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Artificial Intelligence and Its Impacts on Project Management

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1. Chapter 1: Introduction

Overview

Systems that allow face recognition. AI proponents believe that intelligent computers are the only way to ensure the long-term survival of the human race, while opponents of the technology, sometimes known as skeptics, are concerned ab Technology is being used across various sectors to enhance efficiency and effectiveness while making it possible for management to be trustworthy, secure, and acquiescent. Integrating human skills and technology systems has resulted in improved performance and driven culture, with everyone participating, ensuring continual progress (Munir, 2019). Project management is another field that has found applications for integrating technological and human skills (Edkins, 2017). Project management is distinguished by three pillars, which are as follows:

- The presence of project managers who are competent and powerful.
- Providing project managers with an atmosphere that is favorable to the completion of their work.
- Ensuring that everyone across the company is held accountable.

AI is increasing the capacities of humans. This dissertation investigated the advantages of incorporating artificial intelligence into project management while studying the function that artificial intelligence plays in project management, including how it may be used in project management. In addition, it investigated how AI might improve performance in project management. Project managers have access to various AI-based solutions, such as Chatbots, Stratejos, ZiveBox, Rescoper, Click Up, Clarizen, and PolyOne, to aid them in managing a variety of activities (Lahmann et al., 2018). For example, they assisted the manager in putting together the team working on the project and delegating tasks and duties to each team member (Butt, 2018).

AI technologies are important in ensuring project managers efficiently manage and stick to AI AND ITS IMPACTS ON PROJECT MANAGEMENT 12 deadlines, which is another benefit of using these tools.

The use of Artificial intelligence provides project managers with a variety of advantages. To begin, AI is helpful to project managers because machines lighten the load and relieve some of the strain associated with project management. AI is also beneficial in supplying project managers with correct results since the jobs conducted using AI do not include mistakes or errors due to the absence of human intervention (McCarthy, 2007). Additionally, the use of AI assists project managers with gaining insights and developing strategies. For instance, software that uses AI suggests alternate or extra procedures for project managers working on challenging projects. In addition to assisting project managers in carrying out the activities mentioned above, it improved both effectiveness and efficiency, increasing their productivity. This is accomplished by fostering the managers' creative potential while boosting their emotional intelligence (Abduh & Soemardi, 2002). The fourth industrial revolution, more often known as Industry 4.0, is causing substantial shifts within the human race. Advances in technology are bringing about these shifts. The introduction of coal-powered steam engines marked the first industrial revolution, while the widespread adoption of electrification and automation characterized the second. Subsequently, the third industrial revolution emerged with digitization, closely tied to the rise of the internet (Brettel et al., 2014). According to Rüßmann et al. (2015), the critical aspects upon which Industry 4.0 is being nurtured and developed include technical developments in digitalization, artificial intelligence, augmented reality, big data analytics, and the internet of things, to name a few others. In this new age, there have already been successful tests of self-driving automobiles and robots that mimic human behavior in the real world. As a result of the ongoing digital volution, human-machine contact inside businesses is becoming an unavoidable reality for the future. Consequently, there has been a rapid shift in the requirements placed on the future workforce in light of the real prospect that people and robots may collaborate on specific projects.

For businesses to maintain their competitiveness in a market often shaken up by the introduction of novel products and services, they need to re-evaluate their business methods. According to Albach et al. (2015), managers must adjust their firms under perpetual change, and they state that late arrivals struggle to keep up with the quick speed of changes in the industry. Therefore, the solution is to keep ahead of the curve by studying the possibilities of integrating new solutions, such as those brought on by artificial intelligence, into day-to-day company operations. This artificial intelligence is the key to success.

1.1. Research Background

Within computer science, the subfield known as artificial intelligence is a field in which researchers aim to generate higher levels of intelligence inside computer systems (Nilsson, 2010). AI was defined by Russel and Norvig (1995) as the art of developing computers that execute activities that need intelligence when performed by humans. One possible interpretation of this definition is that it has unparalleled potential for the future of human-machine collaboration; there has been a huge increase in the amount of money invested in research and development within this sector in the last several years. In the first half of 2016, the market was responsible for funding 200 AI-related businesses for USD 1.5 billion (Pan, 2016). Artificial intelligence's practical applications are quite diverse and may range anywhere from clever personal assistants to intelligent out the unanticipated and uncontrolled adverse effects of AI (Gurkaynak et al., 2016). According to Gurkaynak et al. (2016), the three known categories (rule-based, learning-based, cognitive) are used in the scientific classification of artificial intelligence systems. Rule-based systems use a set of predetermined rules to make decisions.

Learning-based systems use machine learning algorithms to learn from data and improve their performance over time.

Cognitive systems aim to replicate human-like intelligence and perception, including the ability to reason, understand language, and recognize objects.

1.2. Research Problem

The primary reason for doing this research was due to the fast-paced nature of the technology sector and the significant progress that has been made in project management. Because project managers' work is so vital, this work must be carried out as effectively and efficiently as possible (Vesma, 2009). As a result of technological advances, several technical improvements explicitly aimed at assisting project managers in this area have been produced (Anastasi et al., 2011). As a result, this research aimed to investigate how AI benefits managers.

1.2.1. Theoretical Gaps

Within computer science, the subfield known as artificial intelligence is a field in which researchers aim to generate higher levels of intelligence inside computer systems (Nilsson, 2010). AI was defined by Russel and Norvig (1995) as the art of developing computers that execute activities that need intelligence when performed by humans. One possible interpretation of this definition is that it has unparalleled potential for the future of human-machine collaboration.

1.2.2. Practical Gaps

In the first half of 2016, the market was responsible for funding 200 AI-related businesses for USD 1.5 billion (Pan, 2016). Artificial

intelligence's practical applications are quite diverse and may range anywhere from clever personal assistants to intelligent systems that allow face recognition.

AI proponents believe that intelligent computers are the only way to ensure the long-term survival of the human race, while opponents of the technology, sometimes known as skeptics, are concerned about the unanticipated and uncontrolled adverse effects of AI (Gurkaynak et al., 2016). According to Gurkaynak et al. (2016), the three known categories (rule-based, learning-based, cognitive) are used in the scientific classification of artificial intelligence systems. Rule-based systems use a set of predetermined rules to make decisions. Learning-based systems use machine learning algorithms to learn from data and improve their performance over time. Cognitive systems aim to replicate human-like intelligence and perception, including the ability to reason, understand language, and recognize objects.

How is AI impacting project management?

1.3. Research Significance

Various applications of artificial intelligence have been created to make the job of project managers easier.

1.3.1. At the theoretical level

It is anticipated that the use of a variety of AI technologies by project managers would render project management simpler than it has ever been before. According to McCarthy (2007), the idea that the limitations and assumptions presented to the project team at the beginning of the project do not alter during the project's lifetime has traditionally been accepted as a given. Since then, this is not the case, and now tracking of all constraints and assumptions must occur for the whole of a project's lifespan; this is where AI finds greater utility (Abduh & Soemardi, 2002). For example, executives seldom know when exactly they will be able to step in and help throughout the process of putting a project into action.

1.3.2. At the practical level

It is anticipated that the use of a variety of AI technologies by project managers would render project management simpler than it has ever been before. According to McCarthy (2007), the idea that the limitations and assumptions presented to the project team at the beginning of the project do not alter during the project's lifetime has traditionally been accepted as a given. Since then, this is not the case, and now tracking of all constraints and assumptions must occur for the whole of a project's lifespan; this is where AI finds greater utility (Abduh & Soemardi, 2002). For example, executives seldom know when exactly they will be able to step in and help throughout the process of putting a project into action.

1.4. Research Questions

The primary research questions of the study were built around the benefits and challenges of IT project management in implementing AI solutions. The research aimed to study the impacts of AI on Project Management itself.

RQ1: What are the most significant challenges that the project team members face while working on the project?

RQ2: When managing a project, do project team members use any AI-based tools? What are the current processes you follow to manage a project?

RQ3: Do project team members believe that AI agents will be effective for their daily activities? If so, what are the areas in the project team that believe AI might give more effective assistance for project management?

1.5. Research Objectives

The primary reason for doing this research was due to the fast-paced nature of the technology sector and the significant progress that has been made in project management. Because project managers' work is so vital, this work must be carried out as effectively and efficiently as possible (Vesma, 2009). As a result of technological advances, several technical improvements explicitly aimed at assisting project managers in this area have been produced (Anastasi et al., 2011). As a result, this research aimed to investigate how AI benefits managers.

1.6. Research Hypotheses

Real-world applications of artificial intelligence are already being used in businesses, where they are automating corporate operations to provide superior customer service. When it comes to commercial applications, on the other hand, the study identified an increasing number of urban legends. The assumptions made for the study are as follows. I. A single AI solution would not work for all use cases, and questions should be asked about what consumers are trying to accomplish. II. The terms Artificial intelligence and machine learning cannot be interchanged. Artificial intelligence (AI) combines robotic process automation (RPA) and machine learning. III. The importance of data cannot be overstated in comparison to that of algorithms. The design of an algorithm is dictated by the data structure they are designed to operate with, which means that, in practice, data is more essential than the algorithm itself.

1.7. Research Model

The current research study utilized the qualitative approach to learn the impacts of Artificial Intelligence (AI) on Project Management methodologies. Qualitative researchers operate under the assumption that people's actions hold deeper meanings beyond what may be apparent on the surface. According to Willig and Rogers (2017), probing into these meanings can offer a greater understanding of pertinent social and psychological processes. This methodology investigates how individuals comprehend and give meaning to their experiences and how their interpretations intersect with broader social and cultural narratives. This study aimed to understand the impact of AI on project management utilization in organizations. Chapter Three of the study presents a synopsis of this project's research methodology and design. It delves into the research paradigm, methodology, design, sample, materials, instruments, and data collection and analysis procedures. Additionally, this chapter briefly touches on the significance of data trustworthiness and ethical considerations.

1.8. Research Methodology

Qualitative methodology is an effective research approach for investigating complex phenomena that cannot be easily quantified, such as the social and cultural implications of AI and the challenges of project management. This methodology explores subjective experiences and meanings, providing a more nuanced understanding of these phenomena (Willig & Rogers, 2017). In the context of AI research, qualitative methodology can be used to examine people's attitudes and beliefs about AI and the ethical and societal implications of AI adoption (Bryman, 2016). Qualitative research can also help identify potential biases and limitations of AI algorithms and systems (Kitchin et al., 2015). Similarly, qualitative methodology can be applied to project management research to explore the social and cultural dimensions of project success and failure.

For example, researchers can use qualitative methods to investigate the impact of cultural differences on project teams' communication and collaboration (Geraldi et al., 2011). Additionally, qualitative research can help identify factors contributing to project failure, such as poor stakeholder engagement and communication (Kerzner, 2013). When conducting qualitative research, it is essential to consider data trustworthiness and ethical considerations (Willig & Rogers, 2017). To ensure data trustworthiness, researchers must demonstrate that their findings are credible, transferable, dependable, and confirmable (Lincoln & Guba, 1985). Ethical considerations must also be addressed, such as obtaining informed consent from research participants, ensuring confidentiality and anonymity, and avoiding harm to participants (Willig & Rogers, 2017). An exploratory design was utilized to provide a theoretical perspective for this study, as limited research was conducted on combining artificial intelligence, information technology, and project management. This gap in the literature is filled by using the qualitative research paradigm. According to Creswell and Creswell (2018), the exploratory design model is advantageous when there is little prior research or theory. It involves collecting data through various methods and analyzing it through techniques such as coding and clustering. The study emphasized the importance of reflexivity throughout the research process, as the study biases and assumptions can shape the interpretation of the data. This study has been carried out by analyzing empirical data from project managers working for various firms via questionnaires and interviews. The scope covers factors such as the identification of issues that project managers confront in the course of their daily operations, the assessment of the awareness and utilization, if any, of artificial intelligence systems, and the subsequent creation of use cases for the prospective inclusion of AI systems into the project management lifecycle. This study does not include the scientific or technological development of AI systems; instead, it focuses only on the theoretical evaluation and empirical analysis of the possible managerial and operational effects of AI systems on project management. This research has also been restricted to the subjective data from project managers regarding the organizational environment in which they were functioning at the time this study was conducted.

The data collected were deidentified, and all names of individuals, organizations, or other participants in discussions were removed. In conclusion, qualitative methodology is valuable for investigating AI's social and cultural implications and project management challenges. By exploring subjective experiences and meanings, qualitative research can provide a more comprehensive understanding of these phenomena. However, researchers must be mindful of data trustworthiness and ethical considerations to ensure the quality and integrity of their research findings.

1.9. Scope of The Study

Project management Artificial intelligence (AI) refers to incorporating a system that can manage a task independently of any support from a human being. Making use of the potential of AI does not imply automating activities; instead, it requires concluding a variety of insights, which results in the formulation of process suggestions, the conclusion of project-related matters, and the disclosure of team insights (Schreck et al., 2018). For instance, because of advances in technology, in the not-too-distant future, there will most likely be a certain kind of technology that can match the appropriate level of expertise and responsibility with the appropriate level of resources. The departments of human resources have been investing more money in technology in recent years, intending to make their recruiting procedures more efficient. The Technology Acceptance Model (TAM) was first proposed by Fred Davis in 1986 in his seminal paper - A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results (Davis, 1986). The main purpose of the TAM is to provide a theoretical framework for understanding and predicting user acceptance and adoption of new technologies. It specifically focuses on end-users' attitudes toward using technology and how these attitudes influence their behavioral intention to use it. Since then, the model has been widely used in information systems and technology research to understand how users adopt and use new technologies.

The TAM is based on the idea that user acceptance of technology depends on two main factors: perceived usefulness and perceived ease of use (Davis, 1986). Perceived usefulness refers to the degree to which a user believes a particular technology will help them perform their tasks more effectively. On the other hand, perceived ease of use refers to the extent to which a user believes the technology will be easy to learn and use. With the increasing use of Artificial Intelligence (AI) in project management, it is important to consider how the TAM can be applied to study the impacts of AI on project management. One of the key factors in the TAM is perceived usefulness, which refers to the extent to which a user believes that technology will help them perform their tasks more effectively. In the context of AI in project management, perceived usefulness could refer to how AI can assist with tasks such as project scheduling, risk assessment, and resource allocation. For example, an AI system that can analyze project data and generate optimized schedules could be seen as highly useful by project managers (Zhang et al., 2021). Another important factor in the TAM is perceived ease of use, which refers to the degree to which a user believes that technology will be easy to learn and use. In the context of AI in project management, perceived ease of use could refer to how easy it is for project managers to interact with AI systems and integrate them into their workflows. For example, an AI system that has a user-friendly interface and can easily integrate with existing project management software could be seen as highly easy to use by project managers (Venkatesh et al., 2003). In addition to perceived usefulness and ease of use, the TAM also considers other factors that may influence user acceptance, such as social influence and cognitive instrumental processes. Social influence refers to the impact that the opinions and behaviors of others may have on a user's decision to adopt a technology. In contrast, cognitive instrumental processes refer to the mental processes a user goes through when evaluating the benefits and costs of using technology (Venkatesh et al., 2003). In the context of AI in project management, social influence could refer to how other project managers' or industry experts' opinions and experiences can influence a manager's decision to adopt AI tools.

Cognitive instrumental processes could refer to project managers' mental processes when weighing the benefits and risks of using AI tools in project management (Zhang et al., 2021). Overall, the TAM provides a useful framework for studying the impacts of AI on project management. By considering factors such as perceived usefulness, perceived ease of use, social influence, and cognitive instrumental processes, researchers can better understand how AI tools are adopted and used by project managers and the potential benefits and risks of using AI in project management. According to Helsgaun (2008), businesses that use AI in their recruiting procedures are anticipated to enjoy a 20 percent boost in employee performance. This prediction is based on the findings of a study that was conducted in 2008. On the other hand, Auth et al. (2019) believed that using AI in recruiting leads to a 4% increase in revenues while simultaneously resulting in a 35% reduction in employee turnover rate. This is essential to significantly reduce the amount of time employees waste sitting around doing nothing. Using AI, project managers can examine the output of their teams' members and frequently allocate work depending on the capabilities of each team member. This eliminates the need for the project managers to put in additional effort. AI is also beneficial in developing a knowledge management ecosystem, which is vital in saving information that can be used even after an employee has left the firm. This is another situation in which keeping this knowledge is essential. According to (Passenheim, 2002), AI is also helpful in aggregating behavioral patterns in the workplace while centralizing employees' knowledge.

1.10. The Suggested Project Structure

Real-world applications of artificial intelligence are already being used in businesses, where they are automating corporate operations to provide superior customer service. When it comes to commercial applications, on the other hand, the study identified an increasing number of urban legends. The assumptions made for the study are as follows. I. A single AI solution would not work for all use cases, and questions should be asked about what consumers are trying to accomplish. II. The terms Artificial intelligence and machine learning cannot be interchanged. Artificial intelligence (AI) combines robotic process automation (RPA) and machine learning. III. The importance of data cannot be overstated in comparison to that of algorithms. The design of an algorithm is dictated by the data structure they are designed to operate with, which means that, in practice, data is more essential than the algorithm itself. Artificial intelligence lacks an essential characteristic of human employees and brings unique qualities, such as empathy and judgment, which machines do not possess. V. Anticipate a change in both culture and capabilities. The widespread use of AI in workplaces will increase the number of jobs handled by apps that are part of a system of record. VI. AI is a disruptive technology that can potentially transform project management practices and processes. VII. The adoption of AI in project management is likely to increase in the future. VIII. AI can improve project outcomes by enhancing efficiency, accuracy, and decision making. IX. The benefits of AI in project management outweigh the potential risks and challenges. X. Project managers and other stakeholders are open to adopting and integrating AI into project management practices.

2. Chapter Two

Review of Literature

2.1. Introduction

Artificial Intelligence has been surfacing for the last few decades, and it is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to biologically observable methods. The statement emphasizes that artificial intelligence (AI) is a scientific and engineering field focusing on creating intelligent machines and brilliant computer programs. AI aims to enable machines to perform tasks that require human intelligence, such as recognizing patterns in data, making decisions, and understanding natural language. AI is closely related to the study of human intelligence, as both fields share a common goal of understanding and replicating intelligent behavior. However, AI does not have to confine itself to biologically observable methods, such as studying the brain and cognitive processes. Instead, AI can use various computational methods and techniques to achieve intelligent behavior.

One of the key approaches to achieving AI is through machine learning algorithms, which enable the system to learn from data and improve its performance over time. Machine learning algorithms can be applied to various tasks, including speech recognition, image recognition, and natural language processing. Another important aspect of AI is its ability to interact with the environment and make decisions based on incomplete or uncertain information. This is achieved through probabilistic reasoning and decision theory, which enable the system to make optimal decisions in complex and dynamic environments.

Overall, the statement highlights the broad scope of AI as a field that encompasses a range of techniques and methods that can be used to create intelligent machines. While AI is related to studying human intelligence, biological constraints do not limit it. It can use various computational methods to achieve intelligent behavior (McCarthy, 2004). The work of Artificial Intelligence started with computer machinery and intelligence, now known as Turing Test, where a human interrogator would distinguish the response between a human and a computer. This test has undergone significant scrutiny since it was published, but this remains an integral part of the history of Artificial Intelligence. Artificial Intelligence can be distinguished into different approaches; one would be Human Approach which involves systems that think like humans and systems that act like humans. The ideal approach should include systems that think and act rationally (Turing, 1950).

Artificial Intelligence (AI) combines computer science and datasets used for problem solving. AI refers to developing computer systems that can perform tasks requiring human intellect, such as visual perception, speech recognition, decision-making, and language translation. One of the primary subfields of AI is machine learning, which involves using algorithms that can learn from data without being explicitly programmed. In machine learning, the computer system is trained on a dataset and then uses that training to make predictions or decisions about new data. This approach is particularly useful when the rules for decision making are difficult to define or where traditional programming methods are ineffective. Another important subfield of AI is deep learning, a specific machine learning approach involving artificial neural networks. In deep learning, the computer system is trained on large amounts of data using a hierarchical approach, allowing it to learn and extract features. This approach is instrumental in image and speech recognition tasks, where traditional machine learning approaches may be less effective. AI is not just a single technology but a combination of different techniques and approaches. By combining computer science and large datasets, researchers and developers can create intelligent systems that can solve complex problems and perform tasks that were once thought to be the exclusive domain of human beings.

Overall, AI in modern technology and its subfields of machine learning and deep learning help solve complex problems. With the continued development of AI, intelligent systems are expected to become even more sophisticated and capable in the years to come (Nadikattu, 2016).

Artificial Intelligence can be mainly of two types of Weak Artificial Intelligence, also called Narrow AI, or Artificial Narrow Intelligence (ANI). In ANI, artificial intelligence is trained and focused on performing certain tasks. This is the primary type of AI that drives the world today and has been used in robust applications, Voice Assistant technologies like Alexa, Siri, and Google Home, and Robot Vacuums like Irobots and Roborocks (Johnson, 2021). The next type of artificial intelligence mainly consists of artificial generic intelligence (AGI) and artificial superintelligence (ASI). AGI is where a machine would have intelligence equivalent to that of humans and will have self-aware consciousness, which also can solve problems, learn, and plan for the future (Brown, 2022).

ASI is where a machine would have superintelligence that goes beyond human intelligence and is entirely theoretical. ASI surpasses human intelligence in all respects. This would mean that machines with ASI would have the ability to understand and solve problems that are currently beyond human comprehension. Unlike human intelligence, which is limited by factors such as biological constraints, ASI has the potential to be infinitely more powerful and versatile. This infinite potential means that machines with ASI could learn and adapt at an unprecedented rate, making them capable of solving complex problems within fractions of how much a human being would take. However, it is important to note that no practical examples of ASI exist. Major advances have been made in AI, but we are still far from achieving a superintelligence level beyond human intelligence. The concept of ASI raises important questions about the potential implications of creating machines that are more intelligent than humans. Some experts have expressed concerns about the risks of creating machines beyond human control, while others argue that the benefits of ASI could far outweigh any potential risks. While there is currently no practical example of ASI, it remains an essential area of research in AI (IBM Cloud Education, 2020).

Artificial Intelligence has become an integral part of many industries, which include information technology, healthcare, cybersecurity, and art. AI mainly works on a set of algorithms for the execution of a problem or a situation, and an algorithm is a set of instructions that a computer can run. Artificial intelligence algorithms can learn from previous cases' data and can be evolved by learning new strategies. Artificial Intelligence has been impacting the lives of people in modern society. It has been helping people in many ways, which include reading out the text loud, auto switch and switching off lights, getting directions to the unknown place, being directed to newer routes when the current routes have high traffic, shopping recommendations, and movie recommendations (Nadikattu, 2016).

2.2. The independent variable

In project management, the four main factors of top priority include time, cost, quality, and scope, which are the most important parameters from the time planning for the project has started (Clegg, 2015). The project deadline is one of the most critical parameters. To achieve the final project deadline, a project manager must work within a particular financial year over a critical period. The amount associated with the project needs to be carefully spent, and phasing of the money for the project is done so that money would be sufficient for project needs. A project manager should have a clear understanding of the financial aspects of the project. This includes identifying the primary source of funding for the project, which could come from internal budgets, external funding, or a combination of both. By understanding the source of the funds, the project manager can allocate resources appropriately and ensure that the project remains within budget. The project manager should also identify the main activities on which the money can be spent. This involves determining the project's scope and identifying the specific tasks that need to be completed.

By understanding the main activities, the project manager can allocate resources effectively and ensure the project is completed on time and within budget.

Furthermore, the project manager should have a clear understanding of the potential revenue that the project is going to generate. This includes identifying the key performance indicators (KPIs) that will be used to measure the project's success. By clearly understanding the potential revenue, the project manager can allocate resources effectively and ensure that the project is financially viable. Finally, the project manager should use discretion for changing the budget details. This involves establishing clear guidelines for making changes to the budget and ensuring that any changes are communicated effectively to all stakeholders. By defining discretion for changing budget details, the project manager can ensure that the project remains financially stable and that any changes are made transparently and effectively. A project manager should have a clear understanding of the financial aspects of the project, including the source of funding, the main activities on which the money can be spent, the potential revenue that the project will generate, and discretion for changing details of the budget. By clearly understanding these aspects, the project manager can ensure the project is completed on time, within budget, and meets the desired goals and objectives (Sajja, 2021). Project scope is defined in the planning stages of any project, and scope greatly helps manage the expectations of clients and stakeholders. Well-defined scope in any project will help to avoid frequent changes to the requirements. The outcomes of the project not being satisfactory, overrunning of the budgets, and the project not being completed within provided timeline and scope will help to analyze what should be allowed in a project and what needs to be executed. (Dontigney, 2017). Scope management helps establish control factors that can address elements that result in changes during the project's lifecycle. Project scope is a crucial component of project management. Project scope refers to the specific tasks, deliverables, and objectives that must be achieved as part of a project. Without a clear understanding of the project scope, project managers may not be able to accurately estimate the time and budget required to complete the project. Project scope forms the basis for every decision that needs to be taken during the project.

It provides a clear understanding of what needs to be achieved and helps project managers to prioritize tasks, allocate resources, and make informed decisions about project changes. For example, suppose a new task or requirement arises during the project. In that case, project managers can evaluate it against the project scope and determine whether it aligns with its objectives and priorities. The project scope also helps to define the project's boundaries and limitations. This includes identifying any constraints, risks, and assumptions associated with the project. By understanding these limitations, project managers can decide how to allocate resources based on project risks. Furthermore, project scope helps ensure that all stakeholders clearly understand what the project aims to achieve. This includes defining the project's goals and objectives and the specific deliverables that need to be produced. By clearly communicating the project scope to all stakeholders, project managers can ensure everyone is working towards the same goals and objectives. Project scope is critical for project management because it helps project managers to understand the time and budget required to complete the project, forms the basis for every decision taken during the project, defines the project's boundaries and limitations, and ensures that all stakeholders have a clear understanding of the project's goals and objectives (Team Clarizen, 2021).

Quality factors are applied to a project's inputs, outputs, and processes. Quality factors refer to the standards or criteria used to measure the quality of the raw materials, the results produced, and the processes used to convert inputs into outputs. By maintaining the quality of these factors, project managers can ensure that the project meets its objectives and delivers value to stakeholders. One of the key benefits of maintaining project quality is that it can significantly reduce costs in the later stages of the project. Investing upfront in high-quality raw materials or components can help prevent issues down the line, such as defects, rework, or delays, which can be costly to address.

By ensuring that quality standards are met at every project stage, project managers can minimize the risk of costly errors or defects and prevent waste. In addition, maintaining quality in a project can help boost stakeholders' confidence in the project's success.

If stakeholders are confident in the quality of the project's inputs, outputs, and processes, they are more likely to support and invest in its success. This can help secure funding, attract new stakeholders, and improve the project's reputation. Maintaining quality in a project can also improve efficiency and effectiveness in the project's lifecycle. Project managers can use high quality raw materials and components to ensure that the project runs at peak efficiency and that processes are optimized for maximum effectiveness. This can help reduce the time and resources required to complete the project and improve the overall productivity of the project team. Furthermore, maintaining project quality is critical for delivering value to stakeholders and meeting project objectives. By applying quality factors to inputs, outputs, and processes, project managers can reduce costs, boost stakeholder confidence, and improve efficiency and effectiveness in the project lifecycle (Sajja, 2021)

2.3. The dependent variable

A project manager cannot solve all the problems about a project; innovative ways and technology will significantly help solve most of the problems the project manager faces. The size and complexity of the projects that are worked on make it essential to use technology. New technology capabilities will help lead to more expectations from customers and senior management, and results can be achieved less quickly than before with proper technology usage (Sajja, 2021). Project managers always focus on communication as the most crucial part of project success. The technology used in the project will help ensure proper communication between all the team members and stakeholders. Using cloud-based project management software that is not only cost-effective but can also be easily managed, allows for mobile access, and helps in precise solutions for the project manager that match the overall project.

Gathering updates for a project is a critical and essential task for a project manager, and after the updates, a project plan is prepared accordingly. The latest reports should be distributed to project team members, and using cloud-based project management software helps project managers check the task status, update project documentation, and send alerts to team members when necessary. In the past days, it was believed that a project team worked effectively only when the team members met face to face. Today with the improvement in technology and the development of new software for project management, organizations can build project teams with employees and contractors across the globe in different time zones. This helps to enhance the speed at which the project is completed. Project team members can use technology to organize all the interactions and share ideas with the broader audience, which helps complete tasks faster (Clarizen, 2019). According to William (2005), businesses are becoming increasingly project-oriented, and the annual global project expenditure has been rising and hitting billions of dollars. The companies primary focus is setting up related factors that can influence the success of a project. Information technology is pivotal in managing a project and helps store a large amount of data. A study reveals that humans are slower when compared to technology systems when converting data into information (William,2005). Major organizations around the globe have been investing in new technologies which can help in perform better and help them compete better. We can say that technology has a positive impact on business performance. Technology must be carefully applied to areas in the organization that will help in performing business operations and helps increase the performance of the business (Prieto & Revilla 2004). Technology usage in projects also depends on how well the technology has been designed. While creating new technological systems, we should always consider designing them according to the project's individual needs (Anantatmuula & Kanungo, 2005).

There are various problems when managing the projects, including failure to meet set targets, time and money, ethics involved while managing the projects, and poor communication skills and relations.

Technology can help effectively tackle these issues (Sajja, 2021). Strong and effective leadership is key to project success. With the help of technology, the tasks associated with the project can be automated, which takes some burden off the project manager. Technology helps automate tasks, send alerts, capture and store data, review historical data, and provide necessary projections. According to Anantatmula (2008), technology is pivotal in helping project managers perform their job effectively and efficiently. Many studies are focused on the importance of the leadership style of project managers. Research conducted by Anantatmula in 2008 gathered structured personal interviews to study the relation amount people-related factors in project management, and a model was developed using interpretive structural modeling methodology. This model helped determine the role of the project manager in managing the project and improving project performance. Results indicated that both leadership and management roles are equally important. This study helped the project manager understand the supportive function of technology to help improve project performance. Technology plays a crucial role in project management by providing various tools and programs that aid in efficient project completion. With the help of technology, project teams can easily collaborate, share information, and manage their tasks, thereby improving their productivity and overall project outcomes. The benefit of using AI technology in project management is the ability to streamline communication between team members. With the help of collaboration software, project teams can easily communicate with one another, share information, and receive feedback in real-time. This not only speeds up the decision-making process but also helps in avoiding miscommunication and errors. Project management programs also provide various features that help manage tasks and responsibilities. For instance, they allow team members to set deadlines, assign tasks to specific individuals, and track progress. This ensures that each team member knows their roles and responsibilities and can work towards achieving the project's objectives effectively. In the coming decade, we expect to see further improvements in project management techniques that will significantly enhance project teams' ability to manage various tasks and responsibilities.

For example, we can expect more artificial intelligence-based tools to automate routine tasks and help predict potential issues during the project's lifecycle. Additionally, we can expect to see more advanced data analytics tools that will provide project teams with insights into project performance, enabling them to make informed decisions. Overall, the role of technology in project management is essential, and we can expect to see further advancements in the future that will help project teams achieve their goals more efficiently and effectively (The Editorial Team, 2019).

2.4. The relationship between the independent and the dependent variables

The world is undergoing numerous changes, with technology constantly evolving and improving people's life. Different organizations are implementing project management technologies that will help improve efficiency and effectiveness while enabling management to be dependable and providing a secure environment. Artificial Intelligence in project management can be viewed as a system that can help activities associated with the project without much human intervention (Edkins, 2017). Artificial Intelligence (AI) has revolutionized the way organizations handle projects. It has the potential to streamline project management by automating mundane and repetitive tasks, which allows project managers and team members to focus on more critical tasks. One of the significant benefits of AI in project management is its ability to analyze data and provide valuable insights. AI algorithms can process vast amounts of data from various sources, such as project management software, social media, and other databases, to identify patterns and correlations. By analyzing this data, AI can help project teams gain insights into project performance, identify potential risks and opportunities, and make informed decisions (Lahmann et al., 2018). Moreover, AI can help automate many routine tasks in project management, such as scheduling, resource allocation, and budget tracking. AI not only saves time but also helps reduce errors and improve accuracy.

Another essential application of AI in project management is its ability to provide process recommendations. Based on the analysis of historical project data, AI can recommend process improvements that can help streamline project workflows and increase efficiency. For example, AI can identify bottlenecks in the project timeline and recommend solutions to overcome them (William,2005).

Additionally, AI can unveil team insights by analyzing team communication and behavior patterns. This can help project managers identify potential issues within the team and take appropriate steps to address them. AI can also help identify high-performing team members, enabling project managers to allocate tasks more effectively. AI in project management can help automate tasks, make inferences from insights, provide process recommendations, make decisions, and unveil team insights.

It has the potential to significantly improve project outcomes by increasing efficiency, reducing errors, and providing valuable insights. With further advancements in AI, we can expect to see even more benefits in project management in the coming years (Schrek et al.,2018). Developing a new technology will help match the right skills and responsibilities assigned to resources in the project. Investing in new technology has increased interest, which will help organizations reach their goals. One of the significant benefits of using AI in project management is its ability to help project managers assign tasks to team members based on their capabilities. AI algorithms can analyze data on the skills and capabilities of team members, including their past performance, training, and qualifications, to identify the best candidate for a particular task. By using AI to analyze the capabilities of team members, project managers can ensure that tasks are assigned to the right person, which can lead to better project outcomes. For example, if a team member has shown excellent problem-solving skills, the AI algorithm can suggest that they be assigned to a task that requires similar skills (Anantatmuula & Kanungo, 2005). Moreover, AI can help project managers study the output of team members, which can help identify areas where additional training or support may be required.

For instance, if a team member consistently produces work below the expected standard, the AI algorithm can identify this and suggest that they be given additional training or support to improve their performance. AI can also help predict team members' performance, which can help project managers plan effectively for resource allocation. For example, suppose the AI algorithm predicts that a particular team member will take longer to complete a task. In that case, the project manager can allocate additional resources or adjust the timeline accordingly. Using AI in project management can help project managers assign tasks to team members based on their capabilities, study the output of team members, and predict team performance. This AI usage can lead to better project outcomes, improved efficiency, and more effective use of resources. As AI continues to develop and become more advanced, we can expect to see more benefits in project management in the future (The Role of Artificial Intelligence in Improving Project Management | LIGS University, 2020). AI is beneficial in creating a knowledge management ecosystem that can be very helpful when an employee is leaving an organization. According to Passenheim (2002), artificial intelligence is beneficial in aggregating workplace behavior patterns and centralizing employee knowledge, which helps improve quality and consistency regarding project management. Artificial Intelligence (AI) has gained widespread popularity among different sectors, and project management is no exception. AI in project management involves using technology and algorithms to automate repetitive and time consuming tasks, analyze data, and make predictions based on historical data. AI can be used in project management to improve behavior in the workplace by automating certain tasks and helping employees to focus on more strategic and creative work. For instance, AI can explore data to identify patterns and trends, which can be used to make more learned decisions.

This can help project managers to identify potential issues before they become major problems, allowing them to take proactive steps to address them. In addition, AI can help to centralize workers' knowledge by creating a knowledge base that all employees can access. This can help to improve collaboration and communication between team members, leading to better decision-making and increased productivity.

Furthermore, AI can also help improve quality and consistency in project management. By analyzing data and identifying patterns, AI can help to identify areas where quality is lacking and provide recommendations for improvement. This can help to ensure that all projects are completed to the same high standards, improving consistency across the organization. Overall, the use of AI in project management can revolutionize how we work. By automating specific tasks, centralizing knowledge, and improving quality and consistency, AI can help improve workplace behavior and drive success across the organization (Edkins, 2017). AI also helps detect warning signs for projects requiring different working conditions and will help prevent mishaps during project implementation. Artificial intelligence (AI) machines are designed to mimic or replicate some of the cognitive functions of human beings. One such function is making decisions and solving problems, which are crucial skills for project managers. Project management involves overseeing complex operations, coordinating resources, and ensuring that projects are completed on time and within budget. AI machines can assist project managers in various ways, such as providing real-time data analysis, identifying potential risks, and recommending actions based on data insights. AI machines can also help project managers automate routine tasks, freeing more time to focus on strategic decision-making (Prieto & Revilla 2004). Moreover, AI machines can learn from past project management experiences and data, which can help them make better future decisions. Machines can become more sophisticated and effectively perform project management tasks over time. However, it is important to note that while AI machines can replicate some cognitive functions of humans, they cannot replicate all of them. For example, AI machines may lack the emotional intelligence and creativity that human project managers possess. Therefore, it is important to balance using AI machines to support project management and relying on human expertise to make strategic decisions. AI machines can copy some cognitive functions of project managers, including decision-making and problem solving capabilities. By using AI machines to support project management, project managers can save time, reduce costs, and improve the quality of their work.

However, it is important to acknowledge that AI machines are not a substitute for human expertise and creativity but should complement human skills (Lahmann et al., 2018). The employment of AI tools in project management has made project management work more accessible, while the project management team gives the constraints and assumptions. Executives are sometimes unaware when an objection might stop a project implementation, and AI tools, when employed by an organization, will have crisis dashboards and, with the help of the executives, identify issues faced by different projects (Tonchia, 2018).

In this manner, AI helps executives identify projects that require immediate actions, and project managers work towards resolving them. This helps reduce the response time for the project issues putting them into an acceptable range (The Role of Artificial Intelligence in Improving Project Management | LIGS University, 2020). It becomes difficult for executives to determine the amount of work that should be done without having labor constraints. AI can play a crucial role in project portfolio management, which involves selecting and prioritizing projects to align with the organization's strategic objectives. Project portfolio management aims to increase the value of the project portfolio while optimizing the use of resources, including people, time, and budget. With the help of AI algorithms, project managers can analyze large volumes of data and identify patterns and trends that can inform decision making. AI algorithms can help select the best projects for the organization by assessing the potential risks and rewards associated with each project. AI algorithms can also help identify the best resource management practices for the project portfolio. For example, AI can optimize resource allocation across multiple projects, identifying where resources are over-allocated or under-utilized. This helps project managers ensure that resources are used efficiently and effectively, leading to better project outcomes. Moreover, AI can assist in forecasting the impact of potential changes to the project portfolio, such as the addition or removal of projects. This helps project managers to understand the potential consequences of decisions before they are implemented; reducing the risk of negative outcomes. AI can be highly beneficial in project portfolio management by analyzing data, identifying trends, and optimizing resource allocation.

By utilizing AI algorithms, project managers can improve the project's probability, increasing the organization's value while ensuring that the best resource management practices are in place. This helps organizations to achieve their strategic objectives and remain competitive in the market (Salini et al., 2015). The following literature review depicts a few types of research done to know problems faced in project management and suggestions for reducing them. AI's growing popularity has led organizations to incorporate AI tools into project management processes and software systems. Still, using these capabilities has created a few challenges for project managers using intelligent project management tools. A study by the author Weese explored the challenges project managers encountered while using artificial intelligence tools and technologies to manage project work. The research was conducted by sampling experienced PMP-certified project managers by interviewing them on the current usage of artificial intelligence tools, adaption to changes, time of adoption of new technology, level of artificial intelligent knowledge, project data, and knowledge management. Project managers were also interviewed about integrating artificial intelligence tools and advising new project managers. The research concluded that project managers encounter numerous problems and individual challenges when using artificial intelligence tools and technologies to manage projects. Exploring these challenges can lead to developing new best practices, methods, and additional knowledge for project managers (Weese,2022).

Erin Brown (2013) studied data-driven decision-making as a tool for improving software development productivity. The author collected worldwide project failure rates based on survey information on project managers' views on user satisfaction, quality of the product, and staff productivity. The result was 24% - 36% of software project success has not kept pace with advances in the hardware.

Software managers have limited knowledge about data-driven decision-making in agile-driven software development projects. Research conducted by Erin Brown mainly focuses on how software managers can use data-driven decision-making to improve productivity.

The study was primarily based on three critical dimensions of software organization productivity improvement: people, processes, and tools. The author concluded that positive change could lead to a better understanding of data-driven decision-making in agile environments, which can help organizations create more products, offer more jobs, and help better compete in the global economy. Jagtiani (2017) conducted a study focusing on enhancing software project outcomes. Many factors influence technology factors were. Some can be known during the planning phase, and others require a real-time gathering and analysis that can last through the project's lifecycle. The data collected is often neglected, misclassified, and misinterpreted during the project execution, which will cause project delays, elevated project risk, and missed business opportunities. Project managers overseeing these projects tend to be given inputs provided by technical leads, which tend to be more technical. In this case, project managers tend to perform more arduous tasks; therefore, more research should go into developing new processes which can help in the proper utilization of real-time project execution data to help project managers attain the outcomes. Davahli's (2020) study investigated the current state of artificial intelligence (AI) applications in project management. The study reviewed 652 articles from various databases and classified them based on the PM knowledge areas, processes followed by project managers, and AI techniques used. The study concluded that the application of AI in project management is in its early stages, and many opportunities remain untapped. Most studies reviewed focused on applying AI to the planning, scheduling, and risk management processes. However, the AI models have not been applied to process groups of stakeholder management, procurements management, and communication management of the project, indicating a gap in the literature. Moreover, the study found that machine learning, natural language processing, and expert systems were the most common AI techniques used in project management. These techniques were used to predict project outcomes, optimize schedules, and identify risks. However, research on other AI techniques, such as fuzzy logic and genetic algorithms, is absent in project management. Overall, the study highlights the potential benefits of applying AI in project management, such as improving project performance, reducing costs, and increasing efficiency.

Nevertheless, more research is needed to explore the application of AI in all PM knowledge areas and processes, especially those related to stakeholder management, procurement management, and communication management (Sajja, 2021). The usage of AI in project management can also raise some ethical challenges.

In the article written by Prieto (2019), research was conducted on projects where a proper scope was provided. Specific AI algorithms have been given where transparency and verification processes are essential for using AI to predict project estimates and performance. Prieto (2019) points out that while significant efforts have been made to apply artificial intelligence (AI) in project management, much of this work focused on performance prediction rather than understanding the changing role of project management within an AI system. As a result, there is a need for more research that addresses the impact of AI on project management systems. The author argues that the role of the project manager is changing due to AI and that there is a need for a better understanding of how project management systems can adapt to these changes. For example, AI systems may automate certain aspects of project management, such as risk assessment or scheduling, which can free up project managers to focus on more strategic tasks. However, this also means that project managers must be trained in new skills, such as understanding and working with AI systems. Prieto also notes a need to understand better how AI can improve project management processes beyond performance prediction. For instance, AI could optimize resource allocation, improve communication and collaboration between team members, or identify and mitigate project risks. Overall, Prieto highlights the need for more research to understand better the changing role of project management in AI systems and to identify how AI can improve project management processes beyond performance prediction. This research will be crucial in helping organizations adapt to the changing landscape of project management and take full advantage of AI's benefits (Prieto, 2019) Gil et al. (2021) highlight the growing importance of artificial intelligence (AI) in various fields, such as science, finance, and engineering.

The authors state that AI has been experiencing tremendous growth in recent years, with many models in the research and development phases. They also note that hybrid computational models of learning techniques are currently in the early development stages and require significant improvement. The authors emphasize that analyzing AI techniques in the current scenario can serve as a starting point for research on AI and product leadership and management. They suggest that AI can enhance decision-making processes, improve product design and development, and increase efficiency in various aspects of product management. Furthermore, the authors argue that AI can enhance customer experience and satisfaction by providing personalized recommendations, predictive analytics, and intelligent automation. They also highlight the importance of understanding ethical considerations related to AI in product management and leadership. In summary, Gil et al. suggest that AI has the potential to transform product leadership and management by providing advanced decision-making capabilities, improving product design and development, enhancing customer experience, and increasing efficiency. Nonetheless, they also stress the need for further research to develop and enhance hybrid computational models of learning techniques and to address ethical considerations related to AI in product management and leadership (Sajja, 2021).

2.5. Conclusion

This literature review has analyzed project management, artificial intelligence, and various studies on applying AI in project management. As the implementation of artificial intelligence (AI) in project management continues to grow, it is important to recognize that many challenges are associated with its implementation. One of the main challenges is that AI is still a relatively new technology, and a great deal of research needs to be done to fully understand how it can be effectively applied in project management. AI is being used primarily to automate routine tasks and optimize resource allocation.

For example, AI can be used to study great amounts of data to identify patterns and trends, which can help project managers make more informed decisions about resource allocation and project scheduling. Additionally, AI can automate tasks such as data entry or report generation, freeing project team members to focus on more strategic tasks. Despite its potential benefits, AI's use in project management has limitations. One of the main limitations is that human interaction is often necessary for a project to succeed. This is particularly true with regard to stakeholder management, which is a critical aspect of project management. Effective stakeholder management requires human interaction and communication to build relationships, manage expectations, and address concerns. Furthermore, there is a risk that over-reliance on AI could result in a loss of critical thinking and creativity, which are essential for solving complex problems and making innovative decisions. This is because AI is programmed to follow predefined rules and algorithms. In contrast, humans can think outside the box and come up with creative solutions to unexpected challenges. In conclusion, while AI can significantly benefit project management, many challenges must be addressed before AI can be effectively implemented. Further research is needed to understand how AI can be applied to project management to maximize its potential benefits while recognizing the limitations and the importance of human interaction and critical thinking. The next Chapter overviews this project's research methodology and design.

Specifically, the Chapter discusses the research paradigm, methodology, design, sample, material, instruments, and data collection and analysis procedures. Further, the Chapter briefly discusses the importance of data trustworthiness and ethical considerations.

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