A SWOT Analysis of the Role of Artificial Intelligence in Project Management

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Projects are critical to the success of organizations, and therefore improving project management (PM) is imperative. Artificial intelligence (AI) has revolutionized PM, especially in certain key sectors of the economy. This scientific paper explores the role of AI in PM, focusing on the health, energy, and education sectors. Also, the paper presents an analysis of literature and specialized practice to determine strengths, weaknesses, opportunities, and threats regarding AI in PM through the SWOT analysis method. We highlighted the recent advances in AI and the challenges and opportunities presented by using this technology in PM. The study looks at AI's current and future applications in the mentioned sectors. It provides examples of observed benefits, including reduced project duration, cost savings, and increased project success rates. It also emphasizes the impact of AI in the lifecycle of project managers and discusses job replacement concerns. Our findings highlight the potential of AI to bring significant improvements in PM but emphasize the importance of human communication and collaboration in specific fields, such as the healthcare industry. Given the transition to renewable energy sources, it also highlights the need for an adaptable and data-driven approach to energy sector PM.
Keywords: Artificial Intelligence, Project Management, SWOT Analysis

1 Introduction

Project management (PM) has evolved in all development sectors, and recent decades have witnessed increased application in various areas of private and public practice, particularly in the health, energy, and education sectors. A project is "a temporary effort undertaken to create a unique product, service, or result by efficiently organizing available resources to accomplish stated goals." Thus, entities provide complex and advanced technological solutions, systems, or services through projects [1].

Through PM, entities conceive ideas, develop them and offer new products to customers. Projects play an essential role in an organization and are vehicles through which entities increase productivity [2].

AI has the capacity to become a valuable tool for project management professionals during project delivery. This study aims to examine the overall perception of AI and its usability in various crucial sectors of the economy. The objective of this research is to identify common themes of AI implementation in projects rather than focusing on specific individual cases. [2].

The sectors analyzed are health, energy, and education. The role of AI in the PM of these sectors will be analyzed, followed by a SWOT analysis on the impact of AI in the PM of the respective sectors. Thus, we emphasize the need for the continuous development of AI in improving decision-making, influencing project managers in implementing successful projects, and increasing the success rate of projects, in each field analyzed.

AI originated as a specialized subfield within computer science, with the initial goal of making computers and machines intelligent. This intelligence initially focused on areas like "reasoning, knowledge representation, planning, learning, natural language processing, vision, and perception" [3]. Looking ahead, the ultimate aspiration is to reach AGI ("Artificial General Intelligence"), also known as strong AI. AGI represents a more intricate challenge that involves integrating diverse scientific disciplines like mathematics, psychology, engineering, and others to tackle the concept of intelligence more broadly and comprehensively [3].

In the recent years, AI has made remarkable advancements. Present-day AI systems exhibit the capability to handle specific tasks, ranging from driving cars and scheduling appointments to even engaging in conversations on behalf of users during audio calls. These advancements result from various AI subsets and techniques [3].

However, the most significant challenge confronting societies and businesses lies in effectively harnessing the advantages of AI technologies. While AI presents extensive opportunities for creating new products and services and achieving substantial productivity enhancements, it also brings potential risks. The main concerns revolve around the potential increase in unemployment and wealth inequalities that need to be addressed to ensure responsible and equitable AI implementation.

The use of AI will automate mundane, simple tasks, estimating a time, scheduling a project, assigning the most effective team members, and sharing risky information about a project [1].
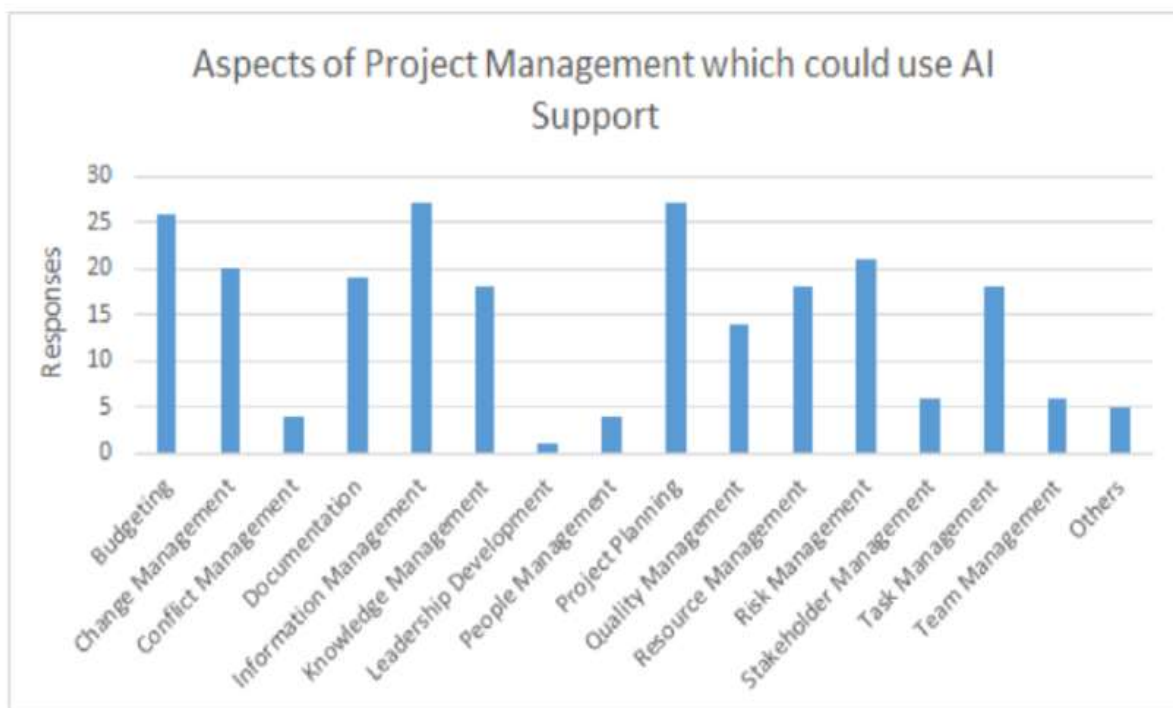

Fig. 1. Aspects of PM that can use support from AI ([25], cited in [26])

As seen in Figure 1, the PM aspects that can use AI support the most are project planning, project information management, budgeting, and project risk management.

Also, analysis shows that using artificial intelligence technologies for project management will be particularly effective in complex projects involving processing and analyzing large amounts of data for decision-making [1].

The destiny of an organization is shaped not just by the projects it pursues but also by the individuals who transform those projects into reality and shape the future. Project professionals hold the key to this transformation, and with adequate support from their organizations, they can turn these ideas into tangible outcomes. By assuming leadership roles and becoming genuine business partners, project professionals can ask the right questions and ensure the successful delivery of business benefits through the projects they manage.
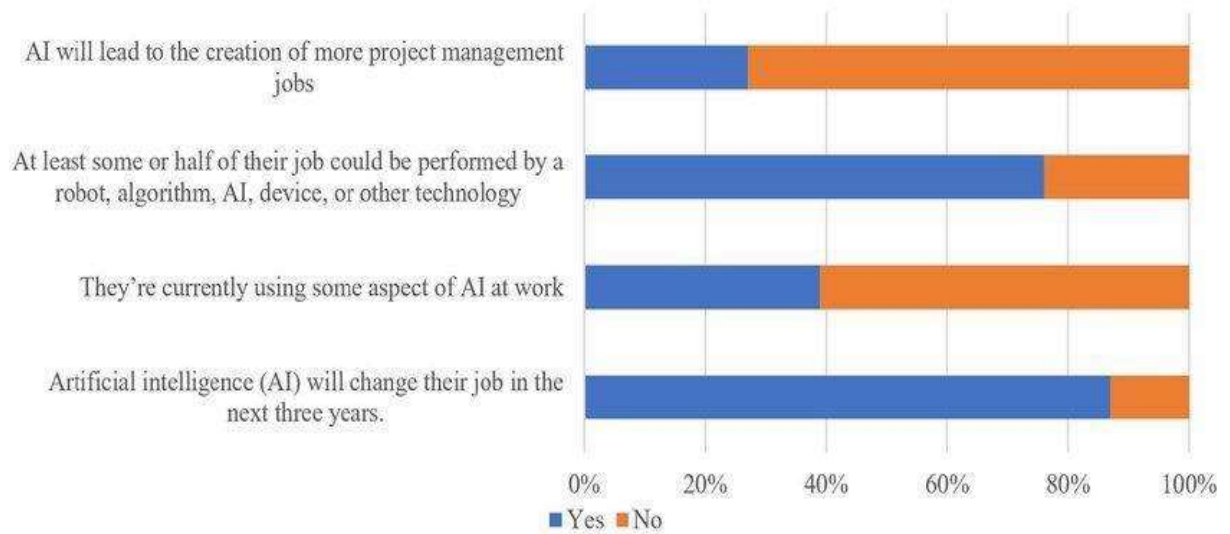
Fig. 2. Atlassian User Review Visualization [4] and Project Manager Profession Pulse Survey [5]

In Figure 2, we have the impact of AI on the life cycle of project managers, according to Atlassian user reviews, following a survey. As a result, we can see that they do not believe that AI will create more jobs in PM, but they also do not use aspects of AI at work. Worryingly, they believe that "AI will replace their job in the next 3 years by about 87%". What is clear from the survey is that users believe that at least half of their job responsibilities can be successfully performed by a robot, algorithm, or AI.

The use of "project intelligence gathering" tools will allow a software project manager to "gain a clear knowledge of the factors that can affect project progress, and this knowledge will enable quick and informed quality decision-making processes that will ensure a performance improved sustainability of the project" [2].

2 Materials and Methods
The research problem. The main question of this study is: "What is the role of artificial intelligence in project management in important sectors of the economy, such as the health, energy, and education sector?".
Research design. The research is based on a documentary study and is exploratory. We discussed the main topics of artificial intelligence in project management.

Our findings were structured on the role of AI in PM.
Sample, population, or subjects. The sample consists of relevant recent papers and studies on the role of AI in PM.

2.1. Data collection
We extensively reviewed and analyzed a diverse array of data sources, drawing upon the valuable insights provided by several prominent and widely recognized journals within the field. The selection of the appropriate journals for this study involved meticulous consideration and thorough evaluation of their reputability, relevance, and scholarly standing.
As a result, we incorporated data from a comprehensive selection of well-established journals that have been instrumental in shaping the discourse surrounding our research topic.
The sources of data reviewed came from the following studied journals:

- Journal of Business Research: a study found that using artificial intelligence in project management can reduce project duration by up to 30% [20];
- Journal of Management Information Systems: a study found that using AI in project management can increase project success rates by up to 50% [21];
- Project Management Institute: a survey found that the use of AI in project

management can lead to increased project speed and efficiency, as well as a reduction in project risk [22].

We conducted an exhaustive review and analysis of data from a diverse range of meticulously studied reports, each carefully selected to ensure the utmost reliability and relevance to our research objectives. The process of identifying and sourcing these reports involved a systematic and thorough evaluation of their credibility, methodology, and alignment with the specific focus of our study.

Through this rigorous approach, we aimed to integrate a comprehensive array of insights and findings from various reputable sources, thereby enriching the depth and breadth of our investigation.

The sources of data reviewed came from the following studied reports:

- KPMG research: according to the research, the organizations that invested in AI saw an average productivity increase of 15% [23];
- Deloitte report: according to the report, the use of artificial intelligence in project management can lead to an average cost savings of 20% [24].

Including data from these carefully chosen journals ensured the reliability and robustness of our research and allowed us to draw from a diverse range of perspectives and methodologies.

Drawing upon data from these extensively studied reports ensured a comprehensive and well-rounded exploration of the subject matter. The integration of findings from these diverse sources enabled us to form evidence-based conclusions and informed recommendations, thereby advancing the understanding of the role of artificial intelligence in project management and its potential implications for future practices.

2.2. SWOT analysis method

The method used for this article is SWOT analysis, which is a simple, versatile, repeatable, and intuitive method for finding the strengths, weaknesses, opportunities, and threats of artificial intelligence in different project management sectors. Moreover, the

SWOT (strengths, weaknesses, opportunities, and threats) analysis has demonstrated its efficacy as a valuable instrument, providing a suitable foundation for identifying existing challenges and outlining prospective courses of action.

To assess the influence of AI on project management, the SWOT ("Strengths, Weaknesses, Opportunities, and Threats") analysis method proves to be a robust and systematic approach. This scientific exploration delves into the application of SWOT analysis in understanding the role of AI in project management, highlighting its benefits and limitations in facilitating decision-making and driving project success.

The SWOT analysis method is a structured and systematic approach to evaluate the internal and external factors that can influence a particular subject or situation. It comprehensively assesses the subject's current state and potential future prospects. When applied to showcase the key role of artificial intelligence in project management, the SWOT analysis can offer valuable insights into its strategic significance. Here is a breakdown of the scientific aspects of the SWOT analysis method:

Strengths (Internal Factors): In the context of AI in project management, strengths refer to the inherent advantages and positive attributes that AI brings.

Weaknesses (Internal Factors): Weaknesses represent the internal limitations or shortcomings of integrating AI in project management.

Opportunities (External Factors): Opportunities refer to external factors that could positively impact the role of AI in project management.

Threats (External Factors): Threats represent external challenges that may hinder the successful implementation of AI in project management.

Nonetheless, the SWOT analysis as a scientific method provides project management practitioners, researchers, and stakeholders with a structured framework to assess the role of artificial intelligence. It helps identify key strengths, weaknesses, opportunities, and threats related to AI adoption in project management, aiding in developing informed

strategies and decisions to maximize its benefits and address potential challenges.

3 Results and Discussions

The results of this research are grouped into two parts. The first part will discuss current and future applications and research on the role of AI in PM in the health, energy, and education sectors. The second part presents a SWOT analysis of the impact of AI in PM of the sectors mentioned above.

3.1. The role of artificial intelligence in the project management of the health, energy, and education sectors

Over the past five years, artificial intelligence (AI) has permeated various industries. Companies' adoption of machine learning and deep learning algorithms has led to significant disruption in many existing sectors. From 2020 onwards, "data collection and storage have become common practice, and sectors that have traditionally relied on well-established databases, such as healthcare, energy, and education, will benefit the most from the solutions provided by AI" [3].

3.1.1. The role of artificial intelligence of the PM in the health sector

The health sector has successfully gathered precise and pertinent patient data, making AI an ideal match for the data-rich healthcare environment.

AI has the capability to facilitate seamless analysis of scan results through image recognition. It has proven to be a valuable aid to doctors in diagnosing symptoms at a significantly faster rate, as AI can process multiple scans much more efficiently than humans. However, even though AI may exhibit higher diagnostic accuracy, it is essential for doctors to closely monitor its output to prevent false diagnoses and ensure patient safety.

The healthcare sector offers a diverse range of applications for AI technology. Predictive analytics is projected to yield a remarkable 25% reduction in healthcare costs by 2023 [6]. By harnessing the potential of predictive analytics, mainly through machine learning algorithms, AI can assist doctors in taking proactive measures to safeguard their patients' well-being. This approach to healthcare is significantly superior to the reactive methods commonly employed today [6].

As of 2020, AI has the ability to make precise predictions about an individual's probability of loan default by examining their financial history. Consequently, this could result in AI systems determining access to treatment based on a person's insurance status [7].

In the healthcare industry, particularly during the execution phase of projects, a distinct set of challenges arises. The process involves multiple layers of stakeholders, each of whom must grant approval for every step. Given the many people caring for a specific patient, human-to-human communication becomes essential in project management. For instance, when a patient is being discharged, effective communication from the discharging physician to the attending physician regarding the patient's precise condition is crucial. Any inaccuracies in this communication could potentially lead to adverse outcomes. This is an area where AI cannot replace the role of humans involved [6,7].

In an industry where patients' lives are on the line, ensuring that projects stay within their scheduled time and budget is of utmost importance. One promising technology in this regard is machine learning-based project management, which is relatively new. By leveraging historical team performance and project progress data, this approach allows project plans to be continuously adjusted and optimized in near real-time. This adaptability helps enhance project outcomes and reduces the risk of going over time or over budget.

3.1.2. The role of artificial intelligence of the PM in the energy sector

The energy sector is undergoing significant transformations that will impact its growth and resilience. Renewable energy (RE) emerges as a powerful resource for driving global development in the future. Given the pressing challenges of climate change, depletion of conventional resources, and escalating pollution, it is imperative that the world fully harnesses the potential of renewable energy

(RE) and avoids squandering this crucial opportunity [10,13].

The energy sector is experiencing significant transformations primarily driven by the rising adoption of renewable energy (RE) technologies with variable energy supply. This shift is accompanied by managing large volumes of data, bidirectional energy flow, and the growing necessity to enhance energy storage solutions [10,13].

As environmental pressures on energy sources increase, it comes as no surprise that renewable energies (REs) are gaining prominence in energy grids due to the human desire for better energy control. The growth of renewable energy is evident, and the key challenge lies in effectively managing it to meet the global demand for clean and affordable energy. Consumers, producers, and governments emphasize the importance of cost-effectiveness and environmental considerations. In this context, solutions must be sought, and artificial intelligence (AI) emerges as a significant opportunity to address the current needs of societies. The widespread implementation of AI offers several advantages, including high-speed predictions and generalizations, flexibility, explanatory capabilities, and symbolic reasoning, which can significantly contribute to overcoming these challenges [11,13].

AI plays a crucial role in the energy sector, mainly due to its ability to handle vast amounts of data and navigate through the growing complexity of energy systems.

Within the renewable energy (RE) sector, AI can significantly enhance various aspects, including improved monitoring, efficient exploitation, enhanced maintenance, and optimized energy storage solutions. Additionally, AI facilitates the implementation of timely operation and control systems to bolster the RE sector. The integration of AI in power systems offers several significant applications in the realm of renewable energy [12,13]:

- optimizing RE generation, considering the variable nature of renewable sources and the fluctuations in supply;
- ensuring network stability, reliability, and operational safety;
- providing precise demand and weather forecasts;
- implementing efficient demand-side management strategies;
- enhancing energy storage operations;
- facilitating market design and operations;
- improving connectivity between network components and microgrids [12,13].

Thus, in the energy sector, the important applications of AI in decision-making PM are "intelligent matching of supply and demand, intelligent storage, centralized control system, intelligent microgrids" [13].

3.1.3. The role of artificial intelligence of the PM in the education sector

The education sector has witnessed a notable surge in the adoption of artificial intelligence, expanding beyond the traditional notion of AI as a supercomputer to encompass embedded computing systems.

By integrating AI into robots, computers, and supporting devices, educators can create advanced robots that significantly enhance students' learning experiences. This AI-powered technology has the potential to positively impact education from its foundational stages, including early education [14].

Certainly, the use of "cobots", where robots collaborate with teachers or fellow robots (cobots), has found application in teaching children various routine tasks like spelling and pronunciation. These "cobots" are designed to adapt to each student's individual abilities, providing personalized learning experiences [14]. Likewise, web-based and online education has evolved significantly beyond merely offering downloadable materials for students to study and complete assignments. Recent studies reveal the integration of intelligent and adaptive web-based systems that dynamically adjust their behavior based on instructor and student interactions, thereby enriching the overall educational experience [15].

Artificial intelligence (AI) has been integrated into various aspects of education, encompassing administration, training, teaching, and learning [16]. These domains form the foundation for comprehending and analyzing the role of AI in education.

While assessing the implementation of AI in

education, with a specific emphasis on administration, instruction, and learning tasks, we only scratch the surface of the implicit research question. The use of AI in education holds the potential to profoundly revolutionize multiple facets of the educational landscape [17,18]. By exploring the diverse applications of AI, we gain a glimpse of the significant impact it can have on education.

Thus, in the education sector, the important applications of AI in PM decision-making are on "administration, instruction, and learning, being explored and explained based on the findings of the analyzed articles" [18].

3.2. SWOT analysis of artificial intelligence applications in the three studied sectors

This analysis employs the SWOT ("Strengths, Weaknesses, Opportunities, and Threats") framework to comprehensively assess the impact of AI in these studied critical domains. By examining the current state and future prospects, this study sheds light on AI implementation's potential benefits and challenges, aiding policymakers and stakeholders in making informed decisions to harness AI's potential for positive societal outcomes.

The SWOT analysis of AI applications in the health, energy, and education sectors highlights the immense potential and complexities associated with AI adoption. By leveraging the strengths and opportunities while addressing the weaknesses and threats, stakeholders can make well-informed decisions to foster AI's responsible and beneficial integration in these critical domains.

Strengths:
- Increased efficiency: Artificial intelligence can automate repeatable processes and labor-intensive tasks, leading to increased efficiency in managing health, energy, and education projects [2,4,6,9,11].
- Optimization of resources: AI in PM can help optimize human and material resources, ensuring a better allocation and efficient use [2,3,6,11].
- Improved analysis and predictability: With the help of machine learning algorithms, artificial intelligence can analyze

and interpret existing data to provide predictions and relevant information in managing projects in these sectors [3,5,6,8,12].
- Automate repetitive tasks: By automating repetitive tasks, AI can free up the time and resources of the project management team to focus on strategic and decision-making activities [3,4,6,9].

Weaknesses:
- Dependence on quality data: Implementing artificial intelligence in project management requires quality data and sufficient quantity to obtain relevant and accurate results. Data availability and quality can be challenging in specific sectors such as health, energy, and education [2,4].
- Significant upfront investment: Implementing AI technologies requires significant investment in infrastructure, software, and staff training. This can be a financial challenge for certain under-resourced organizations and institutions [2,3].
- Reluctance to adopt: A feeling of reluctance or fear in adopting AI in PM can be a limitation, especially in the health sector, where there can be a concern about the confidentiality of data and the impact on the doctor-patient relationship [2,3,4].

Opportunities:
- Better decision-making processes: Artificial intelligence can help make better and more informed decisions in managing health, energy, and education projects by analyzing data and providing model-based suggestions and recommendations [2,4].
- Reduction of human errors: AI can help reduce human errors in project management, providing greater accuracy and consistency in task execution and decision-making [3.4].
- Increased productivity: The use of artificial intelligence can lead to increased productivity in project management by automating tasks and eliminating redundant activities [2,3,4].
- Personalization of services: AI can be

used to provide personalized solutions and services in the health, energy, and education sectors, adapting to the individual needs of patients, consumers, or students [2,4].

Threats:
- Data security: The use of artificial intelligence involves a significant amount of sensitive data. Cyber threats and the risk of unauthorized access to this data can be a major concern and have severe consequences in the health, energy, and education sectors [5,8,19].
- Social and ethical effects: The

implementation of artificial intelligence raises questions and concerns about the social and ethical impact of the technology. The use of AI in project management must be carefully managed to avoid discrimination and injustice [8,19].
- Over-reliance on technology: An over-reliance on artificial intelligence in project management can create vulnerabilities in the system should technical failures or service interruptions occur, affecting ongoing operations and projects [5,19].

The main elements of the SWOT analysis are presented in Table 1.

Table 1. SWOT analysis of artificial intelligence applications in the 3 studied sectors

Strengths	Weaknesses	Opportunities	Threats
• Increased efficiency • Optimization of resources • Improved analysis and predictability • Automate repetitive tasks	• Dependence on quality data • Significant upfront investment • Reluctance to adopt	• Better decision-making processes • Reduction of human errors • Increased productivity • Personalization of services	• Data security • Social and ethical effects • Over-reliance on technology

Continued research, collaboration, and ethical considerations are essential to unlocking AI's transformative capabilities and ensuring a sustainable, equitable, and successful future for society.

4 Conclusions
This research paper has explored the role of AI in PM, with a specific focus on the health, energy, and education sectors. Projects play a critical role in the success of organizations, and improving project management is crucial to achieving desired outcomes. AI has revolutionized project management practices, offering numerous benefits and opportunities for efficiency, accuracy, and decision-making.
The study utilized a SWOT analysis method to comprehensively examine the impact of AI

in the mentioned sectors. The strengths of AI implementation in project management include increased efficiency, resource optimization, improved analysis, and the automation of repetitive tasks. These advantages have shown significant promise in reducing project duration, increasing success rates, and driving cost savings.
However, implementing AI in PM also has its weaknesses and challenges. Dependence on quality data, significant upfront investment, and reluctance to adopt AI technology are some hurdles organizations may face. Moreover, concerns about data security, social and ethical implications, and potential over-reliance on technology warrant careful consideration.
The findings underscore AI's immense

potential to improve project management across different sectors significantly. AI's ability to automate tasks, analyze data, and make accurate predictions presents unprecedented opportunities for enhancing decision-making and optimizing project outcomes. However, addressing the limitations and ethical concerns associated with AI implementation is crucial.

In the health sector, AI has demonstrated its prowess in medical imaging analysis, precision medicine, and drug discovery. Nevertheless, it is essential to strike a balance between AI-driven diagnostics and human expertise, especially when patients' lives are at stake.

In the energy sector, AI's applications in renewable energy integration, demand forecasting, and energy storage optimization offer promising avenues for improving sustainability and efficiency. However, ensuring cybersecurity and addressing workforce concerns are essential for smooth AI integration.

In the education sector, AI's role in personalized learning, intelligent tutoring, and administrative efficiency holds great potential for revolutionizing the educational experience. Still, it is vital to maintain a human touch in education and address societal concerns regarding AI replacing jobs.

This research emphasizes the importance of a data-driven approach to AI implementation in project management. Organizations must prioritize data quality, availability, and security to unlock the full potential of AI technologies. Moreover, the study highlights the need to continuously develop and train AI systems to adapt to dynamic project management environments.

Organizations must encourage collaboration and communication between AI-driven systems and human stakeholders to harness AI's benefits effectively. The seamless integration of AI tools into project management processes can lead to more efficient decision-making and streamlined operations.

As the landscape of AI continues to evolve rapidly, continued research and exploration are necessary to stay at the forefront of AI-powered project management. Collaborative efforts between academia, industry, and policymakers are crucial in addressing ethical, regulatory, and technical challenges related to AI adoption.

In conclusion, while AI presents unprecedented opportunities for revolutionizing project management, it is essential to maintain a human-centric approach and consider the broader societal implications. By navigating AI implementation's strengths, weaknesses, opportunities, and threats through a well-informed and responsible approach, organizations can unlock AI's transformative capabilities to drive successful project outcomes and shape a sustainable future for society. The journey towards an AI-enabled project management future must be marked by cautious optimism, proactive adaptability, and a commitment to ethical decision-making, ensuring that AI serves as a powerful ally in achieving organizational objectives and societal progress.

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