

Review article

MANAGERIAL FUTURE OF THE ARTIFICIAL INTELLIGENCE

Iryna Nyenno, Vyacheslav Truba, and Liudmyla Tokarchuk

Abstract. The developed concept for Artificial Intelligence (AI) introduction to the management system is concerned with a range of ethical, social, environmental and legal issues. Management system as a form of organising chaos and complexity becomes the only platform to design business and to make it sustainable irrespective of location and personalities engaged. At the time of the world economy demand for social actors, activism in the necessary transition of management oriented to reach the Sustainable Development Goals (SDG) is a crucial factor to form the new management digitized system. Environmental, Social and Governance (ESG) Investing managed assets as a part of all corporate assets. ESG initiative was a proposal of the UN to promote principles for a sustainable economy. Companies with better ESG performance can increase shareholders' value by managing risks related to emerging ESG issues, namely bring the corporation to have energy transition experience. Different approaches of millennials to managing enterprises show their higher interest than that of predecessors to introduce ESG standards and tasks to the day-to-day management. Millennials are more interested in social values than in the investment return. Even the future of investments is dependent on the basic idea that investors are not short-termist but tend to be loyal to a project about which they have more relevant information. So, they may support new AI-based management in the case it becomes an efficient platform to design a human-oriented enterprise. This study aims at showing what the relationship of the management structure and process should be in order to manage the AI progress. Understanding of management content and work with the AI representation is of strategic importance.

Keywords: management, artificial intelligence, AI, ethics, AI personality, managerial work.

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1. Introduction

Since 1990s certain studies [1] have already demonstrated that in order to have innovative progress the decision power should be transferred to those who have a direct access to knowledge, which will help to settle the conflict of real and formal authority.

The AI active participation initiates the additional responsibility of management on the one hand and connected legal risks to proof the security of this kind of interaction. This kind of automatization is known to require smart systems monitoring to recognize an unsecure situation and threats to an enterprise. The design of the human-AI interaction has to be technically possible, economically reasonable and legally protected in view of human rights. So, to prove the reliability of their interaction it should be considered from the stakeholders' perspective satisfying the main questions:

1. What is the managerial work like while interacting with AI?
2. What is legally acceptable while interacting with AI?

However, the following concerns can be framed: What precautions can a manager take to avoid the "socialization damage"? What precautions can the manager take to meet the ethical aspects of management when certain functions are automated and decrease security of each personality in a company? What precautions can be taken to guarantee legal rights of the safe personal state of the staff for a company to remain human-centred? This framework is even more influential taking into account the fact that from the technical point of view automated systems, including AI robotization, are presented being already able to handle autonomously a wide range of tasks. It can be named the replacement of a human being but does not this replacement mean the same as delegation? Risk management in this sense should directly influence the degree of safety efficiency under the impact of robots and AI drivers. In a technologically advanced society, risks and risky behaviour become an inevitable part of life. It is supposed that the transition from an authoritative style of management to a democratic one may influence collective participation in the decision-making process of a subject and object of management, including the roles of lawyers, engineers and psychologists in final solutions of a human-oriented technological enterprise [2–6]. Thus, different business-units need to cooperate closely and achieve successful results of a company. Given this, the context of Directives, Laws, Codes of conduct, corporate culture and standards are a mix of institutional environment [7–12] which defines the future behaviour of an AI-based enterprise. By this, the hypothesis of this research is to make AI corporately responsible and manageable. The scope of responsibility nominations, namely visible through motto, internal documents, states of art, official webpages, intranet information systems, guidelines for future development, developers (innovators) themselves, other people's values, is ultimately rooted in the content of management.

The important legal point of the AI impact is that AI got a legal entity. The European Parliament in its resolution as of February 16, 2017 [13] fixed that AI may be related to the concept of the "legal status" of an electronic person. However, there are wide-ranging discussions that it is impossible from the technical, normative, and ethical point of view. The realist theory insists that AI entities exist regardless the existence of their legal personhood. The example of this legal feasibility is the availability of corporate legal personhood analogy. Autonomy, intelligence and awareness are the elements to receive the legal personhood. AI behaves

differently than software. It is self-learning; it sets goals, evaluates results and changes behaviour. On the other hand, recognition of AI as a legal entity should be supported with certain material assets. This limitation defines a still missing step for AI to become autonomous and to reach singularity.

2. Literature Review

The world progress is connected with industrial revolutions, namely the 4th Industrial Revolution presented “innovation” as a form and method of development. The impact of generating innovations by the responsible fiduciary delegated persons was considered by Dreyer, Goldberg and Schofield [14] in the context of the necessity to manage in the face of readiness to technological and ethical leadership. Some questions about the specificity of AI responsibility have been recently studied by [15–18], which deeply considered the issues of complexity to engage AI to strategic versus routine activity.

Haefner et al. [19] made a conclusion that AI impact can be observed in a form of augmented innovation of an enterprise and defined its role for certain stages of innovative management. Considering the overwhelming competitive advantage of the society’s creative population, such as artists, writers and inventors, there can be observed a definite interest in whether AI can be applicable in this area. Namely, the human-centred examples, where the people’s talents and unique approaches to creativity are actually irreplaceable, it is innovative management that comes to mind.

Human-organised innovation management is a source of new development initiatives for each company. And if at the beginning of fundamental AI management studies, it was argued by Simon [20] that AI is a way for “exploring the consequences of human behaviour alternative assumptions”, there are studies maintaining that AI augments organizational innovation. The first stages of innovation management are namely idea generation and idea development. Accordingly, the main source of this opportunity is that technologically AI systems are designed so that they are trained by human AI experts. It is worth mentioning that usually managers’ judgement is complicated and needs participation of the whole team. The collaborative solutions perhaps may be a way of AI self-learning.

Zekos [21] stated that there is consequently developing consideration that AI and digitalised platforms, sooner or later, will become an important environment for the stakeholder’s management. The studies [22–32] provide evidence of the customer proactive role becoming the “prosumer” of the smart-energy consumption to reach SDG with the help of digital public good. Smart customers, as the stakeholders can be called, whose decision-making process is concerned with AI, may create certain digital jurisdiction, like an autonomous environment. It is as well important that this area will remain manageable and/or predictable.

Business Application for AI is considered by Chan et al. [33], who explain that the core business processes may be supported by AI application, where expert systems are upheld with the case-based reasoning and procedural content generation.

Winkle [34] stated that general motivation for introducing AI is very often related to management intention to reduce self-responsibility. Additionally, threats in the social cuts and

economic crisis escalate various legal court decisions concerned with inadequate social security systems of an enterprise and force top-managers to cover this damage financially. Thus, even an effect of the damage “socialization” occurs. Piñero et al [35] proposed to combine AI and project management training techniques in a certain ecosystem. And Patrignani, 2020, insists on the statement that Information and Communication technologies (ICT) should take into account three dimensions of social desirability, environmental sustainability, and ethical acceptability [36–47]. One of the earliest philosophers was Jonas [48], who proposed the imperative of responsibility as an approach to searching ethics in the technological age for human beings to survive, taking care for the planet and its future. Eichhorn and Towers [49] state that the organizational structure, competencies and responsibilities are defined by the tasks generation and consequently concentrating positions, definition of the level of centralization and decentralization with the monitoring system based on the balanced scorecard. Yet they are concerned more with economic efficiency rather than managerial. And talking about the macrolevel of management impact, the actual concern is provided in relation to Sustainable Development Goals concept. Mercier-Laurent and Kayakutlu [50] continue the series of workshops since 2012 dealing with Artificial Intelligence for knowledge management, energy, and sustainability where a plenty of practical solutions are presented, specifically in order to reach seventeen SDG. As mentioned by Czarnitzki and Carioli [51] highly innovative economies already face the scarcity of skills which is the greatest threat to the innovative projects. The solution to prevent this threat lays in the managerial perspective of creating the cooperative strategies with external partners to bridge the skills gap of the future employees. Thus, the main research questions of this article are:

- Will it be possible to harmonize ethical, legal and management performance under conditions of AI impact?
- What is the skills scarcity for AI to perform management work autonomously?

3. Artificial Intelligence Impact Evaluation

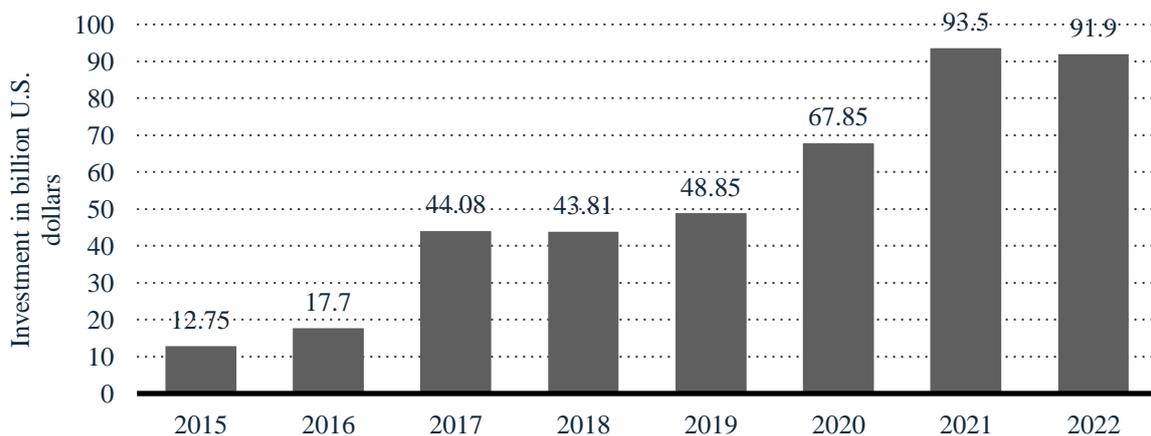
Artificial intelligence, once the subject of people’s imagination and the main plot of science fiction movies for decades, is no longer a piece of fiction but rather commonplace in people’s daily lives whether they realize it or not. AI refers to the ability of a computer or machine to imitate the capacities of the human brain, which often learns from previous experiences to understand and respond to language, decisions, and problems. These AI capabilities, such as computer vision and conversational interfaces, have become embedded throughout various industries’ standard business. Among the myriad processes that artificial intelligence (AI) capabilities are embedded in, the leading process is robotic process automation. Simply put, this is the process by which minor and repetitive parts of business functions are automated so as to not need a human worker to monitor them. Natural-language understanding and generation is also found in both speech and writing as businesses endeavour to improve their capacity to deal autonomously with customer requests. The least focused fields include more abstract AI use, such as transformative programs (Table 1).

Table 1. Primary artificial intelligence (AI) capability adaption rate in businesses globally in 2022, in %

Industry	Human resources	Manufacturing	Marketing & sales	Product/service development	Risk	Service operations	Strategy & corporate finance	Supply chain management
All industries	11	8	5	10	19	19	21	9
Business, legal, and professional services	11	10	9	8	16	20	19	12
Consumer goods/ retail	14	4	3	4	15	31	29	11
Financial services	1	8	7	31	17	24	23	2
Healthcare/ Pharma	15	7	2	4	22	12	8	8
High tech/telecom	6	6	4	7	38	21	25	8

Source: [52].

In 2022, the global total corporate investment in AI reached almost 92 billion U.S. dollars, a slight decrease from the previous year. In 2018, the yearly investment in AI saw a slight downturn, but that was only temporary. Private investments account for a bulk of total AI corporate investment. AI investment has increased more than sixfold since 2016, a staggering growth in any market. It is a testament to the importance of the development of AI around the world (Fig. 1).

**Figure 1.** Global total corporate artificial intelligence (AI) investment from 2015 to 2022 (in billion U.S. dollars)

Source: [53].

AI is actively applied for service operations and strategy and corporate finance, with nearly all industries reporting around 20 % usage of AI in these functions. The most considerable use of

AI in product making was in the financial services industry, with over 30 percent of respondents using AI in 2023. The use of AI in manufacturing and marketing is low, as these can require individual human instincts [54–58] and so lend themselves less easily to AI application and is summarised in Table 2.

Table 2. Artificial intelligence (AI) adoption worldwide 2022, by industry and function, %

#	AI capability	Rate
1	Robotic process automation	39
2	Computer vision	34
3	Natural-language text understanding	33
4	Virtual agents or conversational interfaces	33
5	Deep learning	30
6	Knowledge graphs	25
7	Recommender systems	25
8	Digital twins	24
9	Natural language speech understanding	23
10	Physical robotics	20
11	Reinforcement learning	20
12	Facial recognition	18
13	Natural language generation	18
14	Transfer learning	16
15	Generative adversarial networks (GAN)	11
16	Transformers	11

Source: [52].

Finding AI-related tech jobs has been especially complicated for AI data scientists. Last year, nearly 80 percent of respondents said their organisation found it very difficult or somewhat difficult to hire for such roles. Design specialists were among the least difficult to hire. This might stem from the fact that AI data scientists are a very specialized role while design specialists are a slightly more open-ended position, allowing for more applicants.

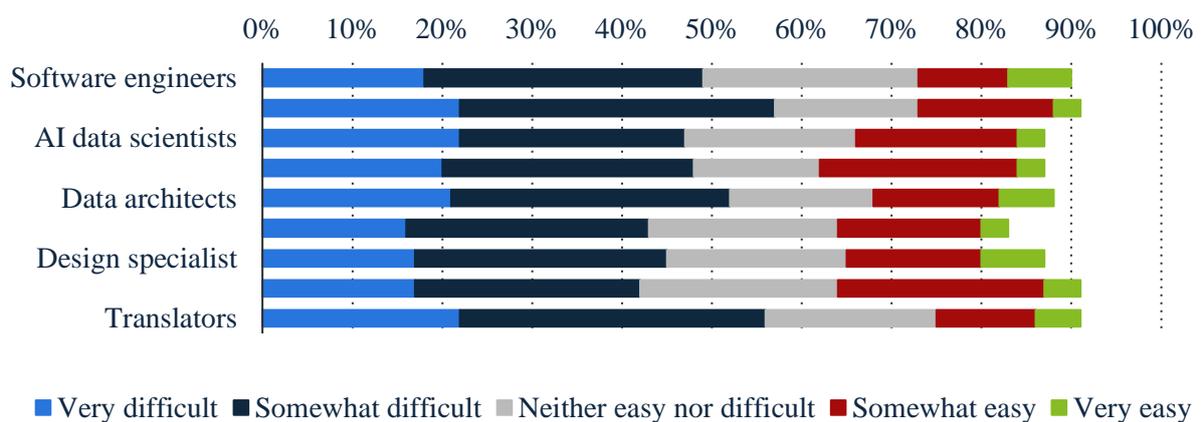


Figure 2. Perceived company difficulties in hiring artificial intelligence (AI) related roles worldwide from 2019 to 2022, by function.

Source: [59].

4. Results and Discussion

Considering AI definition or understanding [18], such tools should be listed as: machine learning, natural language processing and computer vision to implement human's ability to perform, cognize and sense the environment. Yet all these tools cannot work without relevant knowledge-based systems (also natural language processing), knowledge representation and media processing. So finally, the aim of AI is to use knowledge and experience and to provide solutions to the problems based on them [60–63]. AI impact can be visible in almost every industry and this is visible as well in existing and new business-models and influence the economic growth on macro and micro levels. Definitely, the main advantage and distinction of AI is that it follows self-learning model. Thus, the level of complexity is increasing from raw data finding to certain concepts, rules and even heuristic models. Comparison of this progress with management hierarchy demonstrates that the lower-level managers are working with raw data (field research), for the middle-managers it is necessary to use already generated reports in order to analyse them and to systematize. The top-management prerogative is generating strategy and policy.

By this there is a movement from a routine to structured environment with the ability for self-learning and forecasting. AI is considered to be a tool for increasing efficiency of problem solving. Previously the approach was different: systems were supportive, while at the moment, the potential of AI element is that of a player with certain autonomy impacts. This implies certain proactive behaviour and it is a part of the enterprise stakeholders relations. Besides, this is evidence of moving from system (strategic) thinking [64,65] to computational thinking. The core game-changers are as well the consumers engaged to customer personalization process. It is strictly related to provision of the General Data Protection Regulation [66].

Active use of digital platforms in the investment process is explained by the easier access to the venture funds through fintech services [21]. This makes the stakeholder's engagement easier. This way of decentralization impacts the ways an enterprise structures a management method. In the long-term perspective, this may be considered even as a firm governed by the algorithmic code. It is already in progress exemplified by the block-chain solutions of IBM and Northern Trust which allow collecting biometric information and creating the documents repository. Namely, Distribute Ledger Technologies may execute mechanically the limitations for actions caused by the internal and external regulations of a company.

Benkler [67] argues that “blockchain is considered as an opportunity to enable people to function together with the persistence and stability but without the hierarchy”. The principles of smart contracts on which the Distributed Autonomous Organizations are based is simple and transparent unlike traditional bureaucracy of a management system. Since 2016 certain AI-based application for the investment consulting can be observed, while the substitution of the board of Directors is something different. The Directors' level of multitasking can be comparatively less than those of managers. However, even the law gives minimum guidance on the role and tasks of managers. Talking about the “future management by a machine”, which AI role is realistic: assistant, advisory or autonomous? Independent decision-making should be based on an administrative and judgement role. In the future, it is obvious that an exclusive domain of AI will be the administrative work for scheduling, resource allocation, monitoring

and reporting. The definite gap for AI remains in motivating, understanding and interacting with human beings. The AI role can be named as a role of augmented intelligence.

The main legal issues which arise while implementing this future boil down to the following: Who will be legally responsible for the solutions caused by the unpredictable and AI behaviour? How to prevent the situation when a societal impact of AI will be more than human? And once again the answer is concerned with a value-based system of thinking encompassing morale, religion, and mentality.

As certain studies showed [34], people do not follow the code of practice guidelines and the check-lists just because they think of already existing internal experience and prefer working together with consultants than with AI because they find it is more efficient and easier. Thus, the AI engagement encounters a more user-friendly form of consultation headed by a responsible person. This team would give more practical applications and solutions with AI. It is called structured expert communication and is aimed at defining perspectives of staff like managers, engineers, lawyers and psychologists in the context of a company's sustainable development. The gap is more and more serious if the sustainability principles are not based on harmonized value system of individual employees. Each guideline application may occur in the case of the availability of each stakeholder's personal advantages. Many of them cannot see any value of AI introduction in their work and even can see threats and chaos from its impact. The old-fashioned way of adding the AI-based hierarchy cannot reflect the innovative approach either. However, structured expert guidelines meet the concept of human-oriented society and based on the Inner Development Goals (IDG) which mirror SDG principles. Thus, because of the staff values harmonization the company aimed to become an introducing force to achieve 17 Sustainable Development Goals (SDG).

At the same time, the increase of external innovative pressure of AI, which develops steadily and consistently, leads to a challenge of legal risks, ethics and AI uncontrollable progress. The necessary balance in decision-making process which allows reducing risks increases certainty and prevents the punishments because delegating liability to AI should form the final consulting concept of participative decision-making based on the technologies of digitalization and philosophy of human-centred society. Human-first approach opposite to state- or market-first is reflected in the European Declaration on Digital Rights and Principles [68]. Sustainability of the development is concentrated on the people at the centre, solidarity and inclusion, participation, safety and security, and freedom of choice. Chapter I puts people in the centre of digital transformation. Moreover, Chapter II emphasises that technologies should be used to unite, not to separate people, as well as improve their work-life balance and protect them from unjustified surveillance. Namely, freedom of choice is mentioned in Chapter III of the Declaration. AI is defined as a tool to improve our well-being, "taking measures to ensure that research in artificial intelligence respects the highest ethical standards and relevant EU law", while Chapter VI "Sustainability" assures that each digital product should be easily understandable regarding the information about environmental and social impact. Ethics and legal issues are sure to contain such core values as: Autonomy, Justice and Humanity values from the instrumental values. Technological innovations are not good for liveability and privacy. That is why recapitulation is so important, which means asking such responsible questions as: What is the hierarchy of values? What is the connection between values and human rights?

Mintzberg [69] proposed to consider five coordination mechanisms that mainly reveal the ways in which organizations may harmonise their activities:

1. Mutual agreement.
2. Direct control.
3. Standardisation of work processes.
4. Standardisation of output.
5. Standardisation of skills and knowledge (qualifications).

These mechanisms are implemented in the following way:

Agreement promotes work coordination through a simple process of informal communication. Upon mutual agreement, control over a work process is carried out by employees themselves. Because it involves a relatively simple mechanism, coordination is used in the simplest organizations.

Developing from the simplest form, an organization usually turns to the second coordination mechanism. Direct control promotes coordination because one person is entrusted with the responsibility for the work of other people, defining tasks for them and monitoring their actions. The work process can be coordinated and there is no mutual coordination of actions or direct control. It can be standardised when coordination is achieved at the development stage before the work process begins. The work process itself, its results, and the initial conditions – skills (and knowledge) of the people who perform it – can be planned so that they meet specified standards.

Standardisation of work processes involves precise definition (specification) or programming of the work content. When work results are specified, for example, product parameters or production rate, it is customary to talk about standardisation of output.

Standardisation of skills and knowledge (qualifications) means the exact definition of the level of employees' training necessary for participation in the labour process. At first glance, a person acts autonomously in his area (the performance of a good actor also gives an impression of complete improvisation). The same principle controls the work of AI. But in fact, if a manager has learned the roles by heart in advance, AI is not capable to do this. Therefore, the standardisation of skills indirectly contributes to the fact that standardisation of work processes or work results is achieved directly: it controls and coordinates a purposeful joint activity. The key to coordination is their standardised qualification. At the moment, the possibility to standardise AI operations, but not the qualification can be observed.

So, these coordination mechanisms were presented in a certain, very approximate order. As the organisation's activities become more complex, the choice of coordination means changes: from mutual agreement to direct control and standardisation of work processes (mainly), output or knowledge and skills, and finally to mutual agreement again.

In the case of individual work, there is no need for such mechanisms as coordination is carried out in the mind of a manager. But give a manager the help of the staff, and the situation will change significantly. People who work side by side in small groups adjust to each other, usually informally; for them, the most convenient form of coordination is mutual regulation, mutual

adjustment. However, as the number of group members increases, it becomes increasingly difficult to coordinate the work process in informal ways. There is a need for a leader. Control over the group activities passes to one person, as a result, again to one head who controls the others; direct control becomes an optimal coordination mechanism.

With the further complication of work, another stable tendency is manifested: towards standardisation. Solving simple and monotonous tasks, the organisation can rely on the standardisation of work by itself performed by AI (chat-bots as an example). But the need to perform more complex tasks forces an organisation to turn to the standardisation of output, that is, specification of work results, leaving the choice of a work process to an employee. On the other hand, it is often impossible to standardise the results of a very complex work, and then the organization turns to standardising the employees' qualifications. However, if the work divided into tasks cannot be standardized, it may be necessary to return to the simplest, but most convenient coordination mechanism: mutual agreement, after going through the entire cycle. As was noted, in extremely difficult situations, experienced managers get the job done with the help of informal communications.

Up to this point, it was assumed that, depending on the specific conditions, an organization makes a choice in favour of some coordination mechanism. It was also implied that all five mechanisms are, to some extent, interchangeable; an organization can move from one to another. But these assumptions do not mean that any organization can rely on a single coordination mechanism. In fact, all five are usually combined. Regardless of the degree of standardisation, a certain amount of direct control and mutual regulation is always required. Modern organizations simply cannot exist without a leader and informal communication, which are necessary at least to overcome the inelasticity of standardisation. While standardisation and even algorithmizing itself is successfully done by AI.

Mintzberg [69] identified a manager's ten roles, and within these ten roles he managed to accommodate quite a variety of managers' activities. He grouped them into three areas based on the following observation: whatever managers do, they are inevitably involved in one of three "things" – either decision-making, or information retrieval and processing, or interpersonal interaction.

Interpersonal roles:

1. A head is a formal leader of the organization or its units, represents them in both internal (within the organization) and external (outside) interactions.
2. A leader is an actual manager who inspires people and leads them to their intended goals, combining the needs of individuals and an organization.
3. A liaison provides and supports horizontal connections and interactions necessary for effective work.

Information roles:

1. A collector gathers and evaluates the necessary information about what is happening inside and outside an organization.
2. A distributor ensures information flows within the organization or divisions.

3. A representative transmits information to the boundaries of an organization or divisions in order to ensure effective interaction with the external environment.

Decision-making roles:

1. An initiator makes decisions about appropriate changes and ways of their implementation.
2. A troubleshooter allows for unforeseen problems and obstacles.
3. An allocator of resources makes decisions about distribution of resources, including time, money, people and equipment.
4. A negotiator conducts negotiations with the aim of effective decision-making taking into account different viewpoints.

All three categories of roles are always interconnected. Mintzberg's list helps to understand that certain types of activities that may seem like deviations from the real job of a manager are an integral part of that job. The time a manager spends attending a party with department employees, or the time spent attending meetings as a representative of the department, or the time spent communicating with other managers both inside and outside the organization – all this time, according to Mintzberg, cannot be considered separate from the main work. In each of these situations, the manager performs one of the management roles, i.e., does what must be done and must be done by a manager. At the same time, the ability to effectively plan and allocate one's time becomes especially important. In Table 3 there is a presentation of the role approach to management and the capability of human and AI to perform them autonomously.

Table 3. Artificial intelligence (AI) and Manager's autonomy: a comparative approach

Roles in Management	Roles in Management Work			
	AI capabilities are autonomous for implementation		Managerial capabilities are autonomous for implementation	
	Yes	No	Yes	No
Interpersonal roles				
Figurehead	<input type="checkbox"/>	+	+	<input type="checkbox"/>
Leader	<input type="checkbox"/>	+	+	<input type="checkbox"/>
Liaison	<input type="checkbox"/>	+	+	<input type="checkbox"/>
Information roles				
Collector	+	<input type="checkbox"/>	<input type="checkbox"/>	+
Distributor	+	<input type="checkbox"/>	<input type="checkbox"/>	+
Representative	<input type="checkbox"/>	+	+	<input type="checkbox"/>
Roles in decision-making				
Initiator	<input type="checkbox"/>	+	+	<input type="checkbox"/>
Troubleshooter	<input type="checkbox"/>	+	+	<input type="checkbox"/>
Resource allocator	+	<input type="checkbox"/>	<input type="checkbox"/>	+
Negotiator	<input type="checkbox"/>	+	+	<input type="checkbox"/>

Source: developed by the authors.

One of the factors that significantly affect the managerial performance is the type of work performed autonomously based on intuition and managerial skills. It can be noted that managers

performing completely different work have similar concerns, but still, the specific requirements and limitations associated with a specific position can both help and hinder the quality of managerial work. Thus, there must be considered the alternatives available to a manager because of the interaction with AI.

5. Conclusions

This article is an attempt to forecast the scarcity of AI capabilities to perform managerial work. It was based on the existing data of the width of AI application in different industries and business activities. The managerial work was presented through the roles approach by Mintzberg. This short material will be useful for a deeper understanding of the nature of a manager's work in the digitalization epoch. This research aimed to expand this understanding by providing an opportunity to compare managerial work content with AI application in business by offering theoretical approaches with the help of which the work performed and not performed by AI can be evaluated. The future outline of this study may lay in the definition of the content of computational thinking versus applied in management system or strategic thinking [64,65], where "computational thinking is solving problems in a systematized way with or without the help of computer tools". It is in line with the development by Senge's approach to understanding management [70]. He described the five managerial disciplines, which include systems thinking; personal mastery; self-management and personal development; mental models - common vision and team learning.

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