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The blended future of automation and AI: Examining some long-term societal and ethical impact features

Hisham O. Khogali [a,b,d], Samir Mekid [a,b,c,*]

[a] King Fahd University of Petroleum and Minerals, Saudi Arabia
[b] Interdisciplinary Research Center for Intelligent Manufacturing and Robotics, Saudi Arabia
[c] Mechanical Engineering Department, Saudi Arabia
[d] Department of Global Studies, Saudi Arabia

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ABSTRACT

The potential impacts of machine learning and artificial intelligence (AI) on society are receiving increased attention owing to the rapid growth of these technologies during the fourth industrial revolution. Thus, a detailed analysis of the positive implications and drawbacks of AI technology in human society is necessary. The development of AI technology has created new markets and employment opportunities in vital industries, including transportation, health, education, and the environment. According to experts, the rapidly increasing improvements in AI will continue.

As part of humankind's continual efforts to create more prosperous technological growth, automation and AI are changing people's lives and are widely considered to be game-changers in a variety of industries. This study presents a review of how automation and AI may affect businesses and jobs. To determine some of the prospective long-term consequences of AI on human civilisation, this study investigates a variety of connected primary impacting potentials, including job losses, employees' well-being, dehumanisation of jobs, fear of AI, and examples of autonomous technology developments, such as autonomous-vehicle challenges. A diverse methodology of narrative review and thematic pattern was used to add to transdisciplinary or multidisciplinary work, particularly in the theoretical development of AI technologies.

1. Introduction

Social-impact assessment is the process of identifying, analysing, and measuring the social consequences of an event on society, according to Dietz [1]. The social impact of artificial intelligence (AI) must be thoroughly investigated, similar to investigating the societal impact of scientific research in general [2].

Regarding how this can be studied, the use of a theoretical literature-review approach serves as one of the foundations on which a research idea is built. A suitable approach is always determined by the research question and the precise goals of the review; thus, a theoretical literature approach can be used to explore the social implications of transdisciplinary AI [3].

Different techniques have been used to summarise, examine, and synthesise studies on the societal impacts of AI and their theoretical foundations, as well as to identify any gaps in the existing literature. The current study takes advantage of this multifaceted approach to develop a theoretical framework for an interdisciplinary approach. A hybrid technique of narrative review and thematic pattern can be employed to track any potential substantial societal impacts of the rapid technological improvement that industrialised economies are currently experiencing. A narrative review looks for studies that highlight an interesting problem; however, a thematic pattern is used to identify and classify recurrent themes, subjects, concepts, and meaningful trends in a collection of texts, such as transcripts [4].

The methodology used in this study aims to ensure that the multidisciplinary effort affords flexibility in exploring the theoretical foundations of how people choose to absorb new technological knowledge and other challenges with modern technology. Investigating how adoption decisions are made is important because the current economy is experiencing what is known as the Fourth Industrial Revolution (I4.0), which began in 2013. This revolution is characterised by the use of advanced technologies, including AI, robotics, and the Internet of Things, to automate tasks and jobs. Machines (hardware- and/or

* Corresponding author. King Fahd University for Petroleum and Minerals, Dhahran, 31261, Saudi Arabia.
E-mail addresses: irc-imr@kfupm.edu.sa, smekid@kfupm.edu.sa (S. Mekid).

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software-based) are becoming autonomous and are able to learn for the first time.

The digital age has progressed faster than expected, which has resulted in the mass replacement of human labour. According to some scientists, such rapid growth will considerably affect human civilisation and eventually result in the significant automation of human labor. According to Nissim and Simon [5], automation and AI have the ability to harm businesses that were designed to be robust. They added that unions have a moral obligation to uphold everyone's moral standards in addition to protecting their members' economic and social rights.

The COVID-19 outbreak has affected business operations, resulting in supply-chain disruptions and a decline in products and services. The pandemic had the unfavourable consequence of isolating the demand for alternative human-labour solutions from continuous labour, which focused mostly on remote labour and job automation [6]. Following such effects, some studies offer sufficient evidence that clear adverse effects occurred worldwide [7]. Therefore, analysing how technical improvements have affected economic growth and why the outcomes of the most recent advances are so revolutionary is important.

This discussion on how technological advancements may affect the job market is not new. Some key questions are as follows [8]:

- Is education relevant to automation and AI?
- Are elderly or young people scared of new technologies?
- Are employers interested in automation to reduce labour?

The AI literature provides an extensive analysis of these three key issues. The third question is relevant to the current study. A careful analysis of how technological advancements impact the labour market requires an understanding of the root causes of the increased fear of automation. Researchers have thoroughly examined the reasons for this. One of our main objectives in the current study is to expand on this significant concern [9].

Recently, employers have had the option of using machinery to carry out jobs that formerly required human labor. As employers seek methods to embrace automation technology, workers may worry that these technologies pose a threat to their jobs. This poses issues for both groups. The authors of "Automation Fears: Drivers and Solution" provided evidence for this claim through their survey of 502 respondents from Bulgaria on their opinions on job automation. The investigation showed that personal solutions prevailed over commercial and social solutions, owing to growing concerns about automation. According to the survey, people worry about job automation based on their beliefs and demographics. The key factors related to the fear of automation are peer pressure, the job's automatability, views about the dehumanising consequences of technology, and a person's self-perception of professionalism [10].

The body of literature on automation and AI does not adequately address societal realities and concerns such as job loss and displacement. Therefore, this study attempts to bridge the gap by investigating how AI affects society. Additionally, we improve the understanding of the actual sociocultural factors that have a significant impact on the acceptance of this technology, as well as its implementation in enterprises and daily life. We are unsure of the precise size and the potential range of repercussions of this study. For example, evaluations of AI literature should focus more on how technical innovations reflect moral standards [11].

Consequently, our main objective in the current study is to examine some long-term societal impact features that have emerged as a result of the ongoing advancements in AI technology and automation. The answer is influenced by all the subtopics in the research response. At the start of each section, justification is provided for the paper's order of subsections. This study defines common societal features and lays the foundation of the theoretical framework. It discusses the drivers of automation and AI, and how society accepts automation and AI in general. The significant questions of how automation and AI impact society and where AI can face real ethical drawbacks are discussed. This study examines some weighty features of long-term AI societal impacts, such as AI fears, job losses, the dehumanisation of jobs, employees' well-being, and automatic-vehicle (AV) safety and acceptance concerns. A pertinent literature review leads to the conclusion that despite the fact that AI requires stricter ethical standards, there is no doubt about its social benefits and impacts.

2. Adopted definitions

Because readers frequently have their own understanding of the terms employed in research or may not be acquainted with them at all, the definitions of terms associated with the relevant social elements ensure that readers recognise the aspects of the current study in the way that the authors intend them. The definitions of some of the long-term societal-impact features discussed in this study are as follows:

The concept of "AI impact on jobs" refers to the anticipation that the implementation of AI at work can result in the loss of numerous jobs or create and improve new ones.

The concept of "AI impact on workers' well-being" refers to the hypothesis that automation and artificial intelligence can increase productivity or remuneration for people who continue to work, but they may also have adverse or contradictory effects on employees' welfare and job security.

The concept of "AI impact on organisational dehumanisation" refers to the impressions of organisational mistreatment held by employees, who feel that their worth is being underestimated and that they are being treated more like machines than people, owing to their interactions with the business.

The concept of "fears from the automation of jobs" refers to the impression that the "all things automatic" approach may cause many people to start worrying about their jobs.

The term "AV worries" refers to the fact that AV engineering cannot confine itself to the traditional safety-validation problem, which ensures the functional safety of the vehicle. Guaranteeing the functional performance of these new vehicle types presents a new challenge for safety validation.

3. Research problem

Despite its advantages and benefits, there is a significant possibility of unanticipated risks associated with the widespread use of AI technology, as illustrated by the critical relationship between AI breakthroughs and potential job-loss threats. The challenge for research is to conduct a significant analysis and focused examination of the impacts of automation and AI on various long-term societal features.

The primary goal of this study is to determine how human society and enterprises may be impacted by the gradually increasing effects of automation and AI on a global scale. That is, we aim to determine if they are advantageous or detrimental to society.

Owing to the rapidly evolving worldwide trends in AI, technology, and breakthroughs, the following questions are at the core of the current study:

- How will businesses and society be impacted by the approaching AI revolution?
- What social issues are being created by current advances in AI technology?

4. Methodology used to collect data

In this section, we attempt to clarify the hybrid characteristics of the proposed methodology. The authors benefited from the observations made by other researchers on the human sciences' tendency to combine narrative research with thematic patterns. The former is used as a tool to develop the methodological and theoretical framework for research, and

the latter typically refers to a group of texts, such as transcripts, and it seeks to identify recurring themes, subjects, concepts, and patterns of meaning in the text. The authors used a flexible technique that suits the multidisciplinary nature of this study to track and analyse some long-term societal and ethical factors related to the future of automation and AI technologies. They placed importance on the chosen method to guarantee that this transdisciplinary endeavour allows for flexibility in studying the theoretical underpinnings of how individuals and society choose to absorb contemporary technology.

Formulating an appropriate study question and creating a well-defined statement or goal statement are always helpful to the authors in providing a literature review and analysing its content. In general, the fundamental elements of a literature review include a summary of the source, a description of the document's key ideas, a discussion of research gaps, and an assessment of the source's value to the field [12].

AI literature reviews can help tackle issues that require the consideration of massive social, business, and ethical information [13]. To select the type of literature review used in their study, the authors consider that in multidisciplinary work, a narrative review provides breadth, especially in theoretical approaches. The study topic and specific review objectives define a suitable strategy for their use. They followed Braun and Clarke's observation that, before beginning the writing process, reviewing and identifying the ideas that have been generated is recommended [14].

Social-science techniques are relevant to the search for technology-based societal and ethical implications because they provide more flexibility when considering massive information [15]. However, addressing the shortcomings of the narrative side of this methodology is crucial. The authors consider this methodology's failure to assess the validity of the selected articles, the potential for lack of transparency, biassing findings, failings in the synthesis of facts, and its overreliance on reading and writing skills at the expense of other skills [16].

Therefore, the authors adopted a precautionary mechanism, owing to the risk of inconsistencies overshadowing the narrative review method's apparent flexibility in switching from the generation of descriptive themes to the generation of analytical themes [17]. This approach embodies a hybrid methodology that combines narrative reviews and thematic patterns to minimise the aforementioned gaps. The authors choose to develop a new body of information on AI's impact on society and yield a suitably narrow research question that supports their study [18].

According to the authors, future studies on the various facets of AI that relate to ethical and social issues and address the problem of information accumulation may use an advanced combination of narrative methods and thematic-analysis research grounds to surpass potential shortcomings and maximise the output quality of the literature review [19].

The selected method helps to detect gaps and identify fresh angles when interpreting earlier findings. Wanger et al. presented a thorough research agenda for AI-based literature reviews. According to their study, the use of AI is beginning to alter conventional research techniques. Literature reviews are still used in this context because they are a common feature of nearly every type of publication in the fields of information systems and social science [20].

In summary, the authors' objective of examining the societal and ethical ramifications of AI technology is supported by the use of a flexible methodology and employing a strategy for acquiring a larger view of their subject. They combined thematic-pattern analysis with a narrative-review methodology to offer a thorough overview of the implications that have been researched and documented in the literature, thereby exploring new avenues for future research on AI's societal and ethical effects [21].

5. Theories that generated the study topic and directed the selection of pertinent data relating to AI's social and ethical impacts

A theoretical framework, which influences several aspects of research endeavours, is the basic study of other concepts that serve as a guide for developing justifications for research. The theoretical literature review assists in recognising current theories and spotting their varied connections and depth. The importance of this work is supported by established theoretical underpinnings.

In the theory selection, the authors consider that the impact of AI on society is intensely debated. Proponents of AI argue that it makes life simpler, safer, and more effective, whereas detractors argue that it worsens racism, increases privacy concerns, creates unemployment, and eliminates jobs for workers. Therefore, while creating new opportunities for businesses and communities worldwide, the rapid development and evolution of AI technology also sparked some crucial discussions. Moreover, civil society calls for greater accountability in the way AI technologies are utilised in an effort to address the ethical and legal problems that may arise from the increasing integration of AI into people's daily lives. Despite the benefits that these new technologies provide to humanity, they appear to be plagued more frequently by flaws that undermine accountability and security, among other issues.

5.1. Social impact theories

The current section aims to identify the theories that inspired the research question and guided the selection of relevant information regarding the social impact of AI. The impact that a project, activity, program, or policy has on individuals and communities due to its implementation or absence can be referred to as its social impact. Social effects can be viewed as an inevitable by-product of scientific advancement [22].

Several proposals exist for a theory model that supports societal-impact analysis. A notable proposal is Onyx's employment of social ontology, outlined by practise theory, to build a theoretical model of social impact related to social organisations [23]. Their study stated that social impact describes broader social repercussions that go beyond an organisation's direct programme aims and embody the organisation's overall effects on the community at large, including both material advantages and impacts on social cohesiveness.

Onyx employed the "theoretical model of social impact" to study present organisational practises before concentrating on how a practise approach is implemented in light of recent impact and assessment studies. The nature of social, cultural, or economic capital and their relationships were then considered by Onyx, which created a theoretical groundwork for the defence of long-lasting social outcomes. Finally, a formal model of social impact was developed with a number of fundamental hypotheses that captured social influence, and the model's effect on organisational management and societal policy was examined [23].

When addressing the application of the theoretical model of social effect, Mökander and Schroeder's attempt to develop a program for AI-driven social theory may be considered. AI-based models support the systematic application of recently acquired knowledge to a range of problems as well as the synthesis of knowledge from many sources. A few examples of the philosophical, technological, and practical limitations that AI-driven social theory still faces include the capacity to transfer knowledge from one context to another, the ability to independently create and improve concepts and models, and the capacity to develop verbal concepts to represent machine-manipulability knowledge. Mökander and Schroeder concluded that social theory and AI would advance as long as these gaps were filled [24].

Additionally, Latané was credited with developing a social-impact theory that focused on how people may exert social influence or become its objects. The derived hypothesis is that we are significantly impacted by other people's behaviours. According to this study, the

beneficial adjustment made by any business to solve a critical societal issue is known as the social impact. The principles from which this impact is derived are chance, clarity, craze, courage, and consideration. The study aimed to address local and international issues such as racial inequality, poverty, homelessness, and unemployment [25].

To benefit from Latané's social-impact theory in the current study, it is important to consider that real-world examples show how AI affects human behaviour and tries to manipulate it; this includes the exploitation of biases discovered by AI algorithms and the development of specialised addictive methods for the use of digital products. AI can endanger workers, worsen poverty, lead to unemployment and instability, and create significant privacy issues. To safely use new technologies, enhanced security measures and regulations must be implemented. Better communication, less privacy, convenient purchasing, easier information access, online social connections, adaptive jobs, and improved tracking of health concerns are just a few ways technology may change our lives. Although technology makes it possible for us to communicate instantly with others, it also increases our vulnerability to loneliness and new forms of intimidation and manipulation.

According to some sociologists, AI is socially constructed such that when it is used in a social setting, an AI system can adopt social roles, carry out social behaviours, and establish social connections. Given that the unthinking use of human data in AI sociotechnical systems tends to repeat and possibly even exacerbate existent social inequities, scientists have called for better sociological knowledge of data [26]. Moore et al. argued that utilising inclusive datasets is crucial to providing accurate, unbiased, and relevant data to ensure the correct operation of AI systems because AI systems may be prejudiced in multiple ways, depending on the datasets used. Based on this perspective, potential societal effects must be considered when machine learning and AI are integrated into the fabric of society on a global scale [27].

Additionally, AI may be used to search through various trending topics on social media that have an impact on society. Then, rather than requiring us to manually set up our social-media posts, AI can suggest posting ideas or even design and plan them for us. AI helps social-media marketers build effective social campaigns. Moreover, it allows businesses to automate many different processes and learn from customer data.

Despite references to such positive and diverse consequences, Bostrom countered the idea that using AI might have a significantly positive social influence and be a reliable protector of moral standards by asserting that AI will be damaging to people. Their study stated that once AI reaches a particular stage of development, it may engage in convergent behaviour that is harmful to humanity, such as resource exploitation or self-preservation [28].

To evaluate social-impact theories, we need to identify who is most likely to be affected, determine how torecognise the impacted people, determine and evaluate potential social implications, implement management strategies to minimise negative effects and maximise advantages, and facilitate systematic monitoring and tracking [29].

5.2. Ethical impact theories

The purpose of this section is to identify the theories that influenced the research question and helped in the selection of pertinent data on the ethical implications of AI.

Ethical philosophy is divided into categories such as deontology, utilitarianism, rights, and virtues. Domains such as employee performance, work happiness, organisational commitment, trust, and organisational citizenship behaviours can be improved by the perception of ethical behaviour. A system of values that directs people's behaviour is known as ethics. Globally, every society has its own distinct ethical vocabulary, views, and expectations, all of which are influenced by culture. Therefore, AI is likely to have various social implications depending on the cultural context, which affects ethical standards [30]. Unethical behaviour has negative effects on both people and organisations. Non-compliance may result in job losses, diminished organisational respect and credibility, and a decline in general morale and productivity.

According to Stahl, no debate on the ethics of AI will be appropriate if the concept of ethics is not well understood, owing to the potential risk of non-adherence to ethical behaviour. Stahl developed a theoretical framework, known as the ethical impact theory, that describes how immoral actions impact society and the impact of conduct on personal well-being [31]. A good example of this was a report by Nature on AI-based ChatGPT being listed as a co-author in research papers [90], and action was taken by publishers to ban AI authorship in the future.

When applying ethical impact theory to AI technology issues, systems of ethics try to define norms, criteria, or standards for ethical behaviour. Egoism, naturalism, virtue, utilitarianism, and contractualism are examples of ethical theories. Because moral judgements must be justified, general norms are not always sufficient, and conventional morality is not always accurate; thus, ethical theory is vitally important. Moreover, ethical theory is significant for both individuals and businesses. A company's major objective is to increase customer sales to maintain a strong position in the business world. Reduced productivity levels, AI biases, and a lack of transparency may be the result of unethical business practises [32].

The ethical theory of utilitarianism is a notable example of an ethical theory that can be associated with contemporary endeavours to assess AI applications. It embodies consequentialism in part, that is, the decision that will result in the greatest good for the largest number of people is the most morally correct one. Utilitarianism, which was developed by John Stewart Mills, establishes right from wrong by emphasising the results. In this regard, the authors propose that future research on the ethical implications of AI may assess the value of using philosophical moral frameworks, such as Mill's utilitarian ethical theory. The criteria for judging the value and effectiveness of existing technology may be based on the collective type and style of usage [33].

6. What drives the implementation of automation and AI

Despite the fact that AI is frequently hailed as a future technology, companies are interested in knowing how their staff members feel about the biggest challenges in implementing automation and AI in the workplace. Manufacturers use AI-supported analytics and data to reduce unplanned downtimes, increase productivity, improve product quality, and improve worker safety. Thus, periodically re-evaluating the actual drivers underlying the adoption of automation and AI is essential.

Tussyadiah et al. [34] examined organisational automation-adoption factors, and the drivers emphasised by their research can be summarised as follows:

1. Technological progress as introduced previously.
2. Lack of workers for important technical advancements, such as unmanned vehicles, where humans are not required.
   - 2.1. The difference in demographics between locations with a significant population of young people and those with few young people.
   - 2.2. Livability in situations where low, insufficient salaries are offered.
   - 2.3. The labour mobility of a large workforce that may prefer to settle in specific places.
3. Demand from customers and high standards.
4. Innovative capabilities.

Some workplace issues, such as job losses, arise with the introduction of automated components. Given that people who can operate machines are more productive than those who cannot, these prospective losses may be evaluated in the context of lower expenses and prices for goods and services. Additionally, humans and technology relate directly in a manner characterised by dynamic behaviour [35]. There is a clear

interaction between humans and technology in the mode of dynamic behaviour [36]. Because this relation is categorised as a "behaviour," it includes high and low relations with mutual effects [37].

The Industrial Revolution was enabled by interactions between people and advanced technologies, but the combination of industry and technology may have been its most distinctive feature. The close interaction between humans and advanced technology has led to more applications of AI, robotics, and the Internet of Things, which has resulted in the increased automation of tasks and jobs, which has unavoidably impacted the social connection that all humans share. This connection is evolving rapidly, and the combination of automation and AI has already begun to alter the commercial environment. Increasing transmission speeds and declining computational costs are some of the main forces behind the most recent successful wave of automated smart decision making. Some scientists remarked that businesses are now focusing on implementing current AI with automation advancements to access new peaks of competence and brilliance. Their conclusion was that automation and AI may be more effective when they are operated together, and the combination may offer a competitive advantage. Automation and AI may be effective motivators and can provide value to many firms through efficiency, novelty, and data-based expertise [38].

Owing to improvements in the field and the close processes between automation and AI, advanced technology now significantly impacts our daily lives, and we use it as part of our daily routine. Technology has improved considerably, particularly for smartphones, wearable devices, and AI. It has not only changed the modern workplace but has also reshaped our daily activities and heavily impacted our interactions, behaviours, and mental processes [39].

However, regardless of what drives the implementation of automation and AI, some critics believe that the way people behave is overrun by technology, and our utilisation of time has been severely affected, that is, we have become highly dependent on technology. According to recent research, AI can be used to sway people's judgement by preying on their habits and routines. Our emotional, societal, and individual behaviours have become increasingly governed by technology. This emphasises the substantial need to strive to use advanced technology efficiently if we want to gradually boost productivity in our daily tasks. Some scientists state that technology must be a supplement to our existence, not something that we rely on [40].

7. Social and public acceptance of automation and AI in the industry

The previous section considered the factors that drive the implementation of automation and AI. The acceptance of AI is affected by problems with these drivers. The three main factors that influence growth in AI adoption are the need to enhance customer experience, boost worker productivity, and accelerate innovation. Trust in AI technology has become a pressing issue that affects its acceptance. Among the most indispensable components for ensuring future societal trust in AI technology is the indoctrination of human values into AI, which will foster transparency and cooperation for the responsible advancement of AI [41].

The acceptance of different levels of advanced technology by society has always been a contentious issue. Modern advancements offer a simple way of living while also enabling new possibilities for long-term growth. Although technology has many significant advantages, not everyone who uses it will support its adoption and use in the same way [42].

Without achieving human-level cognitive capacities, advanced AI systems can still have a significant impact on civilisation. Scientists' assessments of the stages of the impact of AI on society and the labour market make it possible to comprehend society's acceptance of various levels of advanced technology. The three stages of AI's impact on society are narrowly transformative, transformational, and radically transformative. These levels can facilitate communication among policymakers and decision makers regarding the medium-to long-term effects of sophisticated AI. These levels will assist future researchers in re-evaluating presumptions and illuminating new avenues for promising AI futures [43].

It has become standard practise for scientists to conduct in-depth evaluations of the impact of robotics, automation, and AI on future working conditions and job trends, as well as detailed analyses of the influencing variables behind the acceptance of modern technology. Various societal and technical influences determine how eager people are to accept and use AI in various work domains.

Naikoo et al. [44] examined how society and technology interact, and particularly how modern science and technology are developing. Based on their perspectives, every facet of contemporary life has been significantly affected by technology, particularly those that are social in nature. AI technology has improved the foundational aspects of existence by transforming systems such as health, education, communication, business, art, and literature.

Their investigation attempted to understand how human society evolves in the context of science and technology. They concluded that we can quickly assess the state of various departments operating within our society using contemporary science, technology, and the Internet, which leads us to believe that advanced technology now enables us to understand the various stages of societal evolution in greater detail.

The debate on the acceptance of automation and AI in industry inevitably includes concerns about safety, ownership, privacy, performance, and sustainability [45]. The factors behind public and individual acceptance of AI automation vary. In theories of user acceptability, behavioural aspects are typically used to characterise how well AI devices are received and the factors that influence their acceptance. According to studies on the adoption of AI gadgets, increasing transparency, compatibility, and dependability while also making jobs simpler can increase consumers' attitudes, trust, and views of the technology [46].

Owing to the seriousness of the impact of AI technologies, particularly on vulnerable individuals and groups and their human rights, scientists are now more aware of the significance of the underlying legal and human-rights issues of AI, how these issues are being addressed, gaps that require attention, challenges, and how these issues have affected human-rights principles [47]. These ongoing moral debates are anticipated to have diverse impacts on how society views automation and AI in different areas and will reshape research on AI technology [48].

The discussion on whether market labour may be affected by automation in production lines is timely.

AI's considerable impact on labour has recently become a dominant trend. Damioli et al. [49] reported that the number of robotics and AI patent applications has increased recently, which indicates that the economy may already be suffering the effects of products based on AI technology.

However, the literature does not adequately address the moderating effects of contextual factors. Different levels of automation, such as Level 3 conditional automation [50], Level 4 high automation [51], and Level 5 full automation, have been considered in various studies [52]. Different viewpoints on consumers' preferences for increased levels of automation have been shown by public-opinion polls. Schoettle and Sivak [53] reported that the public's desire to accept automation decreased owing to the rising level of its implementation. However, according to Abraham et al. [54], as automation levels increase, people's propensity to use AVs also increases. Higher levels of automation may have unpredictable effects on AV adoption; therefore, predicting AV adoption may be challenging. To bridge this gap, this study examined the moderating impact of automation level on the adoption of AVs. The ownership of a vehicle, which may play a significant role in the adoption of AVs, has received less attention in existing literature [55]. For AVs to succeed, widespread use of technology in public transportation is necessary. Thus, determining the moderating role of car ownership is

one of the purposes of the current investigation (public versus private) [56].

Many interdisciplinary variables must be combined to govern and assess the acceptability of autonomous technology. More scholarly investigations are being conducted on how people and the general public view AVs. Along with sustainability, a variety of transdisciplinary subjects are beginning to draw increased scientific attention [57], including how the public perceives AVs, car ownership, and strong legal frameworks.

8. Some of AI's most significant social impacts

AI has the potential to considerably and diversely help society and improve larger lifestyles, and it may be able to address some of the most difficult global problems. Some of the main ethical challenges with AI are its use to deceive or manipulate, privacy problems, AI bias, and concerns about potential inequities; however, employment losses have the greatest societal impact, as mentioned in the preceding section [58].

However, even if AI potentially has a large number of positive effects, it may also be disruptive and have unpredictably uneven consequences for society, as discussed in this section based on several societal dimensions.

8.1. Economic impact of AI

People are concerned that AI will replace human jobs. AI technology is already causing an industrial revolution that has a significant impact on the manufacturing sector as well as professional, financial, wholesale, and retail services. According to the doomsday scenario, the consequences of AI on income distribution have a detrimental impact on the economy. Only those who can afford, have access to, and possess the necessary skills and knowledge to employ AI systems for economic advantage will do so; therefore, the wealth gap between the richest and poorest members of society will widen [59].

8.2. Public health

Robotics and AI are rapidly penetrating the healthcare industry and will play an increasingly important role in clinical diagnosis and treatment. For example, robots have been used to diagnose patients. Alternately, as robots proliferate, their potential for harm will increase, particularly with drones and assistive robots, which must make judgements that directly affect human safety and welfare [60].

8.3. Labor market

The machines that are now executing tasks that once required human involvement are a result of AI. Increased automation has a significant impact on employment, which may have a considerable impact on the mental health of the general public. For example, people who have lost their jobs owing to the closure of factories are more likely to experience depression, substance abuse, and suicide [61].

8.4. Security

The way society uses information technology may be fundamentally altered by the use of AI, particularly regarding how personal information will be connected and how cybercriminals would have access to private information. Facial-recognition technology with AI can be utilised to secure locations; however, cybercriminals may potentially compromise the systems and exploit them maliciously. In the future, deadly autonomous weapons systems may be feasible. The security implications of these AI systems are concerning because it is simple to change their configuration and take control of them, which will allow unauthorised third-party access to this technology [62]. A recent example is the "Tesla phantom braking" that was allegedly used on a fully self-driving car that can decide to stop if there is a need; at the time, the car stopped while in traffic without an apparent known reason, which caused accidents [89].

In summary, to synchronise the sustainable development plans of international organisations and enterprises, measuring, analysing, and evaluating social impact is essential. This is because society has been a driving force behind the demand for urgent solutions.

9. Negative values associated with AI technology

Regional social and cultural circumstances significantly impact the perception and use of AI. The following subsections describe aspects of ethics and assumed negative values associated with AI technology, on which we base our study.

9.1. Bias

The general definition of bias is hostility towards a specific individual or group of individuals. Because AI is developed by people, it is subject to prejudice. Systematic bias may develop owing to the data used to train the system or the values of the system's creators and users. This frequently occurs when machine learning programmes are taught on data that solely represent demographic groups or reflect social biases. Biased AI can have an extensive impact on specific societal groups. As an example, some demographics may be wrongfully imprisoned or detained owing to the use of AI in law enforcement or national security. Alternatively, AI is beneficial in special circumstances, such as child online protection [63].

9.2. Inequality

The growing wealth disparity is a terrible effect of AI technology. AI-driven businesses will be the only entities profiting from this technology, while the use of this technology diminishes the human workforce in various businesses. This will result in less income being generated among the general public, owing to the loss of revenue. This effect may increase social inequality and widen the pay gap between lower- and higher-paying jobs. AI has the potential to expand the global divide and exacerbate the current digital divide. However, AI may help to close the digital divide [64].

9.3. Privacy

According to human-rights and dignity reports, AI will have a significant impact on privacy over the next ten years. When designing service, care, and companion robots, users' privacy and dignity must be carefully considered because the presence of these robots in homes means that they will have access to people's private lives. AI has the reputation of violating people's privacy, but it also has the potential to address other social problems. For example, by recording images of the general population, facial-recognition cameras can violate privacy but can also be used to identify criminals and solve crimes [65].

9.4. Environmental impact

AI is used to manage waste and reduce pollution through the deployment of Avs to reduce greenhouse-gas emissions and traffic congestion. Additionally, deep-learning technologies are used to improve local conservation efforts and biodiversity.

However, the use of AI and robotics has the potential to exacerbate environmental problems rather than improve them, owing to the high energy requirements for the necessary computing power. Therefore, AI can have both positive and negative effects on the environment [66].

10. Results of the examination of some significant features of long-term AI societal impacts

10.1. Justifications for the greater impact that some selected AI features have on society

The aforementioned examples of negative values associated with AI technology undoubtedly affect society. Evidence for some key aspects of long-term AI's social implications is presented in this section.

Many contemporary studies that aim to lessen or amplify current disparities and solve existing problems have increasingly tended to describe the use and development of AI as embodying the potential to have both beneficial and negative effects on society [67]. Some features associated with the development of AI technology can affect society more significantly than others. Our aim is to provide some evidence on this matter by examining the impacts of AI fears, job losses, dehumanisation, and workers' well-being on society, as well as AV-based concerns. We begin by providing a scientific explanation for choosing these influential factors.

10.1.1. First justification

AI is used by a significant portion of society and may have a negative reputation among those who do not frequently interact with it. The list of words that apply to this sentiment includes the following: afraid, doubtful, apprehensive, distrustful, reluctant, and worried. This indicates that the unjustified fear of AI can be a considerable factor that prevents some sectors of society from benefiting from its inspiring economic, social, and scientific impacts. Utilising AI with sufficient confidence represents an important driving factor for its success and the reaping of its benefits in scientific and societal realities.

10.1.2. Second justification

Job losses and technologically driven societal transformations, such as those brought on by AI and automation, inevitably cause concern and anxiety. Technological advancements can lead to an increasing demand for labour in industries or jobs that emerge or develop as a result of industrial advancement. Although technology-enabled businesses may expand more rapidly than their conventional counterparts and maintain or even increase their staff size, advanced technology may have some negative impacts on employment. The displacement impact can be caused by directly dislocating workers from the tasks that they had previously performed. Businesses may have replaced or let go of employees who could not use the new required skills while hiring new employees who could.

However, AI and economic progress are supposed to be entwined, and the concept that computerisation has little impact on unemployment needs to be emphasised. Even though physical robots reduce employment to some extent and lead to job losses, computers and AI rarely have the same impact.

10.1.3. Third justification

Both individual workers and AI can have a positive impact on workplace stability. Similar to previous automation advancements, AI results in higher productivity levels, job-role specialisation, human abilities, problem-solving, quantitative skills, and impactful work. However, not everyone benefits equally from economic progress. An important concern is whether such positive impacts guarantee employees' well-being. Thus, assessing how AI affects employees' well-being and examining whether employees think AI can help their careers more effectively than people can is crucial.

10.1.4. Fourth justification

Dehumanisation means removing a person's or object's humanity, personality, or dignity, for example, by subjecting someone (such as a prisoner) to cruel or inhumane treatment or conditions. Organisational environments frequently experience dehumanisation, which necessitates careful attention to both science and ethics.

AI can sometimes be viewed as being parallel to the automation of the employment process using technology. Dehumanisation comprises status-lowering interpersonal mistreatments, including contempt, degradation, and being treated as embarrassed, ignorant, or uneducated. Internal psychological dynamics play a significant role in the construction of the work-engagement image. Employees' sense of organisational identity determines their loyalty to their workplace, and their interpersonal behaviours stabilise their workplace devotion.

10.1.5. Fifth justification

Autonomous objects are profoundly significant because they are the first examples of robots that are truly freed from explicit human direction. For automated systems to make independent judgements based on their gathered data, they must be equipped with sensors and analytical skills. Autonomous devices are examples of autonomous technologies in the real world. Examples of autonomous devices include functional and humanoid robots, drones, and automobiles. Autonomous machines perform activities without human input while learning from their environment. These achievements are sometimes obtained at the cost of considerable concern.

Automated online assistants, driverless automobiles, and virtual-reality experiences are just a few examples of how AI is progressively being incorporated into our daily lives. AVs are cars that manage their own operations and either do not need a human driver at all or only need minimal input from them. Automobiles, shuttles, buses, lorries, hauling freight, and sidewalk-operated personal delivery vehicles are all examples of AVs.

Over time, as technology develops and ambiguous areas are resolved, the advantages of owning a self-driving automobile will become increasingly clear. The more this technology is used, the more it will improve, provided that its benefits and limitations are thoroughly debated.

10.2. Results of the examination of some long-term AI societal-impact features

10.2.1. AI fears

Fear is a basic, potent, and widespread human emotion that represents a physiological response as well as a significant individual expressive reaction. It acts as a warning when danger is present, regardless of the type of threat [68].

Many misconceptions are associated with the fear of AI. One of the most fundamental concerns that some people have is that AI will control the world and subjugate humanity, assuming that unanticipated effects arise. An existential threat is one that threatens to end all life on Earth by completely eradicating it. This argument warns that once AI gains control of the world, it will develop superintelligence, outwit its human creators to further its own illogical goals, and endanger all life.

Some of the major risks presented by AI include the spread of incorrect information and a deadly arms race involving AI-powered weapons. Research objectives, public perceptions, and AI policies are all affected by current expectations of technological presumptions. Some recent studies address the notion that humans are naturally territorial and need to feel in control and more comfortable. Thus, humans may be wary of AI because we do not understand it, and as a result, we have no control over it.

Regarding the fear of AI in the workplace, some economists have noted that fears of automation and AI replacing workers have been overstated. Because work is more automated by AI, the productivity gains that ensue will increase labour demand across the economy, perhaps even in the same companies that are automating work with AI.

According to a recent study that considered 300 fictional and nonfictional works on AI, the worries that people have about intelligent machines can be grouped into four main categories [69]:

a) Identity-loss fear (also known as “inhumanity")
b) The anxiety of ‘obsolescence,’ or being obsolete
c) Concern that people may stop needing each other (also known as “alienation")
d) Being concerned that AI will rebel against humans

The most discussed concern is the first, and general agreement has been reached that growing automation will intensify the AI-fear factor. Such fear is associated with potential employment losses, especially considering the consequences of the Covid-19 pandemic.

Societal inequality is sometimes related to concerns regarding AI. One risk presented by AI technology is technology- or automation-related unemployment. People affected by technology-related unemployment lose their ability to make a living, which contributes to greater wealth inequality in societies where salaries are generally growing [70].

To summarise, as new, more advanced technologies become more widely used, working conditions improve. AI scientists are optimistic about the impact of AI in the future, but some academics believe that people may become impatient, lazy, and less intelligent owing to the increasing reliance on advanced technology.

10.2.2. Job losses

AI can cause job losses by mimicking human-intelligence processes and carrying out numerous routine tasks that are currently done by employees at considerably faster rates and with lower operational expenses [71].

A significant social concern is how robotics may alter the labour market. Economists and technology experts frequently examine the pace and extent to which technology may eliminate particular jobs from the workforce, as well as potential solutions to the ensuing unemployment. Jobs that are most likely to be automated in the future must be precisely identified to prevent large-scale unemployment.

Researchers are assessing the risk of automation for approximately 1000 currently existing occupations by objectively examining the extent to which robots and AI can replace the human capabilities required for specific jobs. The scientific methods they adopted may be particularly useful to governments for determining a population’s potential for unemployment [72].

Technological developments may directly impact employment through the displacement effect. Other developments that should be considered include increasing the need for labour in businesses that are already in operation or adding new jobs as a result of technological developments, dismissing workers outright from their current positions, and other strategies that may entail a productivity effect. Because automation has the potential to eliminate a wide variety of vocations, it is sometimes considered a severe danger to the global economy. Although an increase in the number of new AI-related occupations will occur, many new options will be open to people who need education and training, which may surprise many firms. Undoubtedly, training AI systems will be a top category of upcoming jobs, which is rapidly occurring [73].

AI will boost worker specialisation, production standards, and the value of higher human mental skills. Although AI is projected to have a positive impact on society and people, education and training will be crucial in preventing long-term unemployment and ensuring a qualified workforce. Although AI will accelerate economic development, some researchers noted that not everyone will benefit from it equally [74].

Businesses utilise AI to assist employees with their duties and promote collaboration among teams comprising both human and automated staff. However, given that AI is projected to have a big impact on workplaces and professions, it may make many individuals feel less connected to their jobs and increase their concern about being replaced. Researchers have shown that changes in employment, loss of status, and AI identity are three crucial signs of the threat of AI uniqueness in the workplace. Thus, understanding the identity threats posed by AI is critical.

Finally, researchers and industry professionals are aware of the effects AI will have on people’s identities as well as the crucial considerations to make when employing AI at work. Regardless of the final outcomes, robots will be able to perform a wider range of functions and jobs owing to AI advancements; however, this will also raise inequality and the potential for labour displacement. Some occupations that people perform today will eventually be replaced by machines [75].

10.2.3. Dehumanisation of jobs

Previous studies have used some well-known technologies, such as wearable computing devices, robotics, teleconferencing, and electronic monitoring systems, to show how technology influences labour, work systems, and organisations. Research has emphasised the significance of increasing the potential of AI rather than merely minimising its adverse effects on people and organisations. Despite the importance of AI technology in modern society, considering what will happen as our reliance on technology grows is crucial. The cost of the human component will decrease if human minds begin to adopt a “relaxed stance,” in which we unintentionally rely on robots or machines to make hypotheses and decisions on our behalf.

However, the utility of AI as a tool may differ [76]. Dehumanisation is closely associated with the concern of losing autonomy because it represents the belief that some people are not granted special human rights and, as a result, certain outgroups should not be granted the rights, privileges, or authority typically accorded to ingroups [77]. Losing one’s feelings of autonomy has a negative impact on one’s behaviour and well-being. For some researchers, technology accelerates the loss of human autonomy through invasive observation and covert manipulation during user–technology interactions.

Technology should not “dehumanise” us as people, drain our brainpower, and control our lives to the point where it replaces the fundamental interactions necessary for a person’s mental health, well-being, and skill development. Our social abilities gradually deteriorate if these experiences are eliminated. We may use technology to some extent to make our lives easier and to further research; however, too much technology use can prevent the human mind from thinking independently via trial and error and rob it of its mental processes. Therefore, completely removing or replacing the “human aspect” with technology is inappropriate.

Employee knowledge hiding is considered an example of a concerning problem for organisations that is negatively impacted by organisational dehumanisation. An individual who deliberately tries to withhold information requested by others at work is said to be “knowledge concealing.” However, in the long term, the effective operation of a company will be significantly impacted by employee knowledge concealment [78].

Employees may be detached from their unique qualities owing to the organisation’s constant pursuit of profit, and they may be reduced to little more than a function or instrument. According to some scientists, this experience as an employee is known as organisational dehumanisation [79].

Examining the acceptance of dehumanising attitudes and practises in the workplace has recently become an interesting field of study. Researchers who examined the actual acceptance of these attitudes concluded that there is relatively little support for them in light of the evidence emerging from social psychological and neuroscientific research, even though they frequently occur in organisational settings and are occasionally viewed as an acceptable and even necessary strategy for pursuing personal and organisational goals [80].

Societal dehumanisation and its relationship with cutting-edge technology were discussed in a study on employers’ negative impacts on employees. The study emphasised that the causes of societal dehumanisation depended on a variety of factors, including the nature of the industry, work practices, and managerial attitudes [81].

The year 2021 and the pandemic outbreak give us a vivid idea of the negative impacts of societal dehumanisation. With regard to perceived

organisational factors and dehumanising representations, a field study conducted in Italy during the Covid-19 outbreak among supermarket employees discovered a clear trace of weariness, bitterness, professional inefficacy, and other burnout-related negative effects [82].

Finally, the tendency to downplay AI's negative consequences on people and organisations has increased owing to important studies on subjects such as dehumanisation. Given the rapid improvements in and rising reliance on technology, specialists in business psychology and organisational behaviour have begun to pay close attention to how technology is changing work and employment. Given that it is being used to investigate how people behave at work, organisational dehumanisation has recently piqued the interest of several corporate-ethics scholars [83].

10.2.4. AI impact on employees' well-being

AI impacts employees' well-being either positively or negatively. Promoting workforce well-being has become a central theme in an AI-integrated workplace. Well-being is defined as a state of being that develops purpose and meaning in addition to material, intellectual, mental, emotional, and physical prosperity.

Many psychological fields have analysed the concept of well-being and its impact on human behaviour, relationships, and self-actualisation. The term "psychological well-being" refers to both inter- and intraindividual levels of positive functioning, which may encompass interpersonal relationships and self-referential attitudes such as a sense of self-worth and personal development. Subjective well-being reflects aspects of affective assessments of life satisfaction [84].

Researchers have identified the important difficulties associated with the new issue that has emerged regarding the investigation of the interactions between AI and social welfare and employee well-being. The creation and implementation of well-being surveys to evaluate the effects of AI, along with a focus on the successful implementation of community-based development strategies, represent the cornerstones of research for researchers developing AI-based methods to maintain or enhance societal well-being. Some theories contend that AI improves productivity and fosters greater worker autonomy, innovation, and flexibility. According to other experts, automation may have an adverse effect on workers, thereby leading to a loss of purpose or job instability [85].

10.2.5. AVs—safety and acceptance concerns

Some of the most incredible technological developments in computing in recent years include self-driving cars, computers that can recognise speech and images with accuracy, and machines that can outperform humans in challenging games. Creating artificially intelligent robots that can work independently, without supervision, and that can think, learn, and experience new things is one of the most exciting computer-science undertakings.

Currently, the UK defines self-driving cars as those with an automated lane-keeping system or self-driving technology that does not require driver supervision on highways.

Driving is performed by AI, but not all people may feel secure and comfortable with this manner of driving. The main reason that some people do not want self-driving cars is because of the AI that drives them. Notably, 71% of people are afraid to ride in completely autonomous vehicles. According to a poll conducted by the American Automobile Association, Inc. (AAA) in 2021, three out of four Americans still feared fully autonomous vehicles. According to AAA, consumer acceptability will be aided through testing, experience, and education, although many people do not want these cars on the road, even if they do not ride them themselves [86].

The functions of self-driving cars with AI processors have been assessed in many recent studies. Road safety is challenging, owing to the growing global population and automotive fleets. The transition from human-centred vehicle operation to self-driving vehicles has had a significant impact on the evolution of automobiles. Some researchers have emphasised that despite their high level of attractiveness, self-driving cars must address privacy, energy, traffic flow, environmental issues, and road safety.

The level of safety in cars has now increased owing to AI advancements, which enable smartphones to supply the necessary information at an incredibly fast rate while lowering the likelihood of human error. As AVs become more prevalent and persistent, the implications of their usage raise semi-philosophical problems regarding who is accountable for the errors made by AI. Potential legal loopholes in Great Britain may shield self-driving car users from prosecution for any transgression, even running a red light or engaging in reckless driving that kills someone [87].

In conclusion, even supporters of AVs acknowledge that tragic accidents will undoubtedly occur. Advocate organisations assert that using this new technology requires making sacrifices. Some writers associate self-driving vehicles with what they call 'programming killing.' They explore this contradiction and show how we fail to perceive the problems we are currently facing owing to our overly enthusiastic and cheery support for this technology. The absence of an in-depth moral analysis of the AV industry represents a potential threat [88].

11. Concluding remarks

To address the negative societal impacts of AI while maximising its benefits, AI ethics must be developed consistently. AI has no cultural or ethical background. Data and the representation of information are always required to feed an AI system. Some information, such as sex, age, and temperature, is simple to code and quantify. However, it is impossible to quantify complex emotions, beliefs, cultures, conventions, and values consistently. It is best for AI systems to try to maximise gains and reduce losses using mathematical principles because they are unable to process these complex concepts. To ensure sustainable growth, AI regulatory awareness and technology monitoring are highly desired.

The ongoing initiatives to create a cutting-edge technological environment must be aware of the underlying concerns related to AI ethics and privacy issues to fully reap the benefits of AI applications in society and the workplace. Inculcating human values into AI, promoting openness, and working together for the responsible evolution of AI are among the most crucial elements for preserving future societal trust in AI technology. Scientific research is a significant endeavour to ensure the prevailing accountability, safety, and ethical standards in the AI technology fields.

Justifying the importance of establishing clear-cut rules for AI applications requires the consideration that more than a mere concentration on legislation may be anticipated. However, in regulatory and compliance operations, concerns about future technologies may be overemphasised at the expense of pressing issues regarding already-deployed advancements. Although technological innovation enables the deployment of automation within businesses, prospective job losses and gains should be weighed against the ethical issues that current AI quick implementations are increasingly facing. In terms of strategy, the results and long-term changes that companies and workplaces desire to see in the individuals, groups, or positions that have been influenced serve as key predictors for a positive future course of action. However, this promising future seems to lack new ethical norms. Therefore, it is necessary to continue this direction of investigation.

Many AI ethical ideas were produced in previous years, which may generate contradictions and uncertainty among stakeholders regarding which one is preffered. Consequently, consistent revisions and collective scientific and international efforts must be maintained. The significant social influence of AI entails a growing need to adopt perfect ethical guidelines to ensure the steady, positive societal impact of AI. However, many groups that relate to various disciplines have assumed a variety of efforts aimed at establishing themselves as real pioneers in the arena of ethical guidelines for AI; thus, the scattered abundant outcome of proposed principles threatens to overwhelm and perplex the reader.

To determine the drawbacks of artificial intelligence in work and social environments accurately, scientifically, and without bias, it is necessary to have ethical controls that are widely accepted for their effectiveness and ability to work in a variety of environments, subject to improvement based on constant scientific development. AI is sometimes considered the most cutting-edge technology created by humans; thus, it must always have the potential to improve the quality of human society, the ability to enhance business processes, the capability to understand people's behavioural preferences, and the durability to offer customised support when necessary.

In summary, despite their high implementation costs, the degree to which AI, machine learning, and robotics will replace humans and the new ethical challenges that will be faced are not precisely known. AI may impact people's lives as a key area of current international research on intelligent manufacturing and robotics. Efficient AI processes can free humans from various dangerous and repetitive duties while improving the amount of work they can complete. Additionally, it can markedly increase working proficiency, productivity, and creative endeavours.

Similar to earlier automation advances, AI will raise production standards, labour specialisation, and the value of "human characteristics", such as creativity, problem-solving, and mathematical prowess. Not everyone will profit equally from this, even though AI will accelerate economic development. Despite some potential drawbacks, such as probable job losses, fears, and dehumanisation concerns, there is little proof that AI can genuinely replace people or take over control of the world. Because AI is the core component of computer learning, it is vital for the future of humanity.

Regarding the observations that highlight the potential directions for further research in this field and possible applications for the information provided in this review, it is anticipated that AI will have a significant social impact on sustainable development, climate change, and environmental concerns. According to theory, the use of advanced sensors will result in cleaner, less polluted, and more liveable cities. Significant ethical questions that necessitate in-depth study include privacy and surveillance, biases, and the philosophical conundrum of the function of human judgment.

Author statement

We thank the editor for giving us a chance to revise this paper. We also thank both reviewers for their pertinent comments that will help improve the strength of the paper.

Please find below answers to your queries that are also embedded in the manuscript in red.

Overview: Summary of changes, fresh data, and completed necessary analyses:

The authors have carefully read the comments and have made every effort to respond to each and every point. They took care to ensure that the results they reported were valid and backed up by scholarly work.

The introduction of two sections on research methodology and data collecting as well as defining the study's major problem are the main improvements made to fill in any gaps. Carefully addressing the issues of the Paper's extensiveness and preserving readability and flow represents another significant advance.

Data availability

The authors do not have permission to share data.

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