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ARTIFICIAL INTELLIGENCE IN PROJECTS MANAGEMENT

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Purpose: The article reviews the use and influence of artificial intelligence (AI) on projects management and resultant benefits. The effects of AI technology on the methods and tools of projects management were analysed. The AI challenges in projects management practice were tested.
Design/methodology/approach: Exploration of sources was carried out using the Desk Research method which belongs to the group of qualitative research methods and consists of analysis of existing materials such as documents, WWW pages and other archival sources.
Findings: During the works the areas of applications were analysed with challenges of using the AI in projects management. Besides, the use of selected tools based on artificial intelligence were suggested.
Originality/value: Identification of the areas using artificial intelligence in projects management and the resultant benefits, as well as the specification of challenges related to the AI in projects management and proposals to use the selected tools based on AI are the basic values of this article. It's addressed to those interested in modern project management methods.
Keywords: artificial intelligence, projects management, software based on artificial intelligence, virtual assistant.

1. Introduction

The projects management plays a crucial part in the functioning of modern enterprises and organisations. However, with the fast development of technology the traditional methods of projects management gradually revealed some flaws, such as a low efficiency and slow response. The artificial intelligence (AI) as a leader of the present technological development profoundly changes the way of activities of all branches, and the projects management is not an exception here (Wachnik, 2022).

According to the definition, the "artificial intelligence is the systems' ability to interpret the data from external sources" (Pałka, 2023). AI refers to the technology which enables the

computer systems to indicate human skills such as reasoning, learning, planning and creativity (Bento, Pereira, Gonalves et al., 2022).

Since the XXI century, with large data sets and processing in the cloud, the AI initiated a vehement increase and made great achievements in diagnosis of the picture, processing of the natural language, intelligent recommendations and so forth (Datta, Islam, Sobuz et al., 2024).

The artificial intelligence technology largely influenced the projects management. First, it may assure a much more accurate and faster data analysis and predictability, thereby assuring a more reliable support in the project decisions. Second, the AI technology may automate various aspects of project management, such as allocation of tasks, monitoring of progresses, identification of the risk, estimation and forecasting of costs etc. Such operations improve effectiveness and increase the project management precision.

Admittedly, owing to intelligent cooperation tools and platforms the AI technology facilitates the communication and cooperation between the teams, simultaneously enabling the work of inter-regional and intercultural project teams.

Importantly, the use of the AI technology may largely facilitate the project managers their coping with uncertainty and changes, thereby improving the project's adaptation and flexibility and increasing its chance for success and competitiveness (Bento, Pereira, Gonalves et al., 2022).

Gartner's studies indicate that till the year 2030 as many as 80% of the tasks connected with the project management will be carried out by artificial intelligence supported by large data sets, machine learning (ML) and processing of the natural language (Nieto-Rodriguez, Viana Vargas, 2023).

AI may analyse fast the large amounts of data from the market and supply the information about the trends and preferences of those clients whom we want to contact. Using the collected information the organisation may adjust its long-term strategy to current market requirements and forecast the future changes, which increases the chance of success around the large competition.

Included into artificial intelligence are the component elements shown in Table 1.

Table 1.
Components of artificial intelligence

Component	Characteristics of the component
Machine teaching	The AI branch where the programs and systems automatically modify their knowledge and procedures with the aim to improve the output; the machines follow the distinct instructions of the person who introduces the data, and before the task the device gets a lot of trial examples; due to education and analysis of the designs the artificial intelligence achieves the purpose posed by the person; this scope includes also the deep learning posed by the person; this scope includes also the deep learning – both supervised and non-supervised;
Natural Language Processing (NLP)	enables the computers to understand the human language and create it (creation of words or independent creation of new sentences by the machine) and manipulate it; NLP processes the input data containing the natural text and voice; it is used in the present virtual assistants (Siri, Alexa, Cortana) and in the written language and speech for all languages available for the program;

Expert systems	This is a collection of computer programs using the bases of knowledge and collected rules to solve the decision problems; the expert system reflects the processes of decision making by the human being specialised in a given domain; it has three characteristic features: knowledge bases, procedures and ability to extend the knowledge;
Processing of the picture	This is the area which is focussed on enabling the computers to identify and understand the data of the persons and objects according to the provided video pictures and films; in this case the processing of illustration allows to reply both to the human way of outlook and recognition;
Processing of speech	This scope includes the processing of speech into a text and vice versa; this technology allows to interpret the human speech while being an alternative for human interactions or for transcription purposes; the greatest use of this AI branch presently occurs in servicing a client in the vocal prediction systems;
Robotics	Artificial intelligence plays a key role in robotics in the context of designing, construction and programming of the robots; Robotics use many various technologies to form the systems which are able to program the physical tasks; AI enables the robots to process the sensory information, to learn, to take decisions and interactions with the environment.

Source: Own work based on: European Commission, 2019.

New types of AI appeared recently, including among others the generative artificial intelligence (Gen.AI). This is the type of AI earmarked for creating or producing of the new contents – for example pictures, music or a text - using specific algorithms and models based on self-education. The Gen.AI success depends on the degree of fulfilling the existing challenges within the data management, using such tools as DataOps[1], MLOps[2] (Patience, Bartley, Curtis et al., 2024).

Going into details of this subject the Author hopes to deliver valuable observations and practical guidelines for project managers to better cope with the possibilities and challenges of the AI age.

2. The use of artificial intelligence in projects management

2.1. Scheduling and planning of project works

Traditional planning of projects is usually based on experts' experience and historical data which are easily affected by various subjective factors and restrictions, which results in inaccurate or too conservative planning. The AI technology assures more precise and intelligent planning and scheduling of projects through a detailed analysis of a great deal of data and simulation algorithms. The planning tools based on artificial intelligence may identify fast the critical paths and points of risk in the project, optimize allocation of resources and scheduling of tasks, and improve efficiency and quality of the project accomplishment. Furthermore,

[1] It is a connection of DevOps and Data Science, which means that it is focussed on the process of fast delivery of data to application with a simultaneous improvement of their quality. DataOps is the use of more agile practices of data management with the aim to support the business results based on the data, simultaneously allowing to optimise the operations on the data.

[2] This is a connection of DevOps and machine learning. It focusses more than DevOps on the data and machine learning.

the AI technology may provide dynamic adjustments based on the data acquired at the actual time and advancement of the project realization aimed at the monitoring and forecasting of the project's progresses and costs at the actual time. AI helps the project managers to identify the problems and take activities at the right time so as to achieve better the project goals. Gen.AI may be used to simplify the exploration of historical data to help in the general planning and optimisation of the project. Emphasized should be the fact that the Gen.AI technology may be also used to generate a complex project documentation.

It is worth to pay attention to the project management tool called the Forecast. It uses the algorithms of machine teaching to forecast the time needed to finish the project. According to the historical data and valid indices of the project it is possible to generate the forecast related to the schedule and resources. This instrument helps the project teams in better planning and management of their work.

2.2. Estimation and prediction of costs

Using the AI in estimation and prediction of costs assures a higher accuracy and reliability in projects management. The traditional estimation of costs is usually based on the historical data and experts' evaluations which are easily affected by subjective factors and errors and this causes inaccurate estimation of costs. For their more precise estimation the artificial intelligence technology may discover some concealed correlations from mass data through a precise analysis of large data sets and algorithms of machine teaching (Głowasz, 2022). For instance the costs prediction models based on artificial intelligence may use historical project data and information about the costs at the actual time. Combined with complex algorithms to form forecasts they can estimate more precisely the costs of the project and help the project managers to take rational decisions. Gen.AI may be used to support the costs estimation, analysis of costs and benefits, to carry out an analysis of the worked out value and to identify some mitigating activities when the costs are exceeded.

The implementation of AI may be sometimes connected with high costs which depend on many factors. The organisations should calculate the costs of the purchase, implementation and training of employees and maintenance of the tools and systems based on the AI. Furthermore, it is worth to consider the technical and human resources to use the purchased systems effectively.

2.3. Management of the risk and support in decision-making

One of the most developed areas of the project management automation is the risk management. The machine teaching algorithms using the collected data about earlier projects are able to predict the potential risk and suggest possible effective activities excluding them, which allows for the current adjustment of the project to the changing conditions.

The algorithms contained in AI may analyse the data from various sources and using the expert systems they may help the project leaders to take the most accurate decisions. Such operations refer to every stage of the project work.

The use of the AI in the risk management and decision support assures a more comprehensive and effective solution for the projects management (Głowasz, 2022). The traditional management of the risk is often based on experts' experience and static models of risk evaluation, which hinders the comprehensive identification and response to the potential risk in the project. On the other hand the AI technology may carry out the analysis of large sets of data and use the algorithms of machine education to get out potential correlations and regularity of the risk factors from huge amounts of data in order to achieve a more precise and comprehensive identification and evaluation of risk. For example the risk management system based on artificial intelligence may dynamically monitor and analyse different risk factors in the project, predict possible risky events and help the project managers to formulate on time the precautionary measures to decrease the effects of risk on the project.

AI may analyse huge amounts of data from the market and deliver the information about the trends and preferences of the clients which we want to contact. Using the collected information the organisation may adjust its long-term strategy to the market's current needs and forecast the future changes, which increases the chance of success around a high competition.

2.4. Communication and cooperation in the project

The use of AI in communication and cooperation assures a more efficient and convenient way of work for the project teams. In the traditional project management the communication among the members of the team is often based on traditional methods, such as meetings and e-mails, which is connected with such problems as a low efficiency of communication and untimely transmission of information. The AI technology may assure communication and cooperation among the members of the team at the actual time, owing to intelligent tools and platforms for cooperation (Meharwade, Dsouza, Gupta et al., 2024; Wang, 2023). For example to improve the team's efficiency and synergy, the team cooperation platforms based on artificial intelligence may provide a live chat and documents online, assign the tasks and other functions which facilitate the team members a fast communication and cooperation at any place and time.

To use the AI virtues completely, the managers must develop some supplementary skills. They must redefine their role as the leaders in the organisation and focus on social and relational dimension of their work. Therefore, the managers should find new ways of holding the teams' leadership and management. Technical skills, emotional intelligence as well as the abilities of communication and listening become essential for managers. These skills are particularly important for the teams management in a very respectable, humanitarian and ethical manner, despite the increasing impact of the AI technology on the work environment (Wirtz, Weyerer, Geyer, 2019).

A new role in the projects management is that of the virtual assistants. The digital assistant learns according to earlier entries, data from the project design and general context to adjust the interactions and intelligently intercept the critical information about the project. Such assistant assures immediate revisions of the project status and helps the project manager to update the time and progress of the tasks through the text, voice or chat. Specialists of the projects may use a virtual assistant acting according to Gen. AI to supplement their own analyses or obtain the first working versions to be surveyed by experts. Examples of using a digital assistant include preparing the first version of the analysis of costs and benefits, carrying out a data analysis to be used in recommendation of a change of the scope, preparing a schedule and carrying out the risk analysis. The final result will (probably) require a moderate intervention on the part of an experienced professional to make sure that it is complete and precise (Pałka, 2023).

2.5. Management of quality and monitoring of quality

The use of AI in the management and monitoring of quality assures a more refined and automated tool for the quality management in projects. The artificial intelligence provides assistance in personalisation of project solutions considering individual needs and requirements of the principals. Such an approach translates into a higher satisfaction of the final customer and stakeholders owing to the provision of the higher quality solution.

Traditional management of quality is usually based on manual sampling and control, which is susceptible to the influence of human factors and a subjective evaluation and this results in omission of the data or incorrect evaluation of their quality. The AI technology may assure monitoring and forecasting of the quality of projects at the real time by intelligent tools and algorithms of the quality management. For example, while analysing a large amount of the project data and quality indicators, the quality management system may identify fast any possible problems and irregularities connected with the quality and also remind the project managers to start acting on time to dissolve them.

There are many tools based on the AI now which verify and improve the contents of the project documents, eliminating errors and inaccuracies and thereby improving the quality of the project documentation. Such use considerably confines the risk of defects in consecutive stages of the plan due to incorrect project documentation.

Artificial intelligence assures assistance in personalisation of the project solutions considering the principals' individual needs and requirements. Such an approach contributes to the final client's higher satisfaction resulting from supplying the product or service of a higher quality - which meets better the stakeholders' needs.

2.6. Allocation and optimisation of resources

The use of AI in allocation and optimisation of resources assures more efficient means of the management of resources. According to the collected data the applied algorithms may suggest to the project leaders an optimal (in specified conditions) assignment of resources for the project, which allows to reduce the costs and assure a more effective work of the project team.

The traditional allocation of resources is often based on the experience and the rules, which hinders a complete use of the potential of resources causing a wastage and ineffectiveness. Instead, the AI technology may achieve a dynamic implementation and optimisation of the project resources owing to an effective allocation of resources and algorithms of optimisation. For instance the resources management system based on artificial intelligence may allot and adjust the resources analysing in detail such factors as requirements of the project, the team members' skills and availability of resources in order to maximally fulfil the project requirements and improve the use of the resources.

Jira from Advanced Roadmaps for Jira uses AI in one of the most popular tools for projects management on the market. It enables a more effective allocation of resources in the projects, forecasting the dates of finishing the particular stages of accomplishment, and warns about the potential conflicts.

3. Challenges connected with the use of AI in the project management

The AI technology brings many merits to the projects management but its use is exposed to a number of challenges. The lack of the data is one of the basic challenges connected with the use of the AI in projects management where the project's leader should provide the system with an appropriate amount of the qualitative data for analysis. Many projects have difficulties in this area, which may result in a lower effectiveness of the AI activity and false results.

Table 2.
Challenges in the use of artificial intelligence in projects management

Challenge	Comments
Lack of the data of adequate quality; safety and protection of the data's privacy.	The artificial intelligence training needs a huge amount of the data and the real ones are expensive and more and more difficult to get; therefore the synthetic data are more and more important; these are artificially formed data which replicate the quality and statistical properties of the actual data but they do not contain any real information coming from the real people or the real sources; they are generated through modelling of statistical designs and properties of the data from the real world;
Lack of transparency in the algorithms of artificial intelligence	The lack of transparency in the algorithms action means that the users, decision makers, and the general society do not understand completely the processes of decision making by the AI; there is a need to form some mechanisms which would facilitate the understanding of the general decision process and possible evaluation whether or not the algorithms conform with the society's ethical values; while the artificial intelligence becomes more and more advanced it should enable people to understand how the machine teaching algorithms create the output data.

Cont. table 2.

The users' competences	The users basic competences include the basic knowledge on the AI and its applications, ability to use the AI tools and ability to understand and interpret the results generated by the AI systems; the artificial intelligence extorts a change and increased competences; new categories of IT specialists will be necessary, such as: specialists in machine learning, from python, and those experienced in working with libraries – data science and artificial intelligence.

Source: Own work.

Important challenges are also the problems with the quality of data and protection of privacy. The AI algorithms require a lot of data for their servicing but the quality and integrity of the data may be endangered, while the gathering and using of data may be associated with a decrease of privacy and some legal regulations. Using the AI within the projects management we should pay special attention to the safety and privacy of introduced initial data. Such information should be properly secured against a non-authorized access and possible infringements. Approximately 80% of the time spent on preparation of the ML algorithm is focussed on gathering and cleaning of the data which the algorithm collects while they are raw and not structuralised and transforms them into structuralised data which can train the machine learning model (Nieto-Rodriguez, Viana Vargas, 2023).

Another challenge is also the lack of the transparency of artificial intelligence algorithms. Some AI algorithms act on complex principles which are difficult to understand and explain. This may contribute to limited trust and acceptance of the algorithms' results by the project managers and cause their limited use. According to the complicated algorithms, the systems based on artificial intelligence may undertake specified decisions which are difficult to understand by the employees. Organisations should work out the methods which decode the decisions made by the AI, both to understand the process and to fulfil appropriate regulatory requirements.

The use of the AI poses new requirements and introduces changes for the project managers and teams. The project managers must have an interdisciplinary knowledge and skills so as not only to understand the basic theories and methods of projects management but also to know the principles and use of the AI technology. Furthermore, the project managers must be able to take decisions based on the obtained data. The AI technology may assure a rich support of the data, but the project managers should be able to analyse and use such data so as to get out some valuable information and observations, assuring a scientific basis to take the project decisions. The use of the artificial intelligence will definitely change the traditional style of the project team's work and division of the roles. The members of the team must be flexible to adapt themselves to changes and to learn new skills for close cooperation with the AI technology. It is also important to consider the role played by the person in connection with taking the decision and supervising the projects where a considerable role is played by the algorithm. We can acknowledge that these aspects are connected with the teal management (Laloux, 2015).

The use of the software and instruments based on the AI and the degree of their use raises the issues of ethics and responsibility. Organisations should show more respect to ethical aspects of their use and select those responsible for the consequences of decisions and ways of using.

4. The projects management tools based on artificial intelligence

The development of the software for project management based on the AI became an important trend in the projects management area. The software functions of this type comprise an intelligent support of decisions, automated planning and scheduling as well as the monitoring and forecasting at the actual time. The intelligent function supporting the decisions provides the project managers with scientific bases of the decision making and suggestions through an analysis of large data sets and algorithms of machine teaching.

The function of automated planning and scheduling may – according to the project's requirements and resources - automatically optimise the projects plans and allotments of tasks and also improve the project's fulfilment efficiency. The function of monitoring and expectation will follow the project's progress, costs and quality at the real time by acquisition and analysis of data and expectation of possible problems and undertaking some operations in advance. Such software functions for the project management – based on the AI technology – enable a better adjustment to the complex and uncertain project management. With the continuous development of the AI technology, the project management software based on it will surely be more and more popular and will play a more and more important role in the projects management practice.

Presented below is the software useful in projects management and based on artificial intelligence:

- ChatGPT 4 – worked out by OpenAI; it makes available the API interface for other programs; advanced language model which can give answers, conduct conversations in a natural way and help to edit texts and project descriptions;
- WriteSonic – assists in creation of various contents from blog articles to advertisement contents, offering numerous hints and adaptations to different categories of contents;
- Eightify – abbreviates and sums up the contents of films from YouTube, which is an ideal solution for the fast acquisition of essential information;
- Gist/Claude – creates notes and elaborate summaries from the meetings; it is a useful tool for participants of the meetings;
- Otter AI – prepares the transcription of records and summaries in Microsoft Teams;
- Browse AI – enables the programming of the processor which collects the data from the defined web pages and monitors the changes on those pages;

- TogglTrack – enables the project teams to monitor and control the time devoted to specified tasks; it is used to trace the efficiency, allocation of resources and generation of the reports related to the use of time;
- Simplified – enables the teams' steady cooperation and presentation using the artificial intelligence;
- Compose AI – facilitates answering the emails;
- Eye Contact by NVIDIA – processes fast the picture from the internet camera which creates an impression that the user always looks into the lens instead of the screen of his monitor.

Modern platforms for projects management use more and more AI technology to assure more efficient solutions for project management. Intelligent functions of these platforms include intelligent planning of projects, prediction analysis, intelligent cooperation and automated reporting. The function of intelligent planning of projects uses the AI algorithms and analysis of large sets of data, which enables a fast identification of the critical paths and risk points in the project. The other benefits are the optimized allocation of resources and scheduling of tasks and improvement of efficiency and quality of the project realisation. The predictive analysis function – through the analysis of historical data and information at the real time may predict possible problems and trends in the projects.

5. Summimg up

One of the reasons of a failure to finish the projects successfully is the low level of the maturity of technologies used in the project management (Project Management Institute, 2023, 2024). Such situations may be changed radically owing to implementation of the AI technology. This technology is quite advantageous in projects management considering the increased effectiveness in decision making, optimised allocation of resources and increased possibilities of the risk management. Intelligent platforms and software for the project management provide the project managers with more complex and intelligent tools for management which are helpful in efficient use and successful accomplishment of the projects. Due to the introduced AI technology the project management may achieve automation in planning, completion, and monitoring.

According to 2024 Trends in Data, AI & Analytics, Gen.AI will play a key role in taking a decision based on the data. Gen.AI will be able to help the project managers through automatic generation of visualisation and a hint, thereby simplifying the task of the graphic presentation of analyses. The next area where the Gen.AI may generate benefits is the automated finding of anomalies and analysis of the source reasons. Gen.AI may show extreme values with the causes of their origin; otherwise the non-analysts would not be able to notice them. The next area in

which the Gen.AI will have a considerable influence on explanation of the results of analysis is that the text is generated in the natural language understood by laypersons.

Before the artificial intelligence in projects management there are also some sure challenges which should be continually investigated and solved. Such challenges are among other: the quality of data and non-transparent algorithms and users' competences. At the same time the use of AI also imposes some new requirements on project managers and teams which continually have to learn in order to cope with the changes and development within he project management area. We should also take into account the increased supply of electricity in connection with the AI systems.

Summing up, the impact of AI on project management contributes to an improvement of the management effectiveness, optimisation of the decision-making process, and facilitates the team work, which offers high guarantees of the project's success.

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