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Kubatko Oleksandr
Doctor of Economic Sciences, Professor,
Associate Professor of the Department of Economics, Entrepreneurship
and Business Administration,
Sumy State University
ORCID: https://orcid.org/0000-0001-6396-5772

Ozims Stanley
Student,
Sumy State University

Voronenko Viacheslav
PhD, Associate Professor,
Assistant of the Department of Economics, Entrepreneurship
and Business Administration,
Sumy State University
ORCID: https://orcid.org/0000-0002-0301-5924

Konovalenko Iryna
Student,
Sumy State University

Кубатко О.В., Озімс С.Ч., Вороненко В.І., Коноваленко І.С.
Сумський державний університет

ARTIFICIAL INTELLIGENCE FOR BUSINESS EFFICIENCY AND CIVIL DEFENCE FOSTERING[1]

In today's high-tech society, artificial intelligence technologies are used to increase the efficiency of business operations and facilitate the management of social and economic systems. In the conditions of unforeseen consequences of climate change and regional military conflicts, artificial intelligence technologies are becoming useful for improving civil security. This article explores using artificial intelligence technologies to improve economic efficiency and civil protection levels. Based on the VOSviewer bibliometric tool, the article highlights eight blocks of scientific research related to artificial intelligence and civil protection. The results prove that artificial intelligence, civil defence (along with risk management and preparedness) are separate building blocks for all other connections. As part of the empirical survey, it was found that there is no significant relationship between the integration of artificial intelligence and the accuracy of business decisions. Organisations may need to examine other factors contributing to the accuracy of business decisions, as AI integration alone may not be the deciding factor. Artificial intelligence can be used for civil protection purposes such as forecasting, warning, management of emergencies, and formation of an information base and emergency response scenarios. The article states that one of the advantages of using artificial intelligence is access to "big data" and the possibility of online analysis "in the cloud", forming almost instantaneous information support for management decisions. However, it should not be forgotten that all responsibility for using artificial intelligence technologies, including ethical components and related consequences, rests with the person. The principles of efficiency embedded in the technological aspects of the use of artificial intelligence may not coincide with universal human values, creating challenges and clear threats to the use of such technologies in social practice.

Key words: *artificial intelligence, economic efficiency, civil protection, decision-making, disruptive technologies, bibliometric analysis.*

JEL classification: O33

ШТУЧНИЙ ІНТЕЛЕКТ ДЛЯ ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ БІЗНЕСУ ТА ЦИВІЛЬНОГО ЗАХИСТУ

У сучасному високотехнологічному суспільстві технології штучного інтелекту використовуються для підвищення ефективності ведення бізнесу, полегшення управління соціально-економічними системами. В умовах непередбачених наслідків зміни клімату та регіональних військових конфліктів технології штучного інтелекту стають в нагоді для підвищення громадянської безпеки. Ця стаття має на меті дослідити використання технологій штучного інтелекту для підвищення економічної ефективності та підвищення рівнів цивільного захисту населення. На основі бібліометричного інструменту VOSviewer у статті виділено вісім блоків наукових досліджень, пов'язаних з категоріями штучного інтелекту та цивільного захисту. Результати доводять, що штучний інтелект і цивільний захист (разом з управлінням ризиками та готовністю) є окремими блоками, через які проходять усі інші зв'язки. У рамках емпіричного опитування було виявлено, що немає істотного зв'язку між інтеграцією штучного інтелекту та точністю бізнес-рішень. Організаціям може знадобитися вивчити інші фактори, які сприяють точності бізнес-рішень, оскільки сама по собі інтеграція ШІ може не бути вирішальним фактором. Штучний інтелект може бути використаний для таких цілей

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цивільного захисту, як: прогнозування, попередження, управління надзвичайними ситуаціями, формування інформаційної бази та сценаріїв реагування на надзвичайні ситуації. У статті зазначено, що однією з переваг використання штучного інтелекту є доступ до «великих даних» і можливість їх он-лайн аналізу «в хмарі», формуючи практично миттєву інформаційну підтримку для управлінських рішень. Однак не варто забувати, що вся відповідальність за використання технологій штучного інтелекту, включаючи етичні складові та пов'язанні наслідки лежить на людині. Принципи ефективності, що вбудовані в технологічні аспекти використання штучного інтелекту можуть не співпадати із загальнолюдськими цінностями, що створює не лише виклики, але і явні загрози використання таких технологій у суспільній практиці.

Ключові слова: *штучний інтелект, економічна ефективність, цивільний захист, прийняття рішень, проривні технології, бібліометричний аналіз.*

Statement of the problem. The introduction of disruptive technologies in production processes has an impact on everyday social life. Artificial intelligence technologies are used to improve business efficiency and increase productivity. However, not least, artificial intelligence technologies can play a role in the civil protection of the population, warning of possible threats and providing recommendations for solving critical situations. In the conditions of global and local challenges, which are the consequences of climate change and regional military conflicts, artificial intelligence technologies can help find safe places and minimise the consequences of being in places of increased danger. Access to geolocation for wearable devices, thus allowing artificial intelligence technologies to assess the situation, can have positive and negative consequences. That is why the study of the impact of artificial intelligence on both economic efficiency and the civil protection of the population remains an open scientific question. Through a comprehensive analysis, this research aims to contribute to understanding how businesses can use artificial intelligence to improve decision-making and civil protection.

Analysis of recent research and publications. As industries adapt to a digital era, integrating Artificial Intelligence (AI) into business processes has emerged as a transformative force (Wamba-Taguimdje et al., 2020). AI technologies, which include machine learning, digital processing of natural language, and the creation of predictive analytics, are changing traditional decision-making paradigms in business and social practice. (Cantu-Ortiz, 2021). This evolution prompts a critical examination of the intricate interplay between AI systems and the decision-making frameworks employed by businesses.

Businesses' perspectives on decision-making processes have completely changed due to the introduction of AI technologies (Stone et al., 2020). Historically, human intuition, prior experience, and limited available data have been the basis of decision-making. However, as analytical data increases, artificial intelligence technologies become more common. Businesses increasingly use big data analysis and algorithms to guide and improve decision-making (Gupta et al., 2023). This change is more than just technological; it represents a fundamental rethinking of the environment in which decisions are made, upending long-standing conventions and bringing opportunities and difficulties.

Gupta et al. (2023) claim that organisations can analyse enormous volumes of data with previously unheard-of speed and accuracy when artificial intelligence (AI) is used in decision-making. AI systems excel at extracting meaningful patterns and insights from complex datasets, providing decision-makers with a more comprehensive and accurate understanding of the business environment (Kumar, 2023). This capability fundamentally alters the decision-making dynamic, empowering organisations to make data-driven decisions that were once considered unattainable.

Moreover, one of the significant contributions of AI to business decision-making is its role in predictive analytics (Sarker, 2021). Bharatiya (2023) explained that using sophisticated algorithms, AI can analyse historical data, identify trends, and forecast future scenarios. This predictive capability enhances strategic planning and risk management, enabling businesses to proactively address challenges and capitalise on emerging opportunities (Sarker, 2021). Therefore, AI acts as a strategic partner, augmenting human decision-making by providing valuable foresight into the consequences of different choices.

Thus, this work examines the impact of artificial intelligence on business decision-making and improving the state of civil protection of the population. Thanks to the study of technical, strategic, and ethical aspects of using artificial intelligence, this work sets the general task of revealing the consequences of integrating artificial intelligence into business processes.

Objectives of the article. This article explores how enterprises can use artificial intelligence technologies to improve economic efficiency, focus on ethical considerations and increase the civil protection of the population.

Summary of the main results of the study. Business decision-making is a multifaceted process influenced by several factors spanning individual, organisational, environmental, and contextual dimensions (Zhou et al., 2019). These factors have provided insights into decision-makers complexities in various settings.

At the individual level, cognitive and psychological factors significantly impact decision-making. Wakker (2023) explained that the works on prospect theory have illuminated how individuals make decisions under conditions of uncertainty, highlighting the influence of cognitive biases. Individual decision-makers risk attitudes, cognitive styles, and emotional states contribute to the complexity of the decision-making process (Banerji et al., 2020). Understanding how these individual factors come into play is crucial for comprehending decision-making outcomes in business.

Joseph and Gaba (2020) opined that organisational structures, cultures, and processes are pivotal in shaping business decisions. The concept of bounded rationality, introduced by Shannon et al. (2019), underscores the limitations individuals face in processing information, emphasising the role of organisations in structuring decision-making. Research by Sutcliffe and McNamara (2001) further explores how organisational routines and procedures influence decision-making processes. The organisational context, including power dynamics and communication channels, contributes to the complexity of

decision-making (Joseph and Gaba, 2020). Organisations need to consider these factors to optimise decision-making processes.

Ashill and Jobber (2014) explained that the external environment significantly affects business decision-making. Pfeffer and Salancik (1978) emphasised how organisations rely on their external environment and how resource constraints affect decisions. The decision-making environment is shaped by industry-specific factors, including market developments, regulatory changes, and technological advancements (Liu et al., 2015). Decision-makers must navigate the dynamic interplay between internal organisational factors and external influences to make informed and adaptive choices.

Technological developments have changed the information landscape and affected how firms collect, handle, and apply information to make decisions. Davenport and Harris (2010) highlighted the importance of data analytics and real-time information in discussing how information technology affects decision-making. The emergence of big data, machine learning, and artificial intelligence technologies has presented decision-makers with new opportunities and difficulties (Green et al., 2018). Organisations must adjust to the rapidly evolving technology landscape to correctly use these technologies.

Human factors, such as interpersonal relationships, collaboration, and leadership styles, contribute significantly to organisational decision-making (Abubakar et al., 2019). Additionally, cultural factors are crucial in shaping decision-making preferences and styles across different regions and industries (Pfeffer and Salancik, 2015). Understanding and navigating these human and cultural dimensions are essential for effective decision-making, especially in globalised business environments.

To evaluate the bibliometric relations between the concepts of artificial intelligence and civil defence, we used the Scopus adatabase, which contains scientific articles and materials from conferences about the study. The period of 2010-2023 was chosen for the study since artificial intelligence has already begun to be widely used in industrial, technological, and social processes in the last twenty years. Filters were set for the research on the keywords artificial intelligence (AI) and civil. As a result, 209 publications were selected. Using the bibliometric tool VOSviewer, eight blocks of scientific research related to artificial intelligence and civil defence were identified.

However, after conducting a deeper formal and logical analysis, individual blocks can be combined into one common group. Although the blue and purple blocks are formally independent, they form a group of networks and databases that are essentially similar. Artificial intelligence, civil defense (along with risk management and preparedness) are separate blocks through which all other connections pass. The last group includes decision support and decision-making systems (Figure 1).

Saha et al. (2023) also explained that infusing AI into decision-making processes introduces ethical considerations that demand meticulous scrutiny. AI systems, when trained on biased datasets, have the potential to perpetuate and even exacerbate existing biases (Rodgers et al., 2023). Therefore, this raises concerns about fairness and equity in decision outcomes, mainly when AI is employed in critical areas such as hiring, finance, and healthcare. The ethical implications of biased decision-making impact individuals and have broader societal consequences, necessitating an understanding of how AI can be ethically integrated into business decision-making frameworks. Lockey et al. (2021) also explained that reliance on AI introduces new dimensions of risk, particularly concerning the security of AI systems and the data they process. AI is becoming more and more prone to cyberattacks as it advances in sophistication. Maintaining the integrity and dependability of decision-making processes depends critically on AI systems' cybersecurity.

The advent of AI has given rise to predictive analytics as a cornerstone of strategic planning. Organisations can anticipate future trends and potential challenges by leveraging historical data and employing algorithms to identify patterns (Lockey et al., 2021). This predictive capability enhances the strategic foresight of decision-makers, enabling proactive responses to market shifts, customer preferences, and competitive landscapes

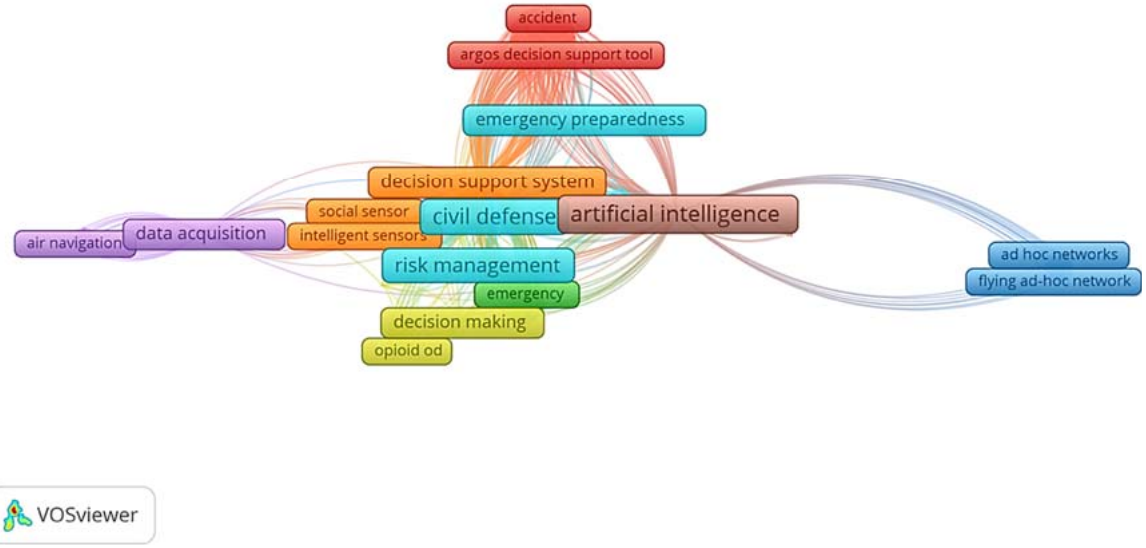

Figure 1. Bibliometric analysis of the relationships between artificial intelligence concepts and civil protection

(Kumar et al., 2018). As a result, AI serves as a strategic ally, contributing to developing agile and responsive business strategies.

As organisations navigate the integration of AI into decision-making, understanding the dynamics of human-AI collaboration becomes paramount. Olan et al. (2022) argue that effective collaboration involves complementing the strengths of AI with human expertise, emphasising the importance of maintaining a balance between technical precision and human intuition. Studies suggest successful integration hinges on fostering a collaborative culture, where human decision-makers actively engage with AI-generated insights, leveraging their interpretative skills to extract meaningful implications (Olan et al., 2022).

The adoption of AI in business decision-making has its challenges. Research by Rodgers et al. (2023) identifies technical, organisational, and cultural barriers to implementation. Technical challenges include integrating AI systems with existing infrastructure, data quality issues, and the need for specialised expertise.

From the point of view of the relevance of the research, it is precisely after COVID-19 that the interest of scientists in assessing the interactions between artificial intelligence and civil defence has increased (Figure 2).

Furthermore, the research conducted by Saadatmanesh (2023) showcases the transformative ability of AI-powered models to enhance stakeholders in making business decisions to predict market trends, respond to dynamic business environments, and optimise resource allocation. According to Stone et al. (2020), the advent of AI has emphasised the importance of predictive analytics and forecasting as a critical component of business decision-making. However, the study of Chintalapati and Pandey (2022) explores the impact of AI on marketing analytics. The study highlighted the role of AI in personalised marketing strategies and campaign optimisation. Also, Rodgers et al. (2023) applied AI models in the human resources decision-making process. The study investigated HR practices and how AI supports talent acquisition, performance evaluation, and work planning. The survey of Mohapatra et al. (2022) also showcases the impact of AI on decision-making in the manufacturing industry. The study investigates the manufacturing sector and explores how AI technology can contribute to process control, quality assurance, and safety management. Moreover, Gupta et al., (2023), show the influence of AI-drive automation on the optimisation of operational decisions.

The integration of AI in business decision-making cannot be overemphasised. Zekos and Zekos (2021) explained that AI has become a reliable instrument in risk management. Belhadi et al. (2022) analysed how AI algorithms can use historical data to identify and mitigate risks, contributing to more resilient and adaptive decision processes and business operations. The study of Wong et al. (2022) also examines the influence of AI technology in managing risk within the manufacturing sectors, thereby showcasing how machine learning contributes to proactive decision-making measures.

Sharma et al. (2022) explore the use of AI in retail decision-making, while the research of Belhadi et al. (2022) gives insights into how AI has impacted the decision-making supply chain and logistic planning. According to Baryannis et al. (2019), AI applications in the supply chain have led to optimising logistics, demanding forecasting, and risk management. However, there is more rapidly evolving research on understanding the impact of AI on decision-making, emerging technologies, industrial applications, and socioeconomic life. The transformative effect of AI on contemporary business decision-making provides a foundation for future research for businesses navigating the use of AI-driven decisions.

A stratified random sampling technique ensured representation from various industries and organisational sizes. The target sample size is 20 professionals involved in managerial decision-making roles. Purposive sampling was used to select participants for in-depth interviews. Approximately 5-10 professionals with diverse experiences in AI-driven decision-making were invited for interviews.

The Hypothesis is to determine if the integration of AI depends on the accuracy of business decisions. Tables 5 and 6 give the results of the contingency Table and the chi-square test, respectively:

H_0: The Accuracy of business decisions does not depend on integrating AI.

H_1: The Accuracy of business decisions depends on the integration of AI.

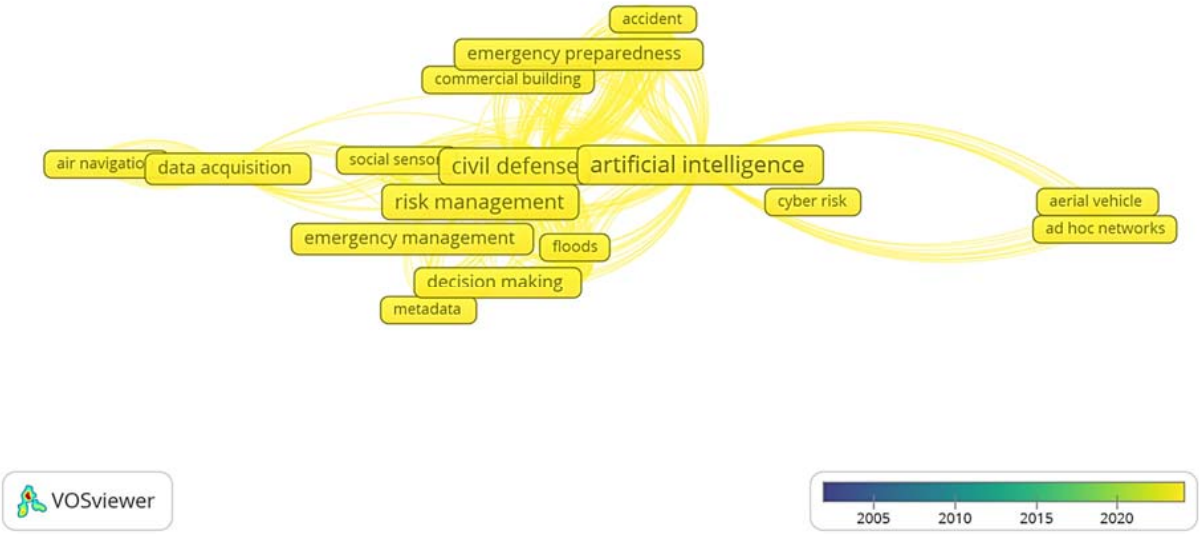

Figure 2. Time periodisation of research on the relationship between artificial intelligence and civil defence

Table 1

Contingency table of participants for in-depth interviews

		AI Integration			Total
		No	Yes	Not sure	
Accuracy of business decision	Slightly contribute	1	0	0	1
	Neutral	2	4	1	7
	Moderately contributes	2	8	3	13
	Strongly contributes	0	7	1	8
Total		5	19	5	29

Table 1 shows the distribution of respondents based on both AI integration (No, Yes, Not sure) and the perceived accuracy of business decisions (Slightly contribute, Neutral, Moderately contribute, Strongly contribute).

The chi-square Table 2 shows that the P-value of 0.252 is greater than the significance level of 0.05. We fail to reject the null hypothesis since the P-value is at least 0.05. There is insufficient evidence to suggest that the integration of AI significantly depends on the accuracy of business decisions.

Table 2

Chi-square table stratified random sampling technique

	Value	df	P-value
Pearson Chi-Square	7.819	6	0.252
N of Valid Cases	29		

The lack of a significant relationship between AI integration and the accuracy of business decisions suggests that, based on the current data, the two variables are not strongly associated. This suggests that organizations may need to consider other factors influencing decision accuracy beyond the integration of AI.

AI has great potential to solve/ mitigate major societal challenges including demographic change, civil security of citizens (Table 3).

The proliferation of artificial intelligence technologies for civil sector systems is attracting the attention of security and ethics scholars. Following the publication of the Trustworthy AI ethical guidelines by the European Union, regulatory issues regarding the application of AI have been critically evaluated (Schmid, Riebe, 2022). The moral side of using artificial intelligence is important since it

Table 3

Samples of AI application for civil defense*

№	Sphere of AI application	Name of the project	Key feature of the project
1	Disaster management	AIFER	The system uses artificial intelligence to record and evaluate the situation based on the example of a flood scenario. Different data from satellites, aeroplanes, and drones, as well as data from social networks, will be evaluated, summarized, and processed in real time.
2	Internet and cyber sucurity	FAKE-ID	To investigate possible attacks and forgeries of images and videos and to develop a software platform for their detection using artificial intelligence. The result will be a system that can analyse image and video data streams in real time and detect fake or forged material.
3	Detection of crime	KISTRA	To investigate the framework conditions for the ethically and legally justifiable use of artificial intelligence by investigative authorities for the detection, prevention, and prosecution of criminal offences. To this end, various AI methods for processing data that can be adapted as needed are being developed.
4	VR tactics training for police forces	KITE	AI-supported VR simulator is being developed for the training of emergency forces. With it, the training environments can be automatically transferred to VR as 3D models and a wide variety of deployment scenarios can be quickly integrated.
5	Security of tunnels and tunnel control centers	KITT	Research is being carried out to detect hazardous situations in tunnels at an early stage and adjust the flow of traffic in real time.
6	Flood warning	KIWA	AI-based tools for flood warning are being developed and tested. Machine learning-based modelling of precipitation-runoff processes in the field should enable rapid conversion of meteorological forecasts into expected runoff volumes.
7	Warning system for heavy rain and urban flash floods	KIWaSuS	To extend the locally accurate forecast period of local flooding to up to two hours in the event of a storm.
8	Fraud and corruption in the health sector	Criminal Networks	This arouses criminal covetousness: It is estimated that billing fraud and corruption in the health care system damage the social system by 14 billion euros annually. However, not only financial damage occurs because patients do not receive the services they need due to billing fraud.
9	Rescue missions	UAV-Rescue	In the UAV-Rescue project, an autonomously deployable unmanned reconnaissance system (UAV) is the main research focus area. The system will be deployed in severely damaged buildings or tunnels to create a complete three-dimensional map of the building interior in real time using artificial intelligence and to detect possible signs of life.

**The table built by authors based on "Artificial Intelligence in Civil Security Research" (Federal Ministry, 2024)*

will help minimise the risks of uncontrolled decisions and reduce expected losses in those processes where artificial intelligence is determined for optimisation.

Decision-makers must precisely know the scenarios under which artificial intelligence technologies work to be able to predict their operation. Assistance in decisions and support of the local population must be timely during a disaster or force majeure. Artificial intelligence technologies can most quickly fill this niche. Machine recognition of objects is relevant for improving drone flights (including at night) and assisting night and day operations.

Using weather data and forecasting weather conditions by artificial intelligence in a specific area will contribute to effective information for the population about risks before and during expected heavy rains, tornadoes, or other critical weather conditions. The latter makes it possible to carry out reconnaissance activities in difficult weather conditions.

Conclusions. The study conducted a comprehensive analysis to investigate the perceptions and experiences of individuals regarding integrating artificial intelligence (AI) in business decision-making. The study detailed how the accuracy of business decisions depends on integrating AI. Within the sole specific case, it was found that there is no significant relationship between AI integration and the accuracy of business decisions, suggesting that, based on the current data, the two variables are not strongly associated. Organisations may need to explore other factors that contribute to the accuracy of business decisions, as more than the integration of AI is needed.

Civil protection systems usually work to prepare and coordinate decisions to protect the population at risk. These tasks must be carried out in "peacetime", conducting risk forecasting and during military operations or natural disasters. Artificial intelligence can be used for civil protection purposes such as forecasting, prevention, management of emergencies, and emergency response phases. One of the advantages of artificial intelligence is access to big data and the ability to analyse it "in the cloud", which creates almost instantaneous information support for making effective decisions. However, it should not be forgotten that all responsibility for using artificial intelligence technologies lies with the person. Software learning algorithms and decision-making criteria are listed as input data for creating artificial intelligence technologies.

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