The Impact of Ai Tools on CEO Decision-making in Project Portfolio Management: Insights from Saudi Firms

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Abstract

This study examines the adoption of low-emission Inhalers versus traditional metered-dose inhalers (MDIs) in the U.S., using data from the Medical Expenditure Panel Survey (MEPS) from 2010 to 2021. Despite the environmental benefits of low-emission inhalers, their adoption has been slow and marked by socio-economic and racial disparities. Analysis reveals that patients below the poverty line are significantly less likely to use low-emission inhalers, as are patients who are uninsured, and patients who self-identify as Black—with all these gaps widening over time. The findings highlight the need for targeted policy interventions to address these disparities and enhance equitable access to environmentally friendly healthcare innovation. Future research should investigate pricing dynamics, out-of-pocket expenditures, and causal mechanisms behind these disparities. This study underscores the challenge of aligning environmental goals with health equity in healthcare innovation.

1. Introduction

Artificial intelligence is a field within computer science that focuses on developing systems and technologies capable of replicating human cognitive functions or behaviors. AI aims to enable machines and computers to learn, solve problems, make decisions, and perform tasks that typically require human intellect (Ahn & Chen, 2021). Nevertheless, it is important to acknowledge that, despite the current hype, numerous applications previously regarded as traditional mathematics or standard programming logic are now categorized as AI. Additionally, AI plays a crucial role in value creation by enhancing efficiency, promoting innovation, and driving the development of new business models and technological advancements (Huang et al., 2025). Artificial intelligence applications range from simple to complex, shaped by various environments and types of decision-making contexts. Lawrence (1991) associated these dimensions with potential applications of AI. The main emphasis is on two primary areas: natural language processing and expert systems (McCarthy et al., 1955; Nilsson, 2010). Therefore, the framework will focus on bottom-up and top-down strategies, mirroring the agreement among numerous researchers (Bolander, 2019). In financial investments and corporate decision-making, artificial intelligence effectively fills various gaps, transforming project planning, Execution, and delivery by boosting the ability to make more precise, efficient, and

data-driven decisions. This paper aims to deepen the understanding of the impact of artificial intelligence on decision-making errors within project-based organizations in Saudi Arabia's industrial sector. To accomplish this goal, several specific research objectives have been established:

1) Examine how decision-making dimensions influence project portfolio management.
2) Analyze how profitability factors impact project management.
3) Investigate the impact of artificial intelligence on enhancing project profitability.

Implementing artificial intelligence in project management allows organizations to improve their decision-making capabilities. This project aims to assess the clarity of decision-making in project portfolio management by integrating sophisticated artificial intelligence techniques. The research aims to define and demonstrate the noteworthy effects of artificial intelligence on project portfolio management by exploring the convergence of three essential domains: artificial intelligence, project portfolio management, and decision-making. We begin by outlining the concept of project portfolios and their management challenges, followed by an analysis of the decision-making aspects in project management. Finally, we examine the relationship between project management and decision-making, with a focus on how artificial intelligence influences decision-making within the context of project portfolio management.

2. Literature review

Amaral and Araújo (2009) emphasise the significance of project management in enabling organisations to address external challenges and maintain competitiveness. Organisations can effectively implement their strategies and initiatives by recognising project management as an essential skill (Hurt & Thomas, 2009). Therefore, projects and project management are vital in reaching strategic objectives while fostering an environment that supports innovation (Anantatmula & Rad, 2013). This perspective encourages organisations to prioritise these skills for sustained growth and adaptability in a rapidly evolving market.

Project portfolio management (PPM) is critical in increasing an organization's financial value by aligning its projects with business objectives. By fostering a well-balanced mix of initiatives, a PPM effectively addresses potential risks and provides essential oversight and support that contribute to project success. Furthermore, it enables the strategic allocation of resources across projects, which boosts efficiency and effectiveness throughout the organization (Butler, 2019). To enhance competitiveness, organisations must prioritise projects that deliver significant benefits. Successful management of these initiatives is vital for maximising their value and achieving overall success. However, challenges can arise in project portfolio management. Despite various guidelines on selecting projects for the portfolio, allocating resources, aligning the reporting portfolio with strategy, and assessing portfolio success, companies still face difficulties in efficiently sharing resources across projects (Patanakul, 2020).

Project portfolio management frameworks aim to improve investment analyses and streamline planning; however, their application has room for enhancement. Henriksen and Traynor (1999) found that managers neglect vital portfolio activities occasionally. Furthermore, managing

multiple projects can cause employee overload, as Cacciuttolo et al. (2023) noted. We can significantly enhance results by deepening our understanding of management's practical elements, particularly managers' actions, and acknowledging the specific conditions under which project portfolios operate. We can establish more effective project portfolio management processes that better assist managers and employees by addressing these factors.

Mintzberg et al. (1976) examine the key factors that contribute to effective decision-making and the essential elements of project management. Policy decisions are of paramount importance as they involve substantial resources, establish significant precedents, and shape subsequent minor decisions. A fundamental characteristic of strategic decisions is their frequent occurrence among senior management, who exert considerable influence over the organization's direction. Such decisions may manifest in formal and informal contexts, whether made intentionally or emerge spontaneously (Al-Banna et al., 2023).

It is essential to recognize that strategic decisions are shaped by the internal context of the organization, comprising psychological, structural, cultural, and political factors, as well as the external context, which encompasses competitive dynamics (Richard et al., 2021). By comprehensively understanding these factors, organizations can enhance their decision-making capabilities and improve the overall effectiveness of project management. While increasing the number of participants in decision-making can bring valuable perspectives, it is essential to acknowledge that the human capacity for processing information has limits (Fiori, 2011). To effectively navigate complex challenges, decision-makers can utilize simplified models, such as heuristics or rules of thumb (Fiori, 2011). These strategies enable them to address intricate problems in a way that aligns with their cognitive capabilities. Embracing the integration of artificial intelligence can significantly enhance this decision-making process, especially in project portfolio management, by providing powerful tools to manage complexity and improve outcomes.

AI encompasses various techniques and approaches, including machine learning (ML), natural language processing (NLP), expert systems, neural networks, and optimization algorithms. These techniques are employed in project management to address complex decision-making issues, improve prediction accuracy, and streamline routine tasks (Beltagui et al., 2020). Successful project planning and scheduling are crucial for achieving project success. Traditional scheduling techniques, such as the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), heavily relieve historical data and expert insights. Nevertheless, AI can significantly improve these workflows.

Literature shows that AI techniques can significantly enhance decision-making in portfolio management, both strategically and operationally (Jiang & Wei, 2019; Brière & Charette, 2020). By improving efficiency, optimizing resource allocation, and facilitating precise predictions and risk assessments, AI opens new avenues for organizations to achieve their goals. One of the most powerful applications of machine learning is in evaluating and prioritizing projects within portfolios. Through the analysis of historical data, resource constraints, and market trends, AI

can identify patterns and accurately forecast the success of various initiatives. Additionally, organizations can enrich their decision-making processes and project portfolio management (PPM) by utilizing Hybrid Decision-Making Systems. These innovative models integrate human judgment with AI insights, forming a robust framework for informed decision-making. By combining expert opinions with the analytical power of AI, these systems empower decision-makers to leverage both human intuition and data-driven insights, ultimately leading to more informed and effective project management outcomes (Tukel & Rom, 2015).

AI fosters a data-driven culture by promoting decisions rooted in objective data instead of intuition, particularly in project portfolio management (Barton & McGowan, 2019). It involves utilizing AI to objectively evaluate projects' value and risk, ensuring alignment with the overarching organizational strategy.

This research seeks to advance project portfolio management by integrating artificial intelligence (AI) to improve project success rates. Additionally, the study will assess how AI positively influences decision-making processes in projects. An overview of the current literature on decision-making and AI in project portfolio management will be provided. By analyzing questionnaire data, we will establish a thematic framework addressing the use of AI in project portfolio management over an extended period.

3. Method

This study aims to investigate the impact of artificial intelligence tools on decision-making in project portfolio management among Saudi Arabian companies. A qualitative research approach was utilized to achieve this, and a questionnaire was crafted. This questionnaire was shared with a carefully selected group of participants, including managers from three industries—construction, manufacturing, and software development—as well as representatives from various departments, such as marketing, quality control, and production. These participants have varying levels of expertise in project management. This methodology will facilitate systematic data collection from the intended population, enabling practical analysis and interpretation of the findings.

3.1 Questionnaire and Sample

The questionnaire is thoughtfully structured into three sections to foster productive discussions. In the first section, we pose general questions that delve into the interviewees' experiences within their companies, their familiarity with essential technological tools, and their insights into portfolio and project management. This approach is designed to collect valuable information that will enhance our understanding and contribute to the development of best practices.

The second section highlights key aspects of project portfolios and their associated decision-making processes. It emphasizes the importance of acknowledging these aspects and utilizing practical tools to enhance profitability. Lastly, the concluding section offers an insightful examination of artificial intelligence tools, demonstrating how they can effectively enhance the connection between project portfolios and profitability outcomes.

The questionnaire was sent to 93 employees from three sectors, yielding 62 responses. Although the sample size may seem small, it is significant due to the respondents' varied expertise. The survey was conducted using Google Forms, which enabled a wide range of anonymous participants, ensuring that diverse viewpoints were captured and represented. This method highlights the commitment to gaining well-rounded insights from multiple sectors.

4. Results and discussion

To enhance clarity in our results, we have combined the responses from participants who selected "Agree" and "Strongly Agree" into a single group. This strategy will enable us to better understand and interpret the overall levels of agreement on the questionnaire's various questions, offering a clearer insight into participants' perspectives.

The following diagram presents the interviewees' responses by sector of activity. This enables us to gain a more accurate understanding of the initial results.
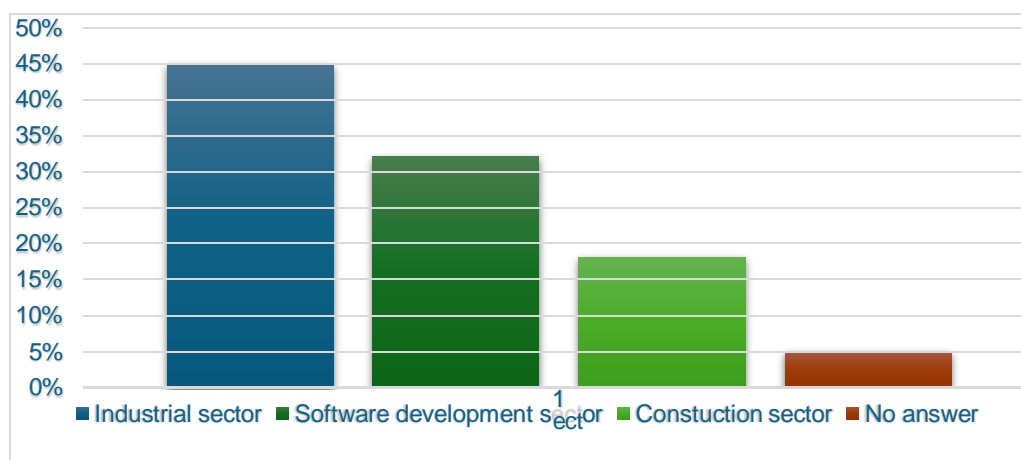

Figure 1. Activity sectors and respondent rate

The histogram reveals a diverse distribution of participants among various sectors. Notably, 45% of respondents come from the industrial sector, demonstrating the effectiveness of our targeted sampling strategy. Furthermore, the software development sector makes a significant contribution to our response rate. This concentration across sectors enables us to investigate how project management issues vary among different industries. The variety of sectors represented by our respondents enriches our study by offering a wide range of perspectives and experiences. This diversity enriches our findings and facilitates a deeper understanding of the factors that shape employees' project management skills. Thorough data analysis is crucial to identify whether trends vary among sectors. This effort will enhance our understanding of how sectors influence specific project management outcomes.
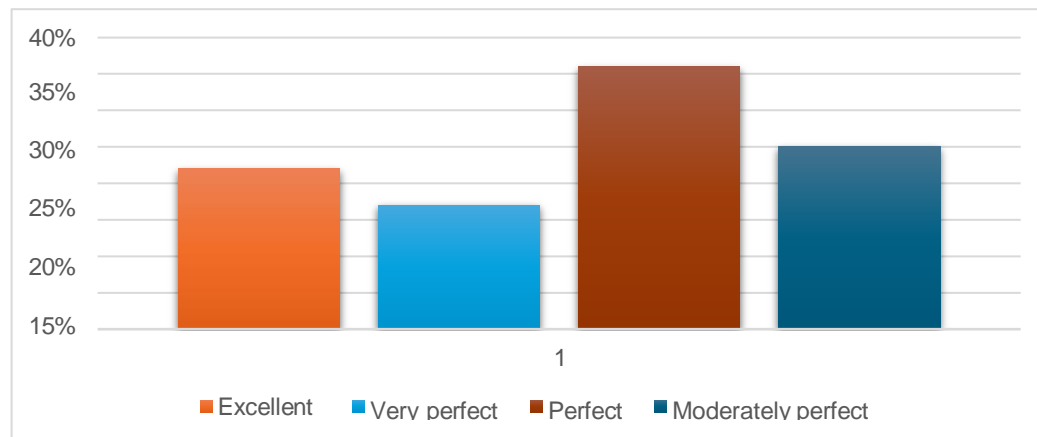
Figure 2. Project management capabilities

The results regarding project management skills reveal a promising array of competencies among participants. Almost 33% regard their skills as outstanding, showcasing a solid foundation in this discipline. Moreover, more than 22% classified their project management skills as "moderate," highlighting a significant opportunity for growth and development. Conversely, approximately 13% perceive their abilities as exceptional, indicating potential for further refinement. This information suggests potential improvements in project management training and the acquisition of relevant experience, laying the groundwork for targeted development efforts.

The extensive data regarding project management skill levels among participants provides crucial insights into the diverse abilities present in the sample. By exploring this variety, we better understand the range of skills available and can anticipate how these differences might influence future survey responses. Consequently, this understanding will help formulate more pertinent questions and enhance the overall quality of our findings.
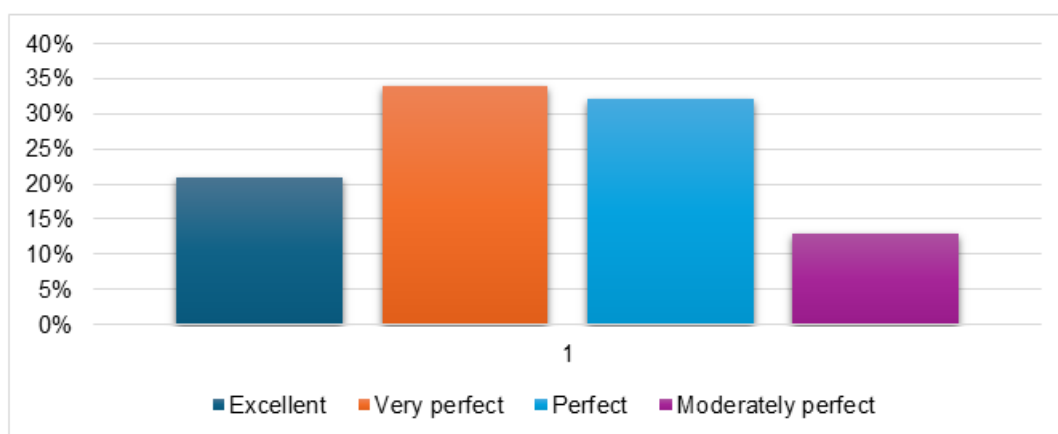

Figure 3. Capability to utilize technological instruments

Notably, over 30% of employees demonstrate strong proficiency in specialized software and development programs across various fields, including construction software and industrial project management tools. Conversely, only 15% or fewer respondents indicated a moderate grasp of these technologies. This highlights a significant opportunity for development, underscoring the crucial role of new technologies in Saudi companies. Enhancing skills in cloud services, cloud computing, and advanced tools can further strengthen the industrial sector and drive innovation.
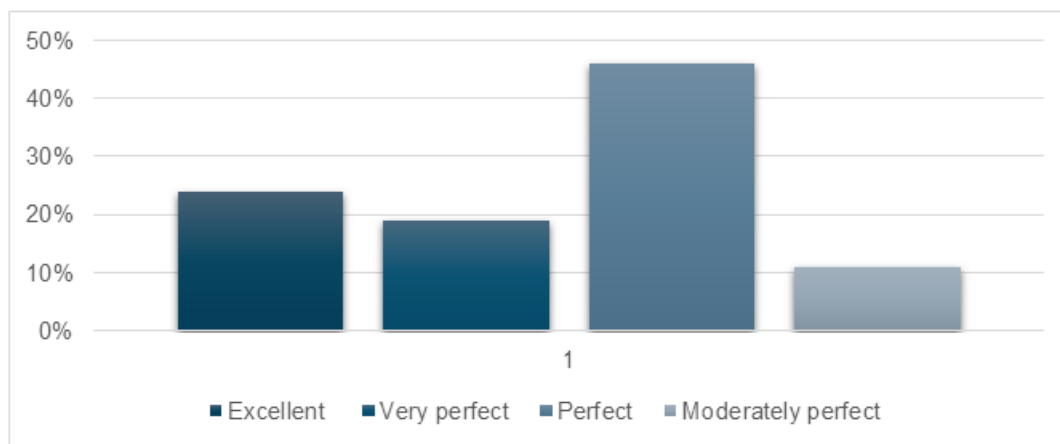

Figure 4. Portfolio management capabilities and decision-making

The table above evaluates employees' skills in utilizing project portfolio management tools and decision-making abilities. The results show a favorable trend, with over 40% of respondents expressing confidence in effectively managing their project portfolio and feeling reasonably assured when making informed decisions about proposed investments.

Moreover, it is noteworthy that 23% of participants consider their project portfolio management skills as "excellent." This group represents a valuable resource for the organization, possessing a higher level of expertise in portfolio management that can be leveraged for future projects. By cultivating these strengths and providing opportunities for further growth, we can enhance the overall portfolio management performance across the team.

Our analysis reveals that fewer than 10% of employees perceive their project portfolio management skills as moderately effective. This finding underscores the potential for growth and development within our team. It implies that the mastery of project portfolio management tools differs among employees, reflecting varying perspectives on their abilities and skills. By addressing these differences, we can introduce targeted training and support to improve organizational proficiency in project portfolio management.

We analyzed five crucial dimensions to assess the effect of a project's portfolio on a company's profitability. By asking respondents to indicate their levels of agreement, neutrality, or

disagreement concerning the influence of each dimension, we seek to gather valuable insights. Our goal is to emphasize the most significant dimensions and comprehend the diversity and consistency of employee perspectives. This thorough analysis will enhance our understanding of the elements contributing to project portfolio profitability, allowing us to make informed decisions for future growth.
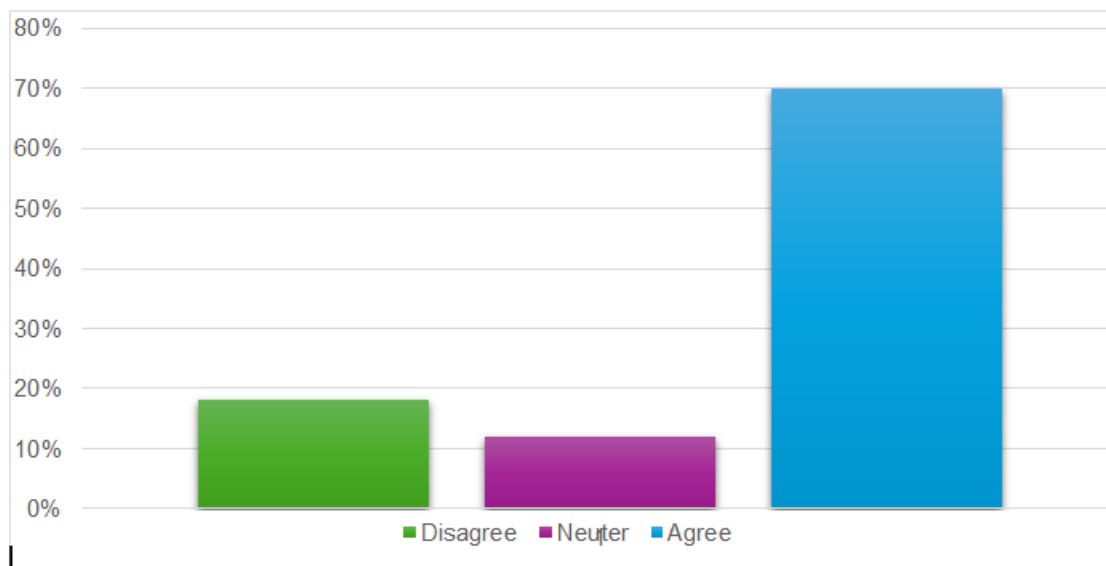

Figure 5. The average responses for the five dimensions of the project portfolio

The chart above reveals that respondents tended to agree more than disagree regarding the aspects of the project portfolio and the possible adverse effects on overall profitability. This finding presents an opportunity to address these issues and improve the portfolio's efficiency.
The first dimension indicates that 70% of participants believe an excess of projects and insufficient resources can harm the portfolio's profitability. Conversely, only 11 participants feel this scenario will not negatively impact profitability.

Twelve participants believe that using project selection methods in a non-discriminatory manner will not harm the portfolio's profitability. Similarly, 32 people believe that increasing the number of small projects will not negatively impact portfolio profitability, while only 12 believe it could lead to lower portfolio profitability. The other two dimensions show similar results. The lack of human and financial resources negatively affects portfolio profitability, with 35% and 23% of responses, respectively.

Evaluating AI tools allows us to explore the connections between vital components of our conceptual framework, introducing a secondary moderating factor: artificial intelligence. For this analysis, we utilized three AI tools: Semantic Linguistic Analysis, Neural Networks, and Bayesian Networks.

Table 1. AI tools used

	Not Important	Less important	Neutral	Important	Very Important
Semantic Linguistic Analysis	2		6	32	9
Neural Networks		8	9	14	8
Bayesian Networks			9	28	15

Implementing artificial intelligence tools reveals a favorable correlation with profitability across the examined sectors. Interestingly, 73% of participants believe that AI tools significantly improve the relationship between project portfolio management and profitability. Nonetheless, it is crucial to recognize certain limitations tied to semantic linguistic analysis, especially within a specific subgroup of participants. This insight prompts us to take a more nuanced perspective when interpreting the findings. By conducting a more thorough analysis, we can gain valuable insights into how project management professionals perceive various aspects of artificial intelligence, ultimately leading to more informed decisions and improved practices.

5. Conclusion and Limitations

This paper aims to explore how specific artificial intelligence tools can enhance decision-making in project portfolio management. By identifying the potential challenges organizations may face during the adoption of these technologies, we can facilitate their successful implementation. Our focus is on uncovering solutions that empower informed decision-making by clarifying the essential factors and data needed to select strategies that maximize results and align with organizational objectives. Ultimately, this research aims to develop a comprehensive decision-making framework that minimizes uncertainties and enhances the likelihood of achieving success.

To effectively address our issue, we have identified the key factors influencing project profitability, the decision-making elements, and the range of artificial intelligence tools employed to enhance decision-making. We distributed a questionnaire to 93 individuals, with 62 completing it. The results from this qualitative survey highlighted the considerable negative effect that various aspects of portfolio management experts have on project profitability. Notably, 73% of participants agreed or strongly agreed with this statement. The respondents demonstrated alignment with several facets of portfolio management presented in the questionnaire. Moreover, a clear trend emerged, indicating more substantial agreement among the three separate decision-making dimensions concerning their impact on the link between portfolio management and various performance indicators.

Regarding the role of artificial intelligence tools in moderating the relationship between project portfolio management and profitability, a substantial proportion of respondents strongly agreed that artificial intelligence has a positive influence.

It is essential to acknowledge that the outcomes influence how each participant perceives their experiences. This limitation reduces the generalizability of practices based on these unique experiences, consequently constraining the scope of the study. Moreover, the diversity of artificial intelligence tools used by participants further complicates the analysis. Although we have reached theoretical saturation, the small participant pool limits our ability to conduct a more in-depth analysis.

The findings suggest that carefully integrating AI can significantly enhance forecast accuracy, optimize resource utilization, mitigate risks, and uncover valuable opportunities that might otherwise be overlooked. Notably, the success of this transition depends on ensuring high-quality data, maintaining transparency in algorithmic processes, and fostering trust among stakeholders. In summary, artificial intelligence has the potential to be a crucial partner in project portfolio management, creating innovative opportunities while prompting us to consider its broader implications. Advances in technology, particularly in AI, suggest that these emerging tools will have a significant impact on future decision-making strategies. This change will require professionals to remain adaptable and ethical to ensure the success of their projects.

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