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TIME MANAGEMENT AUTOMATION IN ENTERPRISES: THE ROLE OF ARTIFICIAL INTELLIGENCE

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АВТОМАТИЗАЦІЯ ТАЙМ-МЕНЕДЖМЕНТУ НА ПІДПРИЄМСТВАХ: РОЛЬ ШТУЧНОГО ІНТЕЛЕКТУ

This article examines the issue of automating time management in companies using artificial intelligence (AI) and analyzing its impact on enterprise efficiency and labor productivity. We draw attention to the fact that in today's competitive environment, traditional approaches to time management are outdated and do not correspond to the realities of a modern enterprise, which values speed and flexibility of decision-making. The integration and use of AI in time management provides new opportunities for optimizing and automating routine tasks and analyzing large volumes of data, which in turn allows employees and managers to focus on the strategic goals of the enterprise. Thus, the use of artificial intelligence contributes to increasing the efficiency and accuracy of time management processes, which is a determining factor in the successful operation of enterprises in modern conditions.

In our research, we analyzed the use of artificial intelligence in various industries such as: information technology, retail, energy and finance. An electronic survey of enterprise managers in the Lviv region showed that artificial intelligence is most often used in the information technology sector. Also in our questionnaire, the respondents had to determine which software based on artificial intelligence they use, Clockwise became such software, thanks to the possibility of automation and optimization of planning, which makes it possible to quickly and flexibly make strategically important decisions. In our opinion, the results of our research show the importance of using AI to optimize time management and improve enterprise productivity in various industries.

However, despite the advantages, the implementation of artificial intelligence is also associated with certain problems. These include high financial costs, ethical issues related to data privacy, and the need for staff training. In our opinion, in order to overcome these obstacles, it is necessary to develop the education system in Ukraine in order to train specialists who are able to effectively use new technologies.

We believe that further research should focus not only on solving the problems that companies face when implementing AI, but also on exploring new opportunities for integrating artificial intelligence into management and production processes.

У даній статті розглядається питання автоматизації управління часом у компаніях за допомогою використання штучного інтелекту (ШІ) та аналіз його впливу на ефективність підприємства та на продуктивність праці. Ми звертаємо увагу на те, що в сучасному конкурентному середовищі традиційні підходи до тайм-менеджменту застарівають і не відповідають реаліям сучасного підприємства в якому ціниться швидкість та гнучкість прийняття рішень. Інтеграція та використання ШІ в тайм-менеджменті надає нові можливості для оптимізації та автоматизації рутинних завдань та аналізу великих обсягів даних, що в свою чергу дозволяє працівникам та менеджерам зосереджуватися на стратегічних цілях підприємства. Таким чином, використання штучного інтелекту сприяє підвищенню ефективності та точності процесів управління часом, що є визначальним чинником успішної діяльності підприємств у сучасних умовах.

У проведеному нами дослідженні, ми проаналізували використання штучного інтелекту в різних галузях таких як: інформаційні технології, роздрібна торгівля, енергетика та фінанси. Електронне анкетування менеджерів підприємств Львівської області показало, що найчастіше використовують штучний інтелект в секторі інформаційних технологій. Також у нашому анкетуванні, респонденти повинні були визначити яке програмне забезпечення на базі штучного інтелекту вони використовують, таким програмним забезпеченням стало Clockwise, завдяки можливість автоматизації та оптимізації планування, що дає можливість швидко та гнучко приймати стратегічно важливі рішення. На нашу думку, результати нашого дослідження показують важливість використання ШІ для оптимізації тайм-менеджменту та підвищення продуктивності підприємства у різних галузях.

Однак, незважаючи на переваги, впровадження штучного інтелекту також пов'язане з певними проблемами. До них належить високі фінансові витрати, етичні питання, пов'язані з конфіденційністю даних, і необхідність підвищення кваліфікації персоналу. На нашу думку, для подолання цих перешкод

необхідно розвивати систему освіти в Україні, щоб готувати фахівців, здатних ефективно використовувати нові технології.

Ми вважаємо, що подальші дослідження мають бути зосереджені не лише на вирішенні проблем, з якими стикаються компанії при впровадженні ІІІ, а й на вивченні нових можливостей інтеграції штучного інтелекту в управлінські та виробничі процеси.

Keywords: *artificial intelligence, time management, time management automation, implementation of advanced technologies, automation, optimization, AI implementation.*

Ключові слова: *штучний інтелект, тайм-менеджмент, управління часом, впровадження новітніх технологій, автоматизація, оптимізація, впровадження штучного інтелекту.*

Statement of the problem. In the modern environment, where competition is increasing and data sets are increasing every day, effective time management at enterprises becomes one of the key components of their effective functioning. Time management is one of the most important elements of the organizational processes of enterprises, which determine the overall efficiency of the organization, the productivity of employees and the quality of the work performed. However, traditional approaches to time management are currently not relevant and do not meet modern needs, which require flexibility and speed in decisions.

Despite the wide use of artificial intelligence in all business processes of the enterprise, the question of its implementation in the time planning process has not yet been fully explored. This is caused primarily by a number of problems faced by managers during the implementation of AI in the time management of the enterprise. But it must be understood that the implementation of AI in the time management process is necessary in modern realities, despite all the obstacles. This is especially important for technological enterprises in the field of information technology, where speed and flexibility play an important role in achieving enterprise goals.

Our research is important and necessary today, because modern companies need innovative solutions to improve time management at enterprises in conditions of high competition and rapid scientific and technological changes.

The implementation of artificial intelligence in time management can be a key factor in achieving the strategic goals of the company, especially justified for technological enterprises in the information industry. Having studied this topic, it is possible to develop practical recommendations for overcoming existing barriers and creating new opportunities for increasing efficiency and optimizing work processes.

Analysis of recent research and publications. Studying foreign literature, we got acquainted with the opinions of scientists who made a significant contribution to the development of time management and research into the automation of processes at enterprises using artificial intelligence. In particular, David Allen [11] is the founder of the GTD (Getting Things Done) method, which became the basis of the modern approach to time management. Philippe Zeltzer [15], a French researcher, focuses on studying the impact of digital technologies on productivity. In his works, including articles, he explores the impact of digital tools on working time management and the implementation of automated solutions to support efficiency in the context of digital transformation. Thomas W. Malone [14] describes how artificial intelligence contributes to the creation of "smart teams" in enterprises, facilitating the management of tasks and communication between employees. One of the leading researchers in the field of artificial intelligence, Nick Bostrom [12], examines the impact of artificial intelligence on corporate automation. He describes the future possibilities of using artificial intelligence in business, including the automation of processes and decision-making, which can radically change approaches to time management.

The formulation of the objectives of the article is to investigate the role of artificial intelligence in automating time management in enterprises and analyze its impact on the efficiency and productivity of the enterprise.

Presentation of the main material. In the modern realities of the rapid development of scientific and technological progress, the introduction of the latest

technologies at the enterprise is an integral part of the organization's development strategy. One of these latest technologies is artificial intelligence, which increases the efficiency of management and production processes. One of the main aspects affected by the use of artificial intelligence is the time management of both company managers and ordinary employees. By automating routine tasks, analyzing large volumes of data in real time and optimizing work processes, artificial intelligence makes it possible to reduce time spent on operational tasks, which leads to increased employee efficiency and allows you to focus on the strategic goals of the enterprise.

Today, more and more enterprises are implementing artificial intelligence to optimize routine tasks and improve the time management of employees. This approach helps employees use their time more efficiently, resulting in increased productivity, reduced stress, and improved overall quality of work.

Now we will consider exactly how artificial intelligence helps in the process of managing one's own time [8; 10; 13]:

- schedule optimization. Artificial intelligence analyzes the user's schedule and uses this information to find free time for urgent matters or to efficiently allocate daily tasks. It allows users to balance work and personal life;

- automating routine tasks: AI enables efficient task management by automating routine tasks such as email processing and meeting scheduling. This reduces time spent on routine and repetitive tasks, allowing people to focus on more important things;

- productivity improvement. Optimization and automation of business processes with the help of artificial intelligence gives more time for strategic and creative tasks and self-development of personnel, which leads to increased efficiency.

Given the growing popularity and benefits of using artificial intelligence to improve time management, it is important to determine in which areas of business these technologies are used most often, for this we conducted a survey of enterprise managers in the Lviv region. The respondents were a number of senior and middle managers, who were asked to give their answers to the questions of the questionnaire developed by us (Fig. 1).

Now let's analyze the results of the survey of respondents. The answer to the question "What industry is your company focused on?" Does your company implement artificial intelligence in the management process or in business processes?" can be seen in Figure 1.

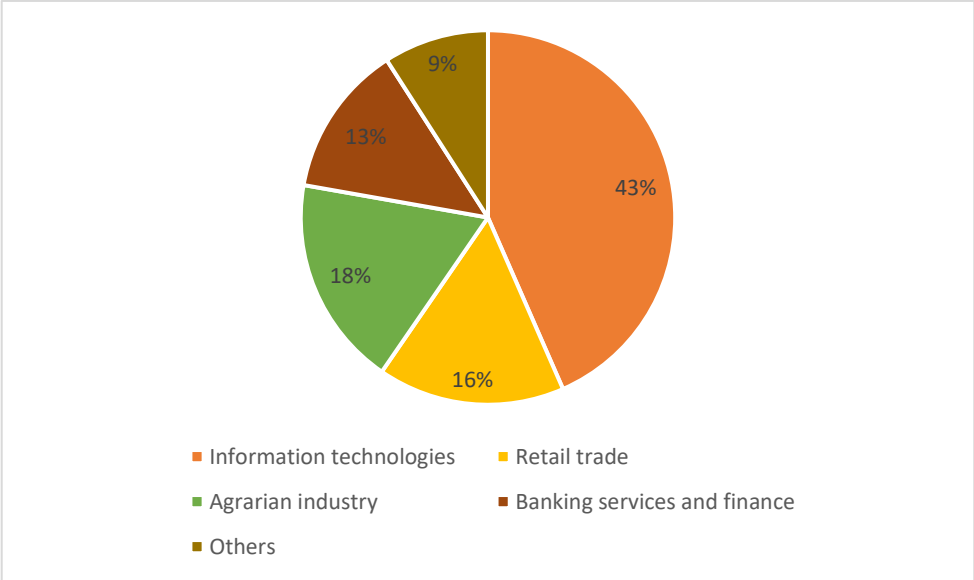


Fig 1. The results of the conducted survey regarding the implementation of artificial intelligence in enterprises of various spheres of activity

Figure 1 shows that the most AI is used in the information technology sector - 43%. This is due to the fact that this sector is closely related to innovation and technology, and therefore companies in this sector have many opportunities to exploit it and resources to optimize their operations.

In second place - the banking and financial sector has a share of 13%, which again reflects the important role of AI in this sector. Automating transactions, analyzing large volumes of data, and ensuring accuracy and security are critical. Overall, these figures reflect that the characteristics of each sector differ in terms of their ability and need to use artificial intelligence for time management.

The retail sector, where 16% of surveyed respondents use AI for time management. This is due to the need to manage large volumes of inventory, supply chains and interactions with customers, which requires the efficiency that artificial intelligence can provide.

18% of agricultural enterprises use artificial intelligence for time management. This is a very high figure, as process automation, efficient planning, infrastructure maintenance and resource management are critical for this sector.

The application of artificial intelligence varies greatly depending on the industry. Its most common use is information technology, where innovation and technology contribute to the implementation of new solutions to optimize operations. Retail is using artificial intelligence to manage large inventories and supply chains, which is essential to improve efficiency. In banking and finance, artificial intelligence plays a key role in automating and analyzing data, ensuring accuracy and security. The energy and utilities sector is also actively using AI to optimize infrastructure and resource management.

Next, we will look at examples of different companies and their experience in applying artificial intelligence for time management.

Table 1. Experience of companies using AI in time management

Company	Experience using AI in time management
Amazon	Amazon is actively using artificial intelligence to improve time management in logistics and warehousing. By optimizing delivery and inventory management processes, AI allows employees to focus on more important tasks. AI can also predict demand for goods, automate inventory management and determine optimal logistics routes. This not only shortens the time to complete tasks, but also significantly reduces logistics costs and improves overall work efficiency.
Microsoft	Microsoft uses artificial intelligence to improve its software such as Microsoft 365, adding more and more efficient features to reduce time consumption and work efficiently. For example, you can cite the built-in artificial intelligence in Word and Excel that helps with automatic data analysis and correction, which allows users not to spend a lot of time on these processes.
IBM	IBM is actively using its Watson platform to improve time management in organizations. Watson provides efficient natural language processing and large-scale data analysis, allowing the automation of many daily processes. This helps to significantly reduce document processing time and provides companies with analytical information for real-time decision-making. In addition, with chatbots, Watson helps optimize customer service and frees employees from repetitive tasks, allowing them to focus on more strategic goals.
Google	Google uses artificial intelligence to effectively manage search and advertising time. Artificial intelligence increases the accuracy of user searches and gives them quick access to the information they need. It can also be used to analyze user data to personalize advertising and make it more targeted. Using advertising in this way not only increases the effectiveness of advertising campaigns, but also saves users' time by offering them the most relevant products.

The source is formed on the basis [1; 6].

The examples listed above show the variety of ways artificial intelligence can be used for effective time management in a variety of industries. AI is used to improve time management through the automation and optimization of logistics processes, forecasting, document processing, advertising personalization, and improving the accuracy of search queries. This makes it possible to significantly reduce the time spent on routine tasks, facilitate interaction with clients and increase the efficiency of various business processes.

The next question of our research concerned which AI-based software the company uses for effective time management or to save time. The obtained results are depicted in Figure 2.

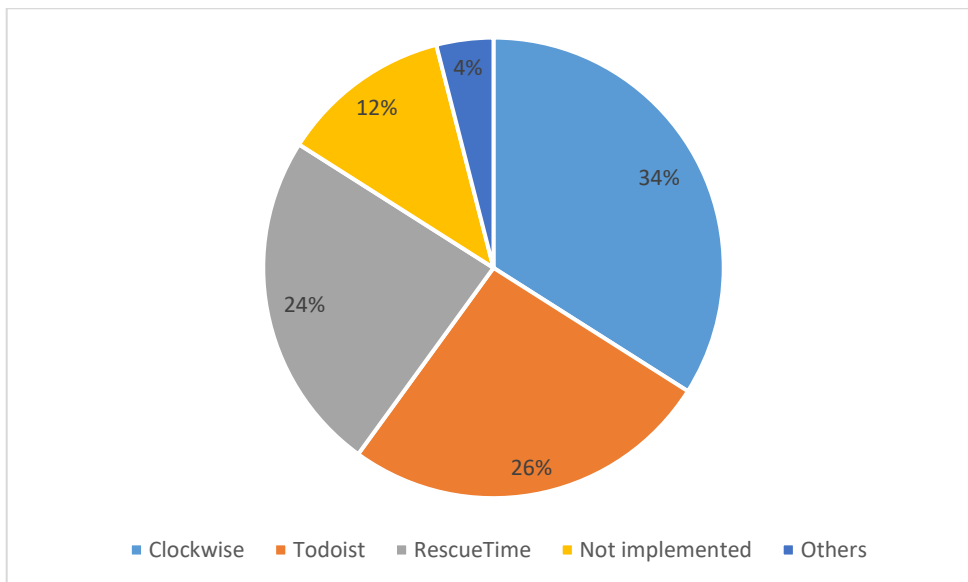


Fig 2. Results of a survey of AI-based software used to improve time management.

As you can see from our research, the largest percentage of respondents voted for Clockwise. This is due to the fact that this software makes it possible to automatically optimize the schedule of both an individual participant and a work group, which is extremely important for managers and freely balance between work tasks and meetings. Artificial intelligence in Clockwise allows you to free up time to focus on more important matters, allows you to systematize both your personal and team schedules. The large number of users among the surveyed enterprises can be explained by the fact that this software is universal both for individual users and for large groups, for example at enterprises.

In second place is Todoist, a software based on artificial intelligence, with 26% of respondents voting for this software. Todoist helps users to manage their task list more effectively, thanks to artificial intelligence, it makes personalized recommendations on what needs to be done first, based on previous tasks, which is important both for individual use and for collective tasks.

And the least number of percentages, namely 24%, respondents gave to the RescueTime software. This software ranked last in our survey because it focuses on individual performance control rather than team project management. For managers,

the priority is software that will be able to combine both personal productivity control of each employee and groups of employees during the performance of tasks.

However, it should be noted that while most businesses are already using AI to improve time management, 12% of respondents have not yet implemented such tools. We believe that companies that do not use AI software should consider integrating it into their workflows. Using such tools will improve time management, optimize resources and increase employee productivity. In today's world, automating work processes is an important factor in maintaining competitiveness, so we recommend implementing these technologies to achieve better results. Hence, AI-based software for effective time management is quite important in today's workflow management. Clockwise is the most popular among the managers of enterprises in the Lviv region that we interviewed, which indicates a tendency to use AI in the automation of planning processes, this makes it possible to significantly reduce the burden on employees and increase their efficiency.

Thus, it can be concluded that the effective use of AI in time management will lead to the integration of artificial intelligence capabilities into planning tools, which will increase the efficiency of employees and optimize the work process.

Despite the fact that artificial intelligence provides significant opportunities for time management, its implementation is accompanied by certain challenges and disadvantages that must be recognized and taken into account during implementation [8; 10; 13]:

Ethical problems. Although AI can help with time management, ethical dilemmas arise, such as privacy risks due to the processing of personal data. In addition, the algorithm may have errors that can make it difficult to make decisions such as time allocation or task completion.

It is quite difficult to introduce artificial intelligence into everyday work processes. For example, setting up time management tools takes a lot of time and affects the speed of strategic decision-making.

Using AI for time management can create security risks. Attackers can manipulate data or use vulnerabilities in the system, which can negatively affect time planning and lead to the loss of important information.

Also, in addition to the disadvantages and obstacles listed above, the respondents indicated which disadvantages they encountered during the implementation of artificial intelligence in time management. Most often, respondents, namely 58%, noted that the implementation of AI was accompanied by significant financial costs. Also, in addition to financial costs, the respondents also often (31%) noted the insufficient level of qualification and training of the company's employees and other reasons caused by the unpreparedness of the company and its staff to implement AI in the time management process. This study shows that employees of enterprises need to be prepared in advance for future changes in the enterprise, regardless of when they will be implemented.

But, in our opinion, the implementation of artificial intelligence in time management will be more justified than neglecting it. Although there may be some obstacles, the advantages provided by the integration of artificial intelligence far outweigh them. Thanks to these advantages, the enterprise will be able to manage time more effectively, which will allow it to achieve its goals faster.

In our opinion, in order to minimize the obstacles faced by managers during the implementation of artificial intelligence in time management, it is necessary to improve the current education system in higher education institutions of Ukraine. To date, the educational program of Ukrainian higher education institutions does not consider or superficially considers the issue of the use of artificial intelligence. That is why it is worth directing efforts to training specialists who will in the future work with artificial intelligence that will be integrated into time management. Such training will be able to increase the efficiency of the enterprise, at the expense of qualified employees who will be able to manage time more effectively with the help of AI.

Conclusions and prospects of further investigations in this direction. The use of artificial intelligence in time management has a number of advantages, such as optimization of work processes and processing of large volumes of data. These

technologies have a positive effect on the overall productivity of the company, as they automate many routine tasks and allow employees to focus on more important matters.

Our research showed that companies in the field of information technology most often integrate artificial intelligence into the process of time management, which is quite logical, because this industry is closely related to the latest technologies. The survey also shows which AI-based software managers use most often in their activities. The most popular program among respondents was Clockwise, which automates the planning of employees and departments and effectively affects time management. However, despite all its advantages, artificial intelligence also has its disadvantages, such as significant financial costs, ethical issues and data security risks, which in turn hinders the implementation of artificial intelligence. Also, all the problems listed above are exacerbated by the lack of qualified workers capable of working with artificial intelligence.

In our opinion, further research into the integration of artificial intelligence into the time management process should focus on finding ways to overcome the key obstacles that enterprise managers face when implementing AI. Also, special attention should be paid to data security and confidentiality. These aspects are becoming increasingly important in a world where information processing is increasingly digitized.

In addition, further research is needed to explore new possibilities of AI for optimization and automation not only in time management, but also in market analysis, strategic planning and customer interaction.

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