more of their academic tasks to these applications, their reflex to check and verify the generated content weakens. Consequently, students increasingly use less

of their analytical thinking skills and cognitive abilities in the production of content. Excessive trust in AI-generated content gradually fosters a dependency on these applications. Ultimately, this dependency leads to laziness among students. In fact, a similar risk also applies to teachers and academic staff.

On the other hand, the findings of the study indicate that as the use of AI applications in education becomes more widespread in this way, students' ability to make decisions weakens. This is because instead of making decisions themselves, students increasingly adopt the habit of substituting AI-generated decisions for their own. As a result, their ability to cope with the tensions involved in the decision-making process also diminishes. In the long term, this vulnerability may indirectly have a negative impact on students' resilience in the face of challenges.

Beyond these effects, as partially mentioned above, there are two major risks associated with AI-generated content. The first concerns the risk that AI applications may produce biases based on religion, culture, gender, socioeconomic status, race, and similar factors. When students place excessive trust in such content, they are unlikely to verify it, and as a result, perspectives that reinforce existing inequalities may become widespread through the education system. The second risk relates to the phenomenon of hallucination or confabulation by AI applications. When such behavior occurs, AI systems generate false content that appears to be accurate. If this content is not identified and filtered out, information that does not correspond to reality may be more easily disseminated through education.

In summary, instead of using these applications as a valuable support to help students fulfill their responsibilities and improve the quality of their work, using them as substitutes for students may, in the long term, lead to highly negative behavioral outcomes

such as laziness, lack of responsibility, and weakened decision-making abilities. This is precisely where the critical importance of responsible AI use emerges. The ethical and responsible use of AI in education can help mitigate these negative effects. In this context, students and teachers should be informed about the long-term deterioration in human skills that may result from replacing human effort with AI. Raising awareness about how these applications can be used to complement rather than replace humans — and the boundaries of such use — is becoming increasingly vital in education.

The Legitimacy Crisis of Higher Education in the Age of AI

AI continues to rapidly transform social domains. One of the most profound transformations is taking place in labor markets and, consequently, in education systems. AI technologies are swiftly altering the skill sets required by professions and job positions, rendering some occupations and roles obsolete. On the other hand, many of the high-level skills and competencies required by emerging or future job positions often have no equivalent in current education systems. Therefore, the severity of the disruptive effects that this transformation may cause in employment will largely depend on how quickly and accurately education systems—especially higher education—can respond to this rapid shift.

To answer this question, Larry Liu draws on Habermas's framework of legitimation crisis and Collins's theories of credential inflation and social closure to theorize the transformative impact of AI on higher education systems *(AI and the Crisis of Legitimacy in Higher Education, American Journal of STEM Education: Issues and Perspectives,* 4, 16–26, 2024). In the context of higher education, Liu defines legitimacy as 'the collective societal believe that obtaining a higher education credential is essential for obtaining secure and desirable middle-class jobs and maintaining or improving social mobility.'

The fact that employability still increases with higher levels of education and that wages for degree holders remain relatively higher indicates that universities currently continue to maintain their legitimacy. Moreover, as AI transforms the labor market—eliminating many job positions while increasing the demand for new skills in those that remain—higher skill expectations in emerging or future occupations are likely to extend the duration of education, especially from the undergraduate level toward doctoral education. This suggests that the legitimacy of higher education may, in fact, increase. However, the critical issue here

is how quickly and effectively higher education systems can harness this potential.

On the other hand, there is a growing trend in labor markets toward emphasizing skills over formal degrees. This shift is also evident in the rising interest in associate-level certificate programs and short-term qualification credentials. As Liu notes, private-sector employers such as IBM, Google, and Delta Air Lines have begun to reduce degree requirements for certain positions. In many countries, there is a noticeable increase in efforts to promote apprenticeship programs. Furthermore, as wages for high school graduates have risen, the college wage premium has shown a decline. Therefore, according to Liu's projection, as students increasingly turn to non-college but lucrative alternatives, the downward trend in college enrollment may become permanent. An indirect contributing factor to this trend is the sharp decline in population growth rates and fertility rates in many countries. Most developed countries now have fertility rates well below the population replacement threshold. As a result, populations are aging, and the number of young people is shrinking. This profound demographic shift will also indirectly lead to a gradual decline in the demand for higher education.

As higher levels of education lead to increased employment opportunities and income, the demand for higher education remains consistently strong. Moreover, countries' ambitions to enhance their economic competitiveness by cultivating a highly skilled workforce further accelerate this demand. Due to reinforcing mechanisms that stimulate rising demand, higher education systems have continuously expanded their capacities and, at a certain point, have begun to produce far more graduates than the labor market requires or than the number of available positions. This phenomenon—often referred to as "credential surplus" or "diploma inflation"—has devalued

higher education qualifications and intensified competition for employment. As a result, individuals are compelled to pursue additional qualifications and certifications beyond what is actually necessary, in order to stand out. This cycle has become a significant issue confronting many countries.

On the other hand, since the 1980s, technological disruptions—particularly the spread of automation—have begun to transform labor markets in ways that disadvantage middle-skilled workers. New job positions are increasingly being filled by highly skilled individuals. This shift has not only accelerated the erosion of the middle class but also made it more difficult for middle-income families to afford access to the high-level skills now required. In this process, the link between high-cost, high-quality higher education and affluent families has become significantly stronger.

As a result, even individuals with university degrees from middle-class backgrounds are increasingly losing their jobs or being pushed into lower-skilled, and therefore lower-paid, occupations. This trend compels a more realistic reassessment of the demand for higher education. As Liu also argues, when the cost of high-quality higher education—capable of ensuring good employment and decent wages—continues to rise, alternative pathways such as vocational schools or jobs that do not require a college degree become more appealing to the large segments of the population losing ground in the labor market.

AI holds the potential to significantly strengthen and expand automation, which has already contributed to the social rupture described above and has profoundly—yet unfairly—transformed the previously more equitable relationship between education and the labor market. Therefore, if no measures are taken to disrupt or at least weaken this powerful cycle, the legitimacy of higher education will decline for large segments of society. Liu

also argues in his article that the unchecked advancement of AI may undermine the legitimacy of the higher education system. Furthermore, both the broader public and businesses have begun to recognize the benefits offered by AI—such as personalized learning experiences and its potential to boost the productivity of low- and mid-skilled workers. As a result, more people are turning toward vocational schools and short-term certification programs that enhance their resilience in the labor market. As Liu notes, businesses are increasingly shifting their focus toward skills-based hiring and are gradually removing the requirement for a college degree.

It is important to emphasize that the legitimacy crisis does not affect all universities equally. On the contrary, legitimacy is actually increasing for nationally and internationally prestigious, high-quality institutions. As noted earlier, these universities have significantly strengthened their connection to high-skilled employment compared to the past, resulting in a substantial rise in demand. Given the limited capacity of such institutions, the cost of access is also increasing. Consequently, the bond between these elite universities and affluent families has become even stronger. Therefore, the legitimacy crisis is primarily experienced by large, disadvantaged segments of society and the middle class, who are losing their footing in the labor market. In this context, the function of "social closure" described by Collins regains its significance, as access to high-value educational credentials becomes increasingly exclusive and selective.

In fact, the meritocratic system, once reinforced by an expanding and massified higher education sector, is undergoing a kind of mutation. As access to higher education becomes widespread among large segments of society, its value gradually diminishes, and it appears as though we are returning to an aristocratic order. The universities that are losing their value or legitimacy

are generally those that emerged during the massification phase and lack a long-standing institutional history. The quality gap among institutions is deepening, and access to the highest-quality education is increasingly beyond the financial reach of the majority. As a result, institutions that once provided upward mobility and prosperity to the middle classes are now in decline. In short, if no corrective measures are taken, the world is rapidly moving toward a new cycle of inequality and injustice.

Instead of a Conclusion

The times we are living in correspond to a period in which digitalization, automation, and AI have formed an entirely new ecosystem. In every aspect of life, digitization is at the center; data is growing exponentially, and data-driven models are increasingly shaping the flow of our lives across all fields. With the development of AI, models based on numerical data have now entered a different phase. AI systems are rapidly transforming all areas of life, making their profound impact felt everywhere — from daily routines to the restructuring of the labor market.

We are now witnessing a period that is fundamentally different from past technological transformations. In this era, human relationships, interactions with the environment, family structures, work experiences, education, health, and engagement with culture and the arts — in short, every aspect of life — are undergoing rapid transformation. The pace of change is so fast that societies are often caught unprepared. As the problems associated with this transformation become more visible, societies are beginning to realize the true nature of what they are facing. Digital addictions are increasing, social polarization is deepening, and individuals are becoming more isolated. Family relationships are not immune to these impacts either.

Modern times have completely severed people's connections with the past cultures of their countries. All the institutions and mechanisms that once sustained these cultures have either been eliminated or transformed into units that serve the functions of the current transformation with new values. The modern individual has been detached from the bonds of responsibility and obligation that were embedded in past cultures — bonds that once shaped family life, neighborhoods, workplaces, interactions with the environment, and, more broadly, all aspects of social life.

Modern culture has been entirely built — and continues to be built — upon this notion of freedom. Moreover, this concept of freedom has been further expanded by the assumption that nature itself can be dominated and controlled at will.

As people have sought to maximize their own interests and profits, the costs of these actions to society and the environment have consistently been ignored. As individuals' ability to engage with what is happening around them has diminished, their sense of loneliness has grown.

With the weakening of social interests and the sense of "we," everyone is increasingly forced to fend for themselves. As social inequalities continue to rise in ways previously unseen, poverty is becoming more widespread. There is no traditional institution that has remained untouched by this transformation. Family structures have changed, economic dynamics have been redefined, the labor market has reshaped other institutions to serve its own purposes, architectural perspectives have shifted, and education has been restructured.

Technological developments occurring alongside this transformation — including AI, automation, and machine learning — form the foundations of this new culture. In particular, digital technologies have become widespread by integrating into people's daily lives, shifting the surface of human interaction from physical spaces to virtual environments.

Human relationships with other people and with the environment are undergoing profound changes. These evolving relationships and bonds are introducing new values into circulation.

On the other hand, especially with automation reaching a new dimension through AI, the likelihood of a massive wave of unemployment in the labor market is growing stronger with

each passing day. At every major turning point, the focus has predominantly been on the benefits of technology, while its potential negative effects on labor and other sectors have often been overlooked. Thus, in recent decades, the prevailing expectation during major technological transformations has been that technological waves would create new job positions and professions to offset these negative outcomes. While a large segment of society has been waiting for employment opportunities to arise from these new jobs, the acceleration of technological transformations and automation has, for quite some time, continued to concentrate economic prosperity exponentially in the hands of those who produce, manage, and occupy new positions with high-level skills.

It is now increasingly acknowledged that, unless different policies are developed, AI technologies will further accelerate this process. As a result, individuals with mid-level skills are increasingly either becoming unemployed or being forced into lower-wage jobs.

As the number of people competing for low-skilled jobs grows, wages fall, and the middle class is rapidly being pushed downward into the lower classes by technological waves. In other words, in recent years, the middle classes in almost all countries have been collapsing at an accelerating pace.

As their socioeconomic status declines, middle-class individuals are finding it increasingly difficult to access the quality of education, healthcare, and other services they previously enjoyed, and even their neighborhoods and social spaces are beginning to shift.

The book by Daniel Markovits, which we discuss extensively throughout this book, essentially tells the story of this transformation and the collapse of the middle class —

specifically in America, but more generally across all countries. The technological waves of recent decades, through the profound transformations they have triggered in the economy, have pushed the middle class closer to the lower classes, while continuing to concentrate a small number of wealthy families around technological transformation and the exponentially growing wages it generates. In this process, the quality of what has become accessible through massification has steadily declined, while high-quality services have become increasingly concentrated in a few areas, with their costs rising accordingly.

Thus, the threshold for affording access to high-quality services continues to rise. The American Dream, once a powerful ideal, now holds little more meaning than simply belonging to a bygone era.

As AI technologies rapidly begin to encompass all areas of life to the extent of forming a full ecosystem, societies are once again being steered toward optimistic expectations based on the same assumptions. According to this expectation, while AI technologies will eliminate many existing job positions, they will simultaneously increase efficiency and productivity, thereby creating a large number of new jobs and maintaining a balance in employment. However, past experiences indicate that the increases in efficiency and productivity brought by automation have tended to benefit capital far more than labor. As businesses' employment capacities continue to shrink with new technologies, the new jobs being created require far more costly advanced skills and experience. Moreover, as Mustafa Suleyman has pointed out, it is now being openly acknowledged that many of the new jobs created may, over time, also be replaced by AI.

In sum, with the spread of automation, a powerful shockwave driven by AI is now rising, further disadvantaging the middle

and lower classes, who had already suffered significant losses to their socioeconomic advantages. Naturally, at this point, large segments of the population who have lost their previous socioeconomic status have become much more politically vulnerable and easier to manipulate. As a result, extremist movements and rhetoric are finding support more rapidly in many countries. Moreover, echo chambers can now very easily and widely intensify social polarization. Violence is increasingly experienced in all its forms — individually, socially, and even between nations. Inequalities are growing rapidly, reaching dimensions never previously experienced.

Since all countries are going through similar processes, the problems are not limited to particular nations; rather, all countries are experiencing similar challenges. Naturally, the ongoing transformation affects all segments of society. Moreover, just as in other countries, in our own country as well, the problems caused by this transformation have increasingly become issues that all segments of society are beginning to complain about, albeit at different levels.

Therefore, it is essential to take swift measures and to develop multidimensional policies regarding this process. However, before doing so, it is crucial to fully understand the big picture of the transformation we are experiencing. In this book, I aimed to contribute to the development of such an understanding. This understanding will help us to fully grasp the scale of the transformation, recognize what we have lost, and understand how the problems we face are interconnected.

In fact, once it becomes clear that these problems are not incidental but rather structural and systemic, the path to developing sound and healthy solutions will finally begin to open.

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The transition from analog to digital, which has expanded measurement to encompass all domains, has accelerated and enabled the construction of a digital world. As digital data has increased, the mathematical models developed have facilitated optimization across various fields and, most importantly, enabled future projections. However, since these models' forecasts for the future are based on past data, individuals are now compelled to carry their pasts into the future through the framework of these models. Much like Ibn Khaldun's famous maxim, "Geography is destiny," the cycle in which advantage reinforces advantage and disadvantage perpetuates disadvantage has, in the digital era, transformed into a new paradigm: "Data is destiny."

The spread of automation through mathematical models driven by digitalization has led to a continuous erosion of the middle classes' position in the labor market. The evolution of automation into an entirely new dimension through artificial intelligence has deepened this loss even further. In short, humanity is entering a new phase in which it is being transformed by a technology of its own creation—one whose true costs we are not yet able to fully comprehend. Resisting the force of this wave appears extremely difficult. Therefore, the first and most crucial step is to understand the nature and depth of the transformation we are undergoing. In this book, Mahmut Özer sheds light on the mathematical models and their characteristics brought about by digitalization, the evolving artificial intelligence ecosystem, the opportunities and risks it presents, and, most importantly, the potential consequences awaiting us in the public sphere. He also provides early warnings about the risks that accompany this profound technological rupture.

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