Intelligent project portfolio development of IT companies

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Abstract

In the dynamic IT industry, project portfolio management (PPM) plays a pivotal role in organizational success. However, traditional PPM methods often struggle to cope with the increasing volume, complexity, and uncertainty of IT projects. To address these challenges, this paper explores the application of intelligent techniques for project portfolio development in IT companies. The paper highlights the benefits of data-driven prioritization, strategic alignment, risk management and resource optimization, and continuous improvement in enhancing PPM practices. It emphasizes the role of machine learning, AI-powered tools, and real-time monitoring dashboards in enabling intelligent project portfolio development. The article contains practical recommendations and steps that IT companies can use to improve their project management processes. It also provides valuable guidance on how to address typical problems and challenges that IT companies may face during project portfolio formation. This article is an important source of information for IT leaders, project managers, and other professionals in the IT industry who are looking for effective ways to optimize project management in their organizations. The paper concludes by emphasizing the importance of ethical considerations, human oversight, and data quality in implementing intelligent PPM solutions. By embracing these intelligent techniques, IT companies can optimize their project portfolios, maximize resource utilization, and achieve their strategic goals.

Keywords

project portfolio, project portfolio management, intelligent project portfolio development, information technology, evaluation and selection of projects, portfolio balancing

1. Introduction

The information technology (IT) industry is a dynamic landscape characterized by constant innovation and rapid change. This environment necessitates a strategic approach to project portfolio management (PPM) for IT companies to thrive. Traditional PPM methods, while valuable, often struggle to keep pace with the ever-increasing volume, complexity, and inherent uncertainty of IT projects. The formation of a project portfolio emerges as a vital mechanism for IT companies, serving as a structured approach to prioritize, align, and manage a multitude of initiatives concurrently [1].

This paper explores the concept of intelligent project portfolio development, a novel approach that leverages cutting-edge techniques to optimize project selection and

V International Workshop "IT Project Management" (ITPM 2024), May 22, 2024, Bratislava, Slovak Republic

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CEUR-WS.org/Vol-3709/paper21.pdf

CEUR Workshop Proceedings ceur-ws.org ISSN 1613-0073

execution within IT companies. By integrating data-driven insights, artificial intelligence (AI), and machine learning algorithms, intelligent PPM empowers IT organizations to make informed decisions, mitigate risks, and ensure project alignment with strategic objectives.

Amidst rapidly evolving technologies, shifting market demands, and resource constraints, the necessity of a well-curated project portfolio cannot be overstated. It serves as a compass guiding the allocation of resources, both human and financial, towards endeavors that promise the highest return on investment while mitigating risks. Additionally, a thoughtfully crafted portfolio enables organizations to adapt swiftly to market disruptions, capitalize on emerging opportunities, and steer clear of potential pitfalls.

Beyond mere project selection and management, a robust portfolio framework fosters strategic alignment with the overarching business objectives of the company. By aligning projects with organizational goals, IT companies can ensure that every initiative contributes meaningfully to the company's mission, vision, and long-term growth strategy. This alignment fosters synergy across departments, enhances collaboration, and cultivates a culture of accountability and transparency [2].

Moreover, in an era where agility and innovation reign supreme, a well-balanced project portfolio serves as a catalyst for driving innovation and fostering a culture of continuous improvement within IT companies. By diversifying project investments across different horizons—ranging from incremental improvements to by embracing AI-powered disruptive innovations—companies can hedge against uncertainties while fostering a culture that embraces experimentation, learning, and adaptation.

2. Materials and methods

In this article, we delve into the intricacies of intelligent project portfolio development in IT companies, exploring the rationale behind its necessity, the fundamental principles underpinning its implementation, and the tangible benefits it brings to the table. Through real-world examples, best practices, and practical insights, we aim to equip IT leaders and practitioners with the knowledge and tools necessary to navigate the complexities of project portfolio management and unlock the full potential of their organizations in an ever-evolving digital landscape.

Let's begin by examining traditional project portfolio management (PPM) methods employed by IT companies, such as:

1. Strategic alignment assessment. The process begins with a thorough assessment of the company's strategic objectives, vision, and long-term goals. This involves collaboration between key stakeholders across various departments to ensure alignment between business strategy and project initiatives [3].
2. Project prioritization techniques. Utilization of various prioritization techniques such as weighted scoring models, cost-benefit analysis, strategic fit assessments, and risk analysis to evaluate and rank potential projects based on their alignment with strategic goals, expected returns, resource requirements, and associated risks [4].

3. Resource capacity planning. Assessment of the organization's resource capacity including human, financial, and technological resources. This involves analyzing the availability of skilled personnel, budgetary constraints, and infrastructure requirements to ensure optimal allocation of resources across different projects.
4. Portfolio optimization algorithms. Implementation of portfolio optimization algorithms and decision-making frameworks to identify the most optimal combination of projects that maximize the overall value while respecting resource constraints and strategic objectives. Techniques such as linear programming, integer programming, and Monte Carlo simulations can be employed to optimize the portfolio [10].
5. Risk management strategies. Integration of risk management strategies to identify, assess, and mitigate potential risks associated with individual projects and the portfolio as a whole. This involves conducting risk assessments, developing contingency plans, and diversifying project investments to minimize overall portfolio risk [13].
6. Continuous monitoring and evaluation. Establishment of robust monitoring and evaluation mechanisms to track the progress, performance, and impact of projects within the portfolio. Key performance indicators (KPIs) and metrics are defined to measure project success and ensure ongoing alignment with strategic objectives.
7. Agile and adaptive governance frameworks. Adoption of agile and adaptive governance frameworks that allow for flexibility and responsiveness to changing market conditions, customer needs, and technological advancements. This involves regular portfolio reviews, adaptive decision-making processes, and iterative adjustments to the portfolio based on feedback and lessons learned.
8. Collaborative tools and technologies. Utilization of collaborative project management tools and technologies to facilitate communication, coordination, and transparency across project teams and stakeholders. These tools enable real-time sharing of information, progress tracking, and collaboration on project-related tasks [14].

In recent years, integrating artificial intelligence (AI) into project portfolio management has gained prominence. AI can assist in optimizing project selection, resource allocation, risk assessment, and overall portfolio performance. By leveraging AI techniques, organizations can enhance their decision-making processes and achieve better outcomes in project portfolio management.

Now, let's delve into intelligent project portfolio development of IT companies, the innovative approach that leverages artificial intelligence (AI) to optimize project selection and execution.

1. Data-driven decision making:
    - Collect and integrate historical project data (costs, timelines, resource allocation, success metrics).
    - Leverage machine learning algorithms to analyze project proposals, identify potential risks, and recommend optimal resource allocation.

- Integrate financial data to assess project ROI and prioritize initiatives that align with business goals.

2. AI-powered tools and techniques:
    - Supervised learning algorithms. Train algorithms on historical data to predict project outcomes (success probability, cost overruns, schedule delays).
    - Unsupervised learning algorithms. Identify patterns and trends in project data to discover hidden insights and potential risks.
    - Natural language processing (NLP). Analyze project proposals, extract key features, and support project selection and prioritization.
    - Project portfolio management software with AI Integration. Integrate existing PPM software with AI capabilities for risk assessment, resource allocation, and real-time project monitoring.
    - Custom AI applications. Develop custom AI applications to analyze data, predict risks, and recommend optimal project portfolios for specific needs.
3. Scenario planning and portfolio optimization:
    - Simulation techniques. Model different project portfolio configurations under various market conditions to facilitate scenario planning and risk mitigation strategies.
    - Multi-objective optimization algorithms. Optimize project portfolios based on multiple criteria (maximizing ROI, minimizing risk, aligning with strategic goals).
4. Continuous improvement:
    - Implement real-time project monitoring dashboards to track progress, identify deviations, and facilitate course correction.
    - Utilize machine learning to analyze project performance data and identify patterns for improving future project selection, execution, and risk management.
    - Encourage a culture of learning and feedback within the IT project management team to continuously refine the intelligent project portfolio development process.
5. Human-in-the-loop approach:
    - While AI plays a significant role, human expertise remains crucial for decision-making.
    - Subject matter experts provide insights, validate AI recommendations, and make final decisions on project selection and portfolio composition.

This combination of data analysis, AI techniques, specialized tools, and human expertise empowers IT companies to make informed decisions, optimize resource allocation, and achieve strategic goals through intelligent project portfolio development.

3. Results

3.1. Problem overview

Ukraine's IT industry has experienced remarkable growth in recent years, establishing itself as a significant player in the global tech landscape. With a wealth of talent, favorable business environment, and competitive costs, Ukrainian IT companies have garnered attention from international markets. However, amidst this growth, the effective formation of project portfolios presents several challenges that warrant attention and strategic solutions.

Talent acquisition and retention. One of the primary challenges facing IT companies in Ukraine is the acquisition and retention of skilled talent. While the country boasts a strong pool of IT professionals, there is fierce competition for top talent both domestically and internationally. This talent shortage can hinder the execution of project portfolios, leading to delays and compromises in project quality.

Limited access to funding. Access to adequate funding remains a persistent challenge for many IT companies in Ukraine. While the country has seen an increase in venture capital investments in recent years, accessing funding for ambitious project portfolios can still be challenging, especially for startups and smaller companies. Limited financial resources can constrain the scale and scope of project portfolios, impacting competitiveness and growth potential.

Uncertain regulatory environment. The regulatory environment in Ukraine can be unpredictable, posing challenges for IT companies in terms of compliance, data protection, and intellectual property rights. Uncertainty surrounding regulations and government policies can introduce risks and complexities into project portfolios, requiring companies to navigate legal frameworks carefully.

Infrastructure and technological constraints. Despite advancements, Ukraine's infrastructure and technological capabilities still face limitations in certain regions. Inadequate infrastructure, such as unreliable internet connectivity and power outages, can disrupt project execution and hinder collaboration within project teams. Additionally, technological constraints may limit the adoption of cutting-edge technologies in project portfolios, impacting competitiveness and innovation.

Market volatility and geopolitical factors. The geopolitical landscape and market volatility in Ukraine and the surrounding region can introduce uncertainties that impact project portfolios. Fluctuations in currency exchange rates, geopolitical tensions, and global economic trends can influence project feasibility, demand for IT services, and market dynamics, necessitating adaptability and risk mitigation strategies.

Cultural and communication challenges. Cultural differences and communication barriers can pose challenges in project portfolio management, particularly for companies engaged in international collaborations. Effective communication and collaboration across diverse teams and cultures are essential for successful project execution but can be hindered by language barriers, time zone differences, and cultural nuances.

3.2. Method for the formation of a portfolio of projects of the IT companies

Stage 1. Project identification. At this stage, potential projects that could be included in the portfolio are identified. These could be new initiatives, client requests, or internal projects for improving business processes.

Stage 2. Projects grouping. Projects are grouped according to six templates A, B, C, D, E and F, which characterize the following categories of projects in an IT company:

A. Product Development Projects. These projects focus on creating new products or significant updates to existing products. They may include the creation of new software, mobile applications, websites, etc.

B. Support Projects. These projects focus on the maintenance and support of existing systems. They may include bug fixes, security updates, performance improvements, etc.

C. Implementation Projects. These projects focus on the implementation of new technologies or systems. They may include the deployment of new IT infrastructure, data migration, user training, etc.

D. Consulting Projects. These projects focus on providing consultancy services to clients. They may include strategic planning, project management, business process analysis, etc.

E. Implementation of Agile and DevOps. Projects aimed at implementing agile development methodologies and automating development and implementation processes.

F. Infrastructure optimization. Projects aimed at improving the company's infrastructure, including networks, servers, computing resources, and security.

These categories can overlap, and a single project may include elements of several types. Additionally, the type of project can change over its lifecycle. For example, a product development project may transition into a support project after the product launch.

The projects of one category of the portfolio have a corresponding set of criteria. Dividing projects into groups allows making portfolio management more transparent by linking projects to specific objectives in a certain way.

Stage 3. Evaluation and selection of projects. At this stage, the criteria and weighed indicators for projects are designed. The algorithm for the solution of this problem depends on the level of maturity of portfolio management in a company.

The problem of evaluation and selection of projects for the portfolio (current or future) is based on qualitative and quantitative analysis of the projects of a portfolio. Qualitative analysis is intended for selection of the most attractive projects in terms of realization of the strategy goals and objectives. The criteria of qualitative analysis can include, for example, importance for business, controllability, urgency, innovation, etc. In this case, estimates can be based on a system of conditional metrics or weight. Quantitative analysis is intended for projects evaluation and prioritizing in terms of economic efficiency [16].

The most important criteria that should be paid attention to in qualitative analysis of the portfolio projects are risks, costs and value of a project for business. Projects of one group of the portfolio are compared with each other by a unified set of criteria. The weighed parameters (weights), based on which the evaluation is performed and a short list of the «recommended» projects is formed, are designed within each criterion. The similar analysis can be shown visually in the form of graphic representations. Decision on the project

selection is made using the method of analytical hierarchy. The hierarchical structure of the selection problem takes the form shown in Figure 1.

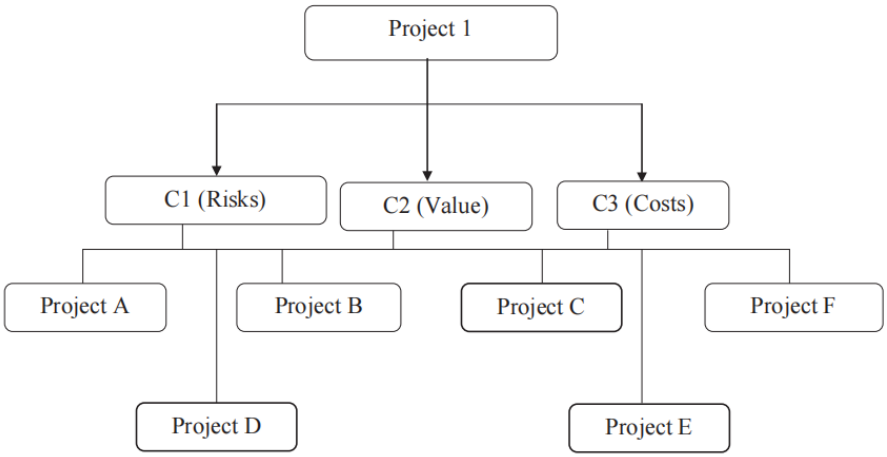
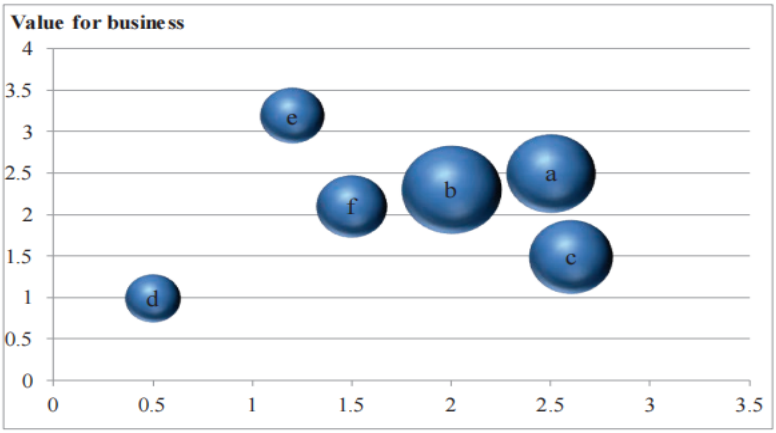


Figure 1: Hierarchical structure of selection of a project to the portfolio.

Figure 2 shows an analytical sample for the projects of two groups of the portfolio at comparison of: the Value (vertical axis), Risks (horizontal axis), Costs (dimensions of a circle) parameters on the bubble diagram.



Project	Risks	Value	Costs
Project b	2	2.3	10
Project e	1.2	3.2	4
Project c	2.6	1.5	7
Project f	1.5	2.1	5
Project a	2.5	2.5	8
Project d	0.5	1	3

Figure 2: Analytic sample for the projects of two groups of the portfolio.

As a result, we need to select from the following 6 projects. The diagram shows that:

- project «e» has high value and is characterized by moderate costs and its implementation is associated with low risks;

- project «c» is associated with high costs and low value for business, in addition, it is highly risky. This project is the least attractive, and in this case, it is necessary to make a decision: either not to include it in the portfolio, or redirect it by changing its objectives and parameters to enhance its attractiveness;
- project «f» is characterized by moderate costs, mode rate risks and high value. The project is recommended to be included into the portfolio of projects.

Stage 4. Portfolio Balancing. The project portfolio is balanced to ensure it aligns with the company's strategic goals, risks, and resources. This may involve prioritizing projects, allocating resources, and determining schedules.

The diagram of the balancing criteria is shown in Figure 3.

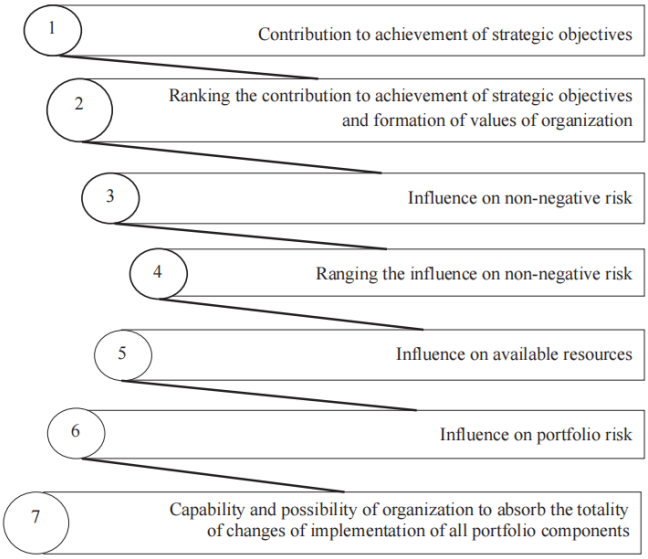


Figure 3: Diagram of criteria of balancing the portfolio of projects.

Stage 5. Portfolio Review and Management. The project portfolio is regularly reviewed and updated to ensure it aligns with changes in the business environment, company strategy, or available resources.

3.3. Project portfolio management tools and techniques

There are many tools for forming a project portfolio in IT companies. Here are a few of them:

1. *Trello*. This is a powerful project management tool that allows you to create boards, lists, and cards to organize projects. It also allows you to use labels, colors, and deadlines to prioritize projects.
   An example of forming an IT company's project portfolio using Trello software is shown in Figure 4.

The examples of successful use of Trello:

- SwagUp: Thanks to Trello, they were able to automate processes and grow into a multi-million-dollar company.
- Instinct Dog Training: Trello gave them visibility, accountability, and organization.
- Desk Plants: They chose Trello because of its intuitive design and suitability to their needs.

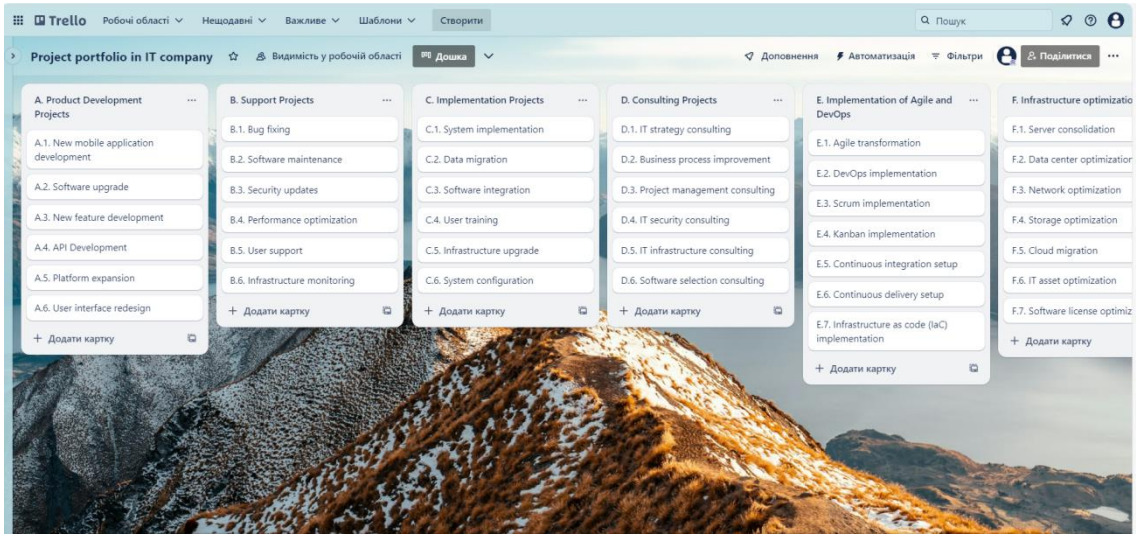


Figure 4: An example of forming an IT company's project portfolio using Trello software.

Thus, Trello can be an excellent tool for forming and managing a portfolio of projects in IT companies.

2. *Primavera P6.* Primavera P6 is a powerful tool for managing IT project portfolios. Here's how it can be used:
    - Project Portfolio Management: Primavera P6 allows administrators and users with privileges to create portfolios that suit their specific needs. These portfolios are named lists or groups of projects that can be made available to users. This is particularly useful in systems with a large number of projects, as it helps limit the number of projects that can be viewed in many pick lists, views, dashboards, and dialogs.
    - Project Selection: Projects can be manually selected or generated from a filter. A manual portfolio allows you to select specific projects from the Enterprise Project Structure (EPS) (see Figure 5), while a filtered portfolio allows you to select criteria that will control what projects appear in your portfolio without having to manually update it.
    - Visibility and Organization: By focusing on relevant projects, schedulers can limit the scope of the effort in a way that significantly reduces the required computing capacity. This provides visibility, accountability, and organization.
    - Ease of Use: The process of creating and assigning a portfolio of projects is straightforward. Users can easily choose their respective projects from the EPS

hierarchy of available projects and move the selection to the list of selected projects.

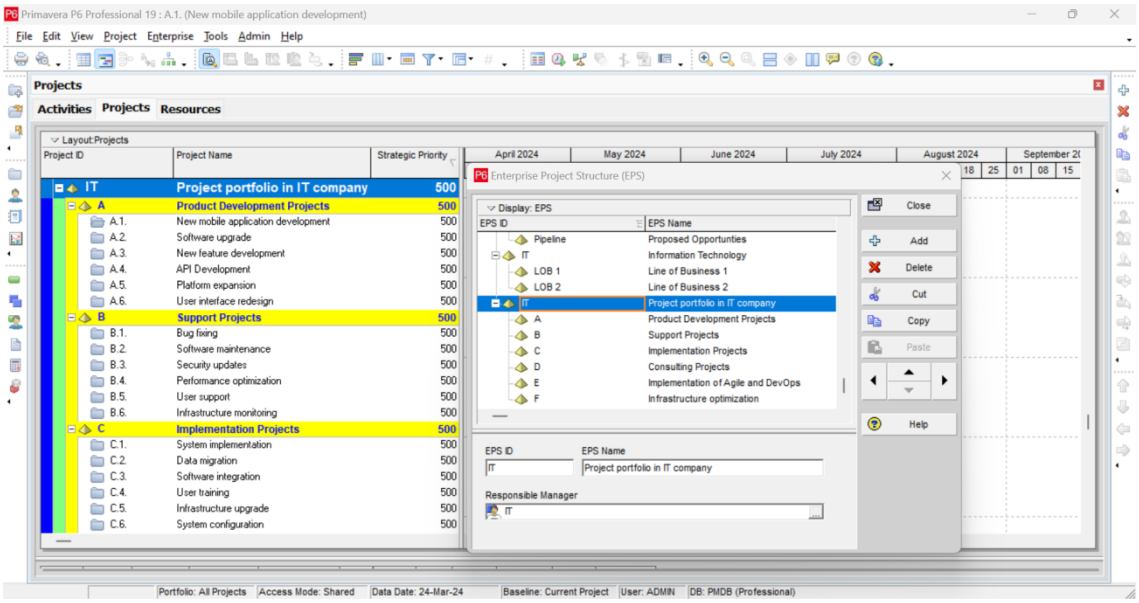


Figure 5: An example of forming an IT company's project portfolio using Primavera P6 software.

3. *Jira*: This is a tool used for project management, including tracking bugs, tasks, and other issues.
4. *Microsoft Project*: This is a professional project management tool that allows you to plan and manage resources, track project progress, and analyze workloads.
5. *Asana*: This is a project management tool that allows teams to organize work, track progress, and achieve goals.
6. *Basecamp*: This is a project management tool that helps teams communicate, organize tasks, and share files.
7. *Zoho Projects*: This is a project management tool that allows you to plan, coordinate, and execute project tasks.
8. AI tools like Gemini and ChatGPT can be valuable assets for IT companies in optimizing their project portfolio management (PPM) processes. These tools can bring several benefits to PPM, including:
   - Enhanced data analysis and insights:
     Gemini. Gemini's large language model capabilities can analyze vast amounts of project data (historical, financial, market trends) to identify patterns, trends, and hidden insights that might be missed by traditional methods.
     ChatGPT. ChatGPT's ability to process and understand natural language can extract key information from project proposals, emails, and other unstructured data, providing valuable insights for project selection and prioritization.
   - Proactive risk assessment and mitigation:

Gemini. Gemini can analyze historical project data and market trends to predict potential risks associated with new projects, enabling proactive risk mitigation strategies.

ChatGPT. ChatGPT can identify potential risks in project proposals and suggest mitigation strategies based on its knowledge of industry best practices and project management frameworks.

- Resource optimization and allocation:
  Gemini. Gemini can optimize resource allocation across multiple projects by considering factors like skill sets, availability, and project priorities.
  ChatGPT. ChatGPT can suggest resource allocation strategies based on project requirements, team capabilities, and budget constraints.
- Scenario planning and portfolio optimization:
  Gemini. Gemini can simulate different project portfolio configurations under various market conditions to help IT companies make informed strategic decisions.
  ChatGPT. ChatGPT can analyze various portfolio scenarios and suggest the most optimal portfolio based on risk tolerance, ROI expectations, and strategic goals.
- Continuous learning and improvement:
  Gemini: Gemini can continuously learn from project data and performance feedback to improve its predictions, risk assessments, and resource allocation recommendations.
  ChatGPT: ChatGPT can refine its understanding of project management terminology and best practices through continuous learning from project data and interactions with users.
- Integration with PPM software:
  Both Gemini and ChatGPT can be integrated with existing PPM software to provide real-time insights, recommendations, and support for project selection, execution, and risk management. This integration can streamline the PPM process and empower IT companies to make better decisions faster.
- Considerations:
  Data quality. The accuracy and completeness of the data used to train and operate these AI tools are crucial for their effectiveness.
  Human Expertise. While AI tools provide valuable insights, human expertise and judgment remain essential for making final decisions and navigating complex project management situations.
  Ethical considerations. It's important to ensure that AI tools are used ethically and responsibly, considering potential biases and fairness issues.

These tools help manage projects, track progress, coordinate teams, and analyze results. The choice of a specific tool depends on the specifics of the project and the needs of the organization.

4. Discussion

The development of IT project portfolio management in Ukraine has promising prospects, such as:

1. Current situation. The IT sector in Ukraine has attracted public attention for several decades, becoming a separate economic and sociocultural phenomenon. Despite the resilience demonstrated by the IT market at the initial stage of the full-scale war, in 2023, disappointing signals began to emerge about the deterioration in some indicators of recruitment, business activity, and the financial status of the IT market.
2. Innovative development. The top level of innovative industries in Ukraine is the information technology industry. This is especially significant, because it creates a very positive image of the country and can attract a great deal of foreign investment.
3. Government initiatives. The Ukrainian government has adopted a “roadmap” for reforming public investments, which includes the creation of a single project portfolio to ensure prioritization and access to funding.
4. Future prospects. Forecasts were created using extrapolation polynomial trendline construction models and by the construction of an artificial neural network. Based on actual and predicted values of the IT market volumes, the authors estimated the level of its future development using taxonomic analysis.

5. Conclusions

In conclusion, the prospects for the development of IT project portfolio management in Ukraine are promising, with a focus on innovative development, government initiatives, and future growth.

The use of project portfolios in the IT sector can significantly increase the efficiency and success of companies in the digital sphere. Portfolios provide a higher level of risk identification and management due to diversification and the ability to identify potential problems at an early stage. Projects within a portfolio can be selected and structured to maximize their value and contribution to the overall success of the business. This makes project portfolio management an important tool for IT companies that want to achieve their strategic goals and increase their competitiveness in the market. However, it’s important to note that the current situation and historical conditions of development cause a number of problems that slow down development and create barriers for the integration of the Ukrainian IT market with the world market.

Given these factors, it is important to continue to invest in the development of project portfolio management and utilize the best practices and tools to achieve success.

By employing these materials and methods, IT companies can effectively form and manage a project portfolio that is strategically aligned, optimized for value and resource utilization, resilient to risks, and responsive to changing market dynamics.

While the IT industry in Ukraine continues to thrive and evolve, the effective formation of project portfolios remains a multifaceted challenge. Addressing talent shortages, securing funding, navigating regulatory complexities, improving infrastructure, and

mitigating market uncertainties require a strategic approach and collaborative efforts from industry stakeholders, government bodies, and educational institutions. By overcoming these challenges, Ukrainian IT companies can unlock their full potential, drive innovation, and sustain long-term growth in the global tech arena.

Overall, AI tools like Gemini and ChatGPT have the potential to revolutionize PPM for IT companies by providing data-driven insights, proactive risk management, and optimized resource allocation. As these tools continue to develop and mature, they will play an increasingly important role in helping IT companies achieve their strategic goals.

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