

Applied Methodological Essence of Project Management in Transport Through Artificial Intelligence

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Abstract. Modern transport projects are complex, multi-stage and long-term, associated with significant calculations, changing schedules, matching resources, analyzing different scenarios for their impact on the development of transport systems and infrastructure. These projects are implemented in a dynamic external environment with a great influence of rapidly changing political, social and natural factors. This objectively requires the application of flexibility in the planning and determination of the various options for development and the search for new approaches to managing transport projects and ensuring the necessary dynamics. Through the application of artificial intelligence, the flexibility in planning and implementation of these transport projects can be improved.

This article examines the possibility of using artificial intelligence in transport project management. More specifically, the methodological essence is emphasized from the point of view of using artificial intelligence in the design and implementation of these projects.

Keywords: Artificial intelligence, methodology, project management, transport projects.

I. INTRODUCTION

Project management in transport is a relatively new approach that is used in planning, construction, rehabilitation, investment, modernization and other activities. Projects in the transport sector can be for traffic management, improving infrastructure safety, building intelligent transport systems, building new infrastructure, etc. They are very diverse and unique to the particular case.

During the processes of design, implementation, commissioning and monitoring, modern information technologies are used in transport projects. However, these projects have seen a serious breach of deadlines, often quality. The causes leading to these violations are not the subject of this article.

Managing transport infrastructure in critical situations as a result of disasters also generates huge amounts of data. Building of an online disaster response system is described in [1].

The latest technology in the management of transport projects is the application of artificial intelligence (AI). Progress in the development of artificial intelligence in the last 3 years has entered the field of project management and at a slower pace in the transport sector. Programmers have created numerous AI-based tools for project management in transport, most of which are cloud solutions. This makes them accessible from anywhere if there is internet. The use of transport project management tools allows large volumes of data to be processed to optimize project planning, implementation and monitoring processes. Many tasks can also be automated, which would reduce the time for the realization of the project and optimize the budget. With these tools, forecasts and scenarios can be generated, thus reducing risk. While transport project management tools may be in the early stages of development, they can be used to reduce costs and increase team communication [2], [3].

II. MATERIALS AND METHODS

In the scientific literature, many attempts can be found to define the concept of artificial intelligence (AI). According to which AI is a system of algorithms that mimic human intelligence to some extent and offer a course of action without being programmed to do so. AI is a program or algorithm that draws conclusions or predictions using a dataset [4].

AI works with huge data sets that are used for training or to solve specific problems. The data it uses can be structured and unstructured. Structured data is organized in tables, by rows and columns, while unstructured data is not organized (example: videos, images, and text).

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Synthetic data, which is artificially generated information when there are too few real-world data, are also used.

An AI model trained with large amounts of structured data is more accurate and efficient. It can be trained to perform one task, and then adapt to perform another task. The most used models are described in [5].

New types of AI are constantly being developed using new algorithms. AI finds application in new areas. Models are being developed which are a combination of two or more architectures. Figure 1 presents a summary of the types of AI by different indicators.

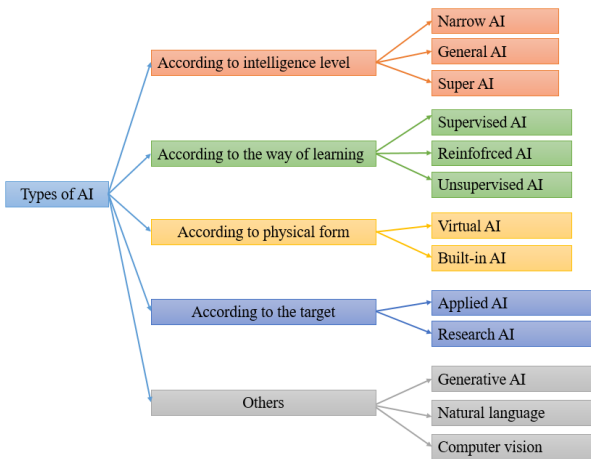


Fig. 1. Types of AI by different indicators.

Generative Artificial Intelligence is the most widely used as it is applicable in many fields and easy to use. From input data in the form of text, image, video or voice, generative AI creates new content. It can generate new project ideas and optimize existing ones [6].

In project management software, in addition to Generative AI, machine learning, natural language, computer vision and intelligent solutions are used to automate processes.

Machine learning based on historical data predicts project deadlines and costs, identifies potential risks, and sets personalized tasks. Computer vision finds application to analyse the progress of the project by using images.

Intelligent AI applications are used to automate tasks, support customers, and answer questions.

When developing the structure of a database, knowledge base, etc. parallel design technology is used. This technology provides a link between the current and transition stages [7].

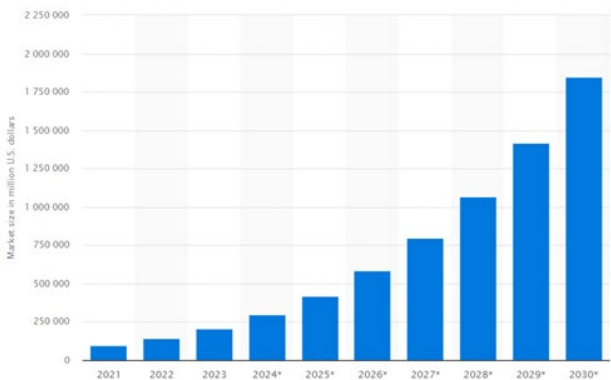


Fig. 2. Forecast for market growth for AI for the period 2021-2030 [8].

An indicator of the development and implementation of AI until 2030 is the forecast of a twenty-fold growth of the market (Figure 2). Everyone will accept and use AI in some way in business and personal life [8].

III. RESULTS AND DISCUSSION

Projects are unique ventures that are limited in terms of scope, time, budget. This makes them difficult to manage based on historical data from transitional projects, as no two projects are exactly the same. They can only be similar. The development of each project goes through seven phases: adoption, initiation, planning, product selection, implementation, monitoring and completion. With data accumulation, AI has the ability to analyze, reason, and solve problems. The quality of the solutions depends mostly on the amount of data available to the AI. It takes longer to build an infrastructure to collect and classify data to power the algorithm. From the main data source we get the collected raw data. Filtered and processed data are obtained from a secondary source. Data that are digital objects and can be reused to train AI are called digital assets [2], [9]. Data-driven project management is an approach that uses data to make decisions. The framework for the use of digital assets includes the following 4 steps [2], [4], [9], [10].

- Creation of digital assets: a set of data and other materials.
- Storage of digital assets: should be easy to find and use.
- Sharing of digital assets.
- Use of digital assets.

The application of digital assets provides the basis for the use of AI in transport project management.

The applications of AI in construction project management are described in [11], [12]. The use of AI allows predicting project costs with greater accuracy, optimizing the project schedule and identifying potential problems, managing resources more efficiently, monitoring performance and detecting deviations from the plan, detecting risks and mitigating them.

AI offers a new approach to project management that is more effective than traditional tools. With the help of AI, project managers can analyze previous data and anticipate potential issues that may affect the project. This reduces the risk of unexpected situations involving people, suppliers, organizations and other factors. AI can also use current and historical data to create different project scenarios and evaluate and rank them according to their meaning. AI helps to plan project costs and time frames more accurately in the early stages [13].

The project manager is the one responsible for making decisions. According to The International Project Management Association (IPMA), it defines the competences that a project manager must possess and publishes them in the Individual Competence Baseline (ICB4). Competence is a combination of knowledge, skills and abilities. With the help of AI, one will have a constant insight and ready-made solutions for any situation that arises [14].

The standard project management methods used are: Gantt Diagram; Critical Path Method; PERT Analysis,

Approaches to Cost Estimation, Progress Reporting and in recent years attempts are seen to implement Agile Methods.

A. Waterfall

This project management methodology is characterized by successive phases, with the next phase beginning after the completion of the preceding one. When using artificial intelligence, you can achieve task automation, report generation and progress tracking.

B. Agile

This methodology is applied to dynamic projects where requirements change frequently. AI achieves task optimization, risk forecasting and resource optimization. A methodology for the use of AI in the management of infrastructure transport projects has been developed [15].

C. Application Of Artificial Intelligence In The Management Of Transport Projects

Project management in the transport sector with AI is not equally developed in different countries. There are more advanced countries that can share experience and knowledge. When implementing AI to manage projects in transport, there is often a lack of database, as well as skilled employees to work with the software. The new channels for data collection should be included and the logic in the application of AI should be sought. Whether the new AI software will be usable by current managers and employees needs to be explored. The latter must be trained to work with the application and, if necessary, be trained to understand AI mechanisms and algorithms. Other issues that are observed are related to security, control, access and data management [16].

A detailed overview of the use of information technology in rail transport is given. The use of various software to automate tasks shows that the sector is ready to move to the next stage – the implementation of AI [17].

Projects in the field of transport are of different types: for construction, rehabilitation, modernization of the transport fleet, construction of intelligent transport systems, logistics and many others. When choosing the right AI software for project management, the type of project is taken into account.

Each project is described by five elements: time, budget, scope, quality and risk, distributed in the project triangle. The project triangle is used to manage the constraints of the project. Optimizing all elements at the same time is impossible,

Transport projects are usually mega projects with huge scope and budget. Budget management is a key activity for its success, which requires constant monitoring and adjustment of costs in all phases, from design to implementation. The expected cost of the project is the result of a preliminary cost estimate, based on historical data for similar projects. At the next stage, an economic assessment of the usefulness of the project is made. A successful transport project ends within the set scope, schedule, budget and according to standards and societal expectations in terms of quality [16], [17].

Quality management of transport projects is an important and responsible task that can be improved with the use of AI. Using the project's data, AI can generate

recommendations on how to improve quality significantly faster than humans. AI can also define the quality requirements of the project and monitor their compliance.

The fifth element of any project is risk. Risk identification, assessment and prioritization is a priority in AI software development. By using statistics and machine learning methods, computer vision and neural networks, early detection of risk is achieved and solutions are proposed on how to reduce their impact [18].

Managing resources in a transportation project can be done with AI and besides optimizing them, it can improve the performance of human resources. With AI, an optimal project schedule can be achieved. Any change in the scope, performance of tasks or use of resources shall be accounted for by AI and the timetable shall be revised [19].

The areas of AI development in project management in the next 10 years are described. These are: cost estimation, schedule management and risk management. The authors propose in the future to look for solutions to integrate AI with other technologies, develop hybrid models, build trust and cooperation between humans and AI [20].

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The described proposals for the implementation of AI in the management of transport projects define the technology as a necessity for the implementation of a successful project. However, certain risks can be identified:

- Security risk.
- Risk of violation of the right to confidentiality.
- AI can gain autonomy and control the project entirely.
- Risk related to data quality or missing data.
- Staff skill issue where the AI can assign a task to an incompetent human.
- At this point, AI is not creative.

D. Methodology For the Creation of AI For the Management of Transport Projects

Figure 3 presents the methodology for creating AI software for transport project management.

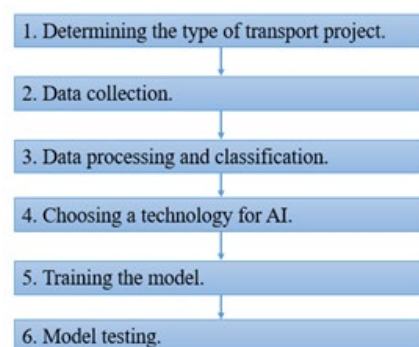


Fig. 1. Methodology for the creation of AI for the management of transport projects.

Step 1. Determining the type of transport project is essential for the selection of AI technology and for building infrastructure for data collection.

Step 2. The quality of AI transportation project management software depends on the data it is trained with. It is important that the data is relevant, correct and comprehensive. In the transport sector, a lot of data is generated, in a different form. There is a huge amount of data in text form, and their analysis would improve the management processes. At this stage, textual data analysis methods work in three languages – English, French and Chinese, and data in different countries are collected in the local language.

Step 3. Before the data classification process, incomplete data should be cleaned and organized. This is followed by uploading the data and training AI. Every time the data changes, the AI model needs to be trained.

Step 4. AI technology is selected from the known: machine learning, voice recognition, natural language processing, etc.

Step 5. Model training is the most complex process and requires the work of specialists. AI platforms have been developed in which we provide data and the platform trains the AI model without writing code [23].

Step 6. After building and training the model, testing follows.

Creating AI software to manage transport projects is a challenging process.

IV. CONCLUSION

Deploying AI in transportation project management is transforming current practices in many aspects which is why it faces severe challenges. In the future, a much wider application of AI in the management of transport projects is expected, as the benefits for its users are:

- Saving valuable time for routine tasks.
- Improving the communications and work of the project team.
- Helps make decisions about which project to invest in.
- Improves project budget management.
- Improves the ability of the project to be completed within the originally set deadline.
- Project quality management.

A key point in introducing and using AI applications in project management is a change in employee thinking and culture. It's not enough for employees to be well informed. They need to be competent and capable.

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