

*Original Research Article*

# The Relationship between Artificial Intelligence (AI) and Portfolio Management (PFM) Theoretical Study

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Abstract

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**This research aims to assess and evaluate portfolio management and its relation to artificial intelligence. The background of the assignment provides the details of the context and matter of the research, followed by the problem statement. The literature review involves the various solutions and answers to the research questions. The resolution mainly aims to mitigate the issues created by insufficient data for AI. Implementing AI can significantly impact the overall project management aspects involving program, operations, and portfolio management, which can benefit the organization immensely. The theoretical study and framework are considered the two divisions of the research prospect, which helps accordingly identify the various factors related to the input of information and data. The aim and objective of the research can be attributed to the description of the relationship and links between the main aspects like AI, project, portfolio, program, and operational management, which can help assess and analyze the various aspects of AI implementation in project management. PMI methodology in portfolio management is considered an essential factor for the implementation plan in multiple organizations.**

**Keyword:** Artificial Intelligence (AI), Portfolio Management (PFM), Portfolio, Portfolio Management Information Systems (PMIS), Strategic Management (PSM)

## INTRODUCTION

Portfolio management involves selecting, prioritizing, and controlling an organization's programs and projects following its strategic purposes, goals, and resources. The primary goal of the portfolio manager is to maximize the portfolio's value as a whole while ensuring the successful implementation of its projects and programs. The Portfolio Management Process is executing those activities to achieve those goals. Maintaining the portfolio roadmap will not be possible without accurate information collection systems. Artificial Intelligence has become an important and growing field in recent years, with many businesses looking to adopt it in order to streamline and automate their processes, giving them a competitive advantage over their rivals. (PMI, 2013). The concept of artificial intelligence refers to how machines and software

systems simulate human intelligence in order to ease human workloads. AI components can be categorized into expert systems, natural language processing, speech recognition, and machine vision, which can provide a significant competitive advantage to various organizations in the management of projects, programs, and portfolios. (Cioffi et al., 2020). The research intends to investigate the relationship between Artificial Intelligence (AI) and Portfolio Management (PFM) and how to align the functions of portfolio strategic management with artificial intelligence and displays the relationships with portfolios, programs projects, and operations. (Al-Walai et al., 2021). The research involves the main components associated with portfolio management in projects and the association of AI implementation in overall management.

The theoretical framework of artificial intelligence and its relation with portfolio management and project management is considered the main area of focus of this research evaluation and analysis which can help in identifying the research questions (Castro and Ferreira, 2020). The literature review is based on the overall aims and objectives of the research which displays the theoretical study of the topics and their interconnectedness.

### **Problem statement**

One of the biggest artificial intelligence problems is the need for more sufficient data. This problem becomes even more acute when considering the various data types necessary for project and portfolio management. AI for PPM requires data from multiple sources, including finance, customer or product, and external market data. However, this data is often siloed across departments, making it difficult to collect and analyze. An organization could integrate its data into a centralized analytical repository. Business owners generally lack access to the sophisticated and expensive processing resources required for artificial intelligence. The lack of access to AI expertise is another obstacle to effectively utilizing these resources. The poor visibility of the outcome due to sufficient data can be considered a problem that can affect AI, project, and portfolio management in various global organizations (Aziz and Dowling, 2018). This particular problem can be considered the main element of the research which helps in evaluating the various reviewed literature in the theoretical framework (Davies, 2022).

### **Literature review**

There are many other studies that linked artificial intelligence to other determinants. According to (Iwuanyanwu, 2021). A study examined how American companies implement artificial intelligence (AI). A copy of the questionnaire was sent to each of the 330 selected companies, for a total of 330 copies distributed. According to the results, Competitors' activities, Professional bodies, multinational organizations' actions, and customer satisfaction are the most critical institutional factors affecting AI application. The results of this study indicate that AI has a significant positive impact on organizational competitiveness. Considering AI's considerable implications for corporate competitiveness, it makes sense to encourage investment in it. Reference to (Hemalatha and Kumari, 2021). Using artificial intelligence to improve the effectiveness of organizations. Despite its past reputation as science imagination, Artificial Intelligence (AI) has recently achieved numerous

milestones, which have led most professionals and experts to acknowledge that it is essential and inevitable that Artificial Intelligence is integrated into the workplace. Human resource practices and organizations are not exempt from AI's impact on almost every profession and industry. Reference to (Anon., Mihai-Alexandru Cristea), Artificial Intelligence: Improving Organizational Performance, Artificial intelligence is being used in law firms to automate document drafting and research. Using machine learning, computers can quickly extract all pertinent information from these documents. The documents can be given to AI by someone who needs to draft a contract. The computer generates a record automatically with all necessary information included, as opposed to the user writing it out themselves. Although there are studies of the relationship between artificial intelligence and many variables, there need to be more studies linking artificial intelligence and portfolio management.

The components of artificial intelligence like automation computing, robotics and reasoning, and machine learning aspects can be considered as the main elements of creating a proper framework for the creation of relation and communication among the various aspects of project and portfolio management. The literature also provides a detailed evaluation and analysis of the various aspects of portfolio management along with the interconnectedness among programs, projects, portfolios, and operations. Strategic management of the portfolio can be enhanced by the implementation of artificial intelligence elements which can increase the productivity and effectiveness of the programs for the organization managers and project teams (Cheng et al., 2022). Artificial intelligence also affects the development of portfolio charters and the overall roadmap which can also help in managing strategic change in the projects and portfolio management perspective. AI components can also significantly affect the development of portfolio governance management and portfolio optimization. Portfolio, value, oversight, and communication management can also be enhanced and enabled by the proper implementation of AI elements in the operations. Portfolio risks are considered an important aspect of project and portfolio management which can create issues in the overall functionality of the projects affecting the eventual outcome and the timeline (Cioffi et al., 2020). Therefore, the mitigation of risks through the proper implementation of AI aspects on the project portfolio can also be considered a feasible option for organizations undertaking various projects globally. Information system related to portfolio management also has a connection with artificial intelligence and the PMI methodology has been used in the case of conducting this research analysis and evaluation of the various factors associated with the project, portfolio management, and artificial intelligence (PMI, 2013).

## Research questions

Numerous studies have examined the relationship between artificial intelligence and various variables. Due to the lack of research examining the relationship between Artificial Intelligence (AI) and Portfolio Management (PFM), the researcher identified the following research questions:

1. What is the relation between portfolio, program, and project management?
2. How can AI help in managing strategic change in project and portfolio development?
3. What is the role of AI in the development of portfolio governance management and optimization?
4. What is the role of AI in portfolio communication management?
5. What is the role of AI in the management of portfolio risks?

## Research aims and objectives

The main aim and objective of the research are to provide a link between the various aspects of portfolio, project, and program management in connection to the implementation of AI. The various benefits of AI in the various management concepts can be considered integral for evaluating the overall outcome and effectiveness of the implementation program. The effective mitigation of risk through AI implementation in portfolio management is also considered the aim and objectives of this particular research. The provision of international organization examples and illustrations can help in achieving a clear understanding of the various aspects of projects, programs, and portfolios in association with the AI components and elements (Dordevic, 2022).

## Theoretical Framework

### Artificial Intelligence (AI) Definition

Artificial intelligence is the simulation of human cognitive capacities in software. It has been used in various fields, such as business, law, medicine, and journalism. Its use has accelerated rapidly over the last decade, especially in areas that rely heavily on data and analysis. There has been an increased use of AI tools to manage projects and portfolios in recent years. These technologies are having a significant effect on many industries by improving efficiency and productivity. They are also changing how work is done by simplifying specific duties and automating operations (Alshammari, 2022). Artificial intelligence is considered the simulation of various human intelligence procedures by the use of machines and computer software systems which ease the workload

for human beings. The specific applications under the AI components can be attributed to expert systems, natural language processing, speech recognition, and machine vision which can significantly help in providing a comparative advantage to the projects, programs, and portfolio management in various organizations (Wamba-Taguimdje et al., 2020).

### Example of Artificial Intelligence in some countries

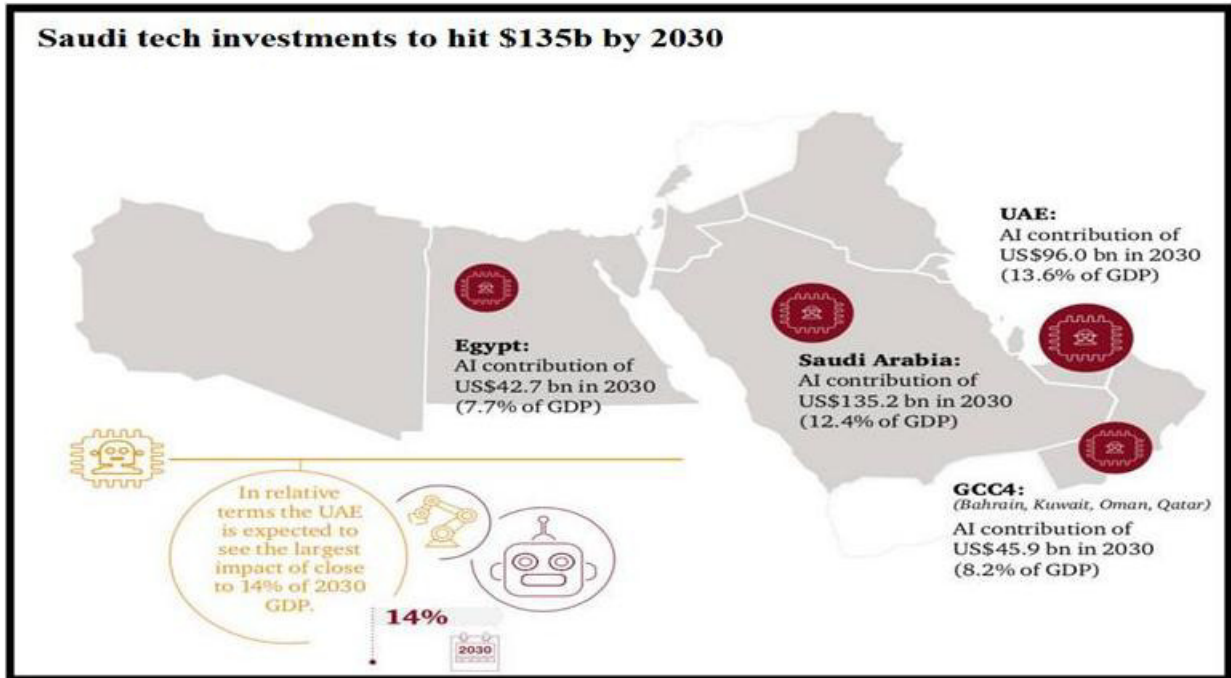
An analysis by PwC indicates that AI will contribute over \$135.2 billion to Saudi Arabia's economy by 2030, which represents 2 percent of the total global benefits of AI. (Alshammari, 2022). In an effort to diversify its economy in the face of falling crude prices, Saudi Arabia announced that it would invest \$20 billion in AI projects by 2030. (thearabweekly, 2020). PwC's report estimates that the Middle East will deliver 2% of the indisputable international advantages of AI by 2030. This equates to \$320 billion. In relative terms, the UAE is projected to have a considerable consequence of nearly 14% of GDP by 2030. AI's contribution to Egypt is anticipated to gain \$42.7 billion by 2030, equal to 7.7% of Egypt's GDP. (saudigazette, 2022). **Figure 1**

### Components of Artificial Intelligence (AI)

There are particularly five primary components that can be associated with artificial intelligence namely learning, reasoning, perception, problem-solving, and language understanding. Learning consists of the initial stage of the development process which involves the memorization of various individual items and different solutions to the problems and issues identified in the projects. Reasoning involves the automated translation and transcription of the various topics of programs and project management in addition to portfolio management which solves the issues of induction in the systems (Dzingina et al., 2020). Problem-solving is the component that deals with the ability to interpret the manipulations and misrepresentations of data within the project and portfolio management system involving various algorithms-based functioning. The utilization of various sensory elements in reasoning and providing value to the aspects of the project components are considered the perception stage of the AI implementation in the portfolio and project management. The understanding of proper means and methods of using the conventional approach in solving the issue in project management can be attributed to machine learning components (Copeland, 2022) **Figure 2**.

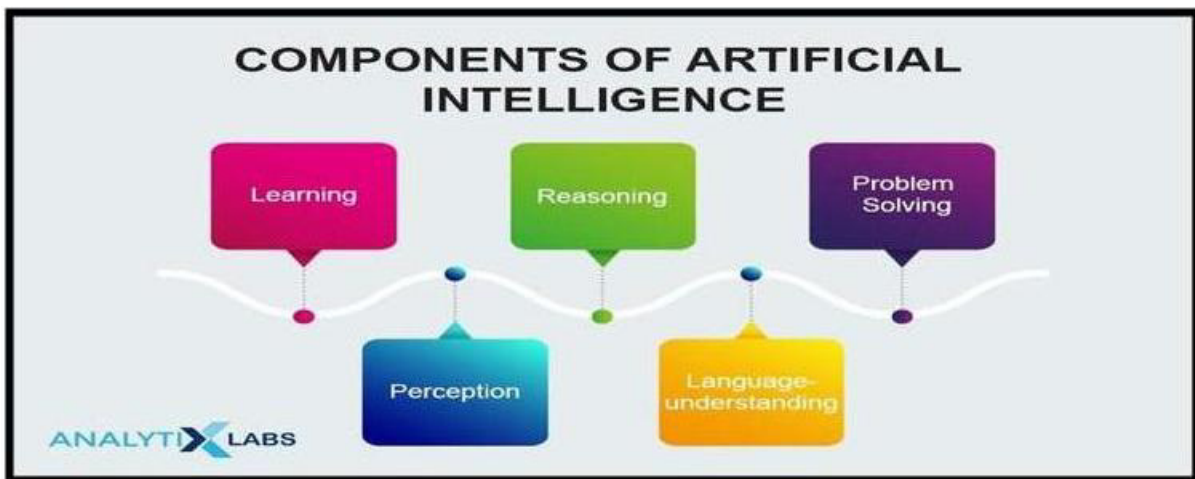
### Portfolio Management Definition

Portfolio management is considered the proper control



Source: (Saudi gazette, 2022)

Figure 1. Saudi Arabia Investment in AI

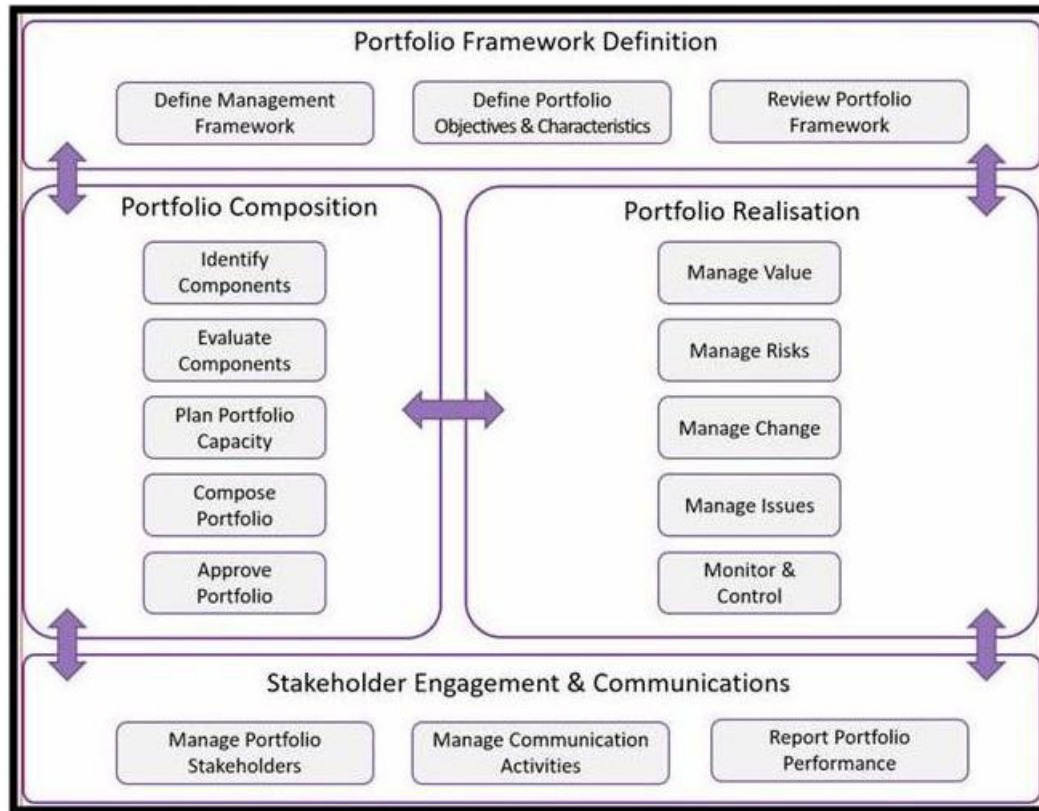


Source: (www.analytixlabs.co.in, 2021)

Figure 2. Component of AI

and evaluation of the programs and projects of organizations by the process of appropriate selection and prioritization of the methods and procedures. The programs and projects should be aligned with the strategic objectives of the organization and should carry the capacity to deliver. The ultimate goal and objective of portfolio management are to create a balance between the application of change strategies and maximize the business prospects which can provide a successful

outcome of the various projects and programs (Gerald, Teerikangas, and Birollo, 2022). PMI portfolio management is considered the main function of portfolio management which involves the centralization of multiple portfolios for enabling the proper execution of making effective decision-making in the projects which can also help in meeting the various organizational goals and objectives. (PMI, 2013). The portfolio management can be defined also as below four steps (Kourounakis, 2019).



Source: (Kourounakis, 2019).

Figure 3. Portfolio Framework

- Definition of the portfolio framework: this practice incorporates the activities related to the definition of the goals, features, and management approach of the portfolio, including the description of the governing bodies (functions) and their commitments, the administration skills needed, the management processes and portfolio artifacts. The framework is subject to periodic review and may be modified in reaction to changes in the portfolio environment or the need for improvement.

- Portfolio Composition: This process includes activities related to identifying and evaluating portfolio candidates to make investment decisions and allocate resources. These are recurring actions conducted periodically and according to the requirements of the portfolio and the organization.

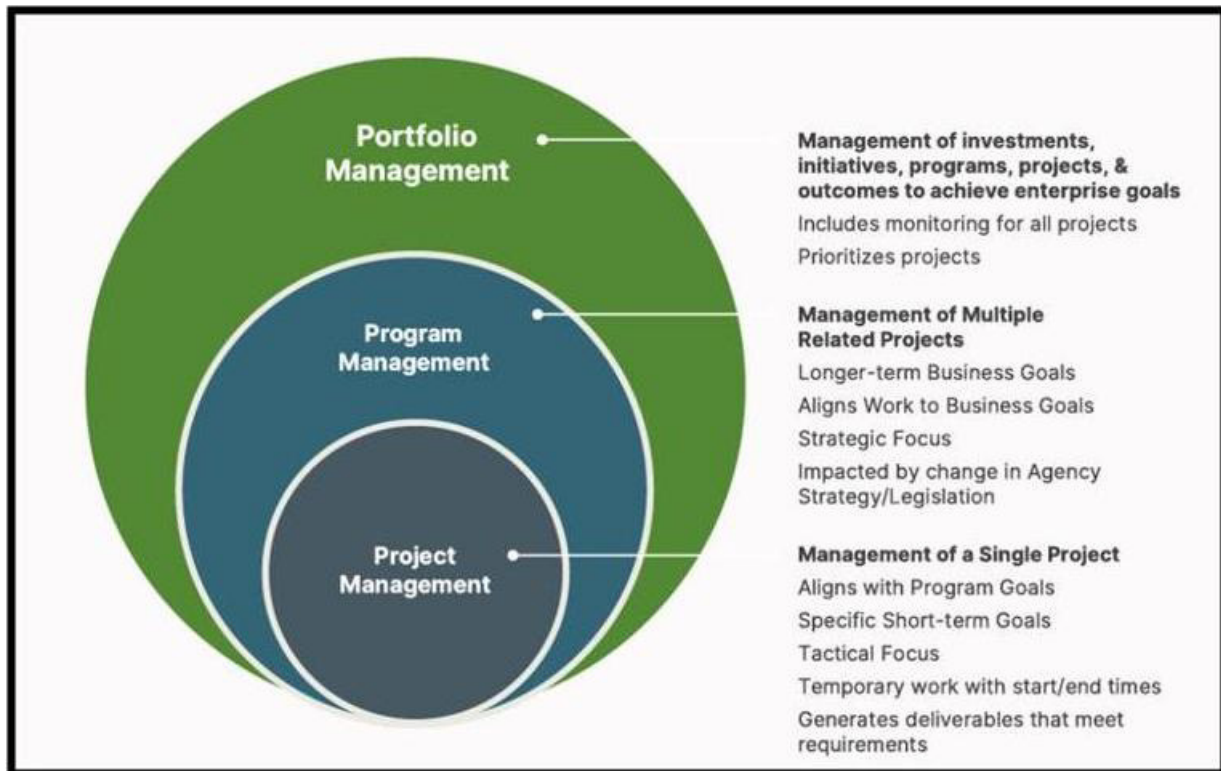
- Portfolio Realization: This process includes activities associated with managing portfolio performance to ensure constituents achieve their objectives and analyzing performance indicators to determine the portfolio's overall health. Portfolio components are temporary, and portfolio assets execute continuously throughout the portfolio's lifetime. All elements of the portfolio are scrutinized for portfolio construction. (Kourounakis, 2019).

- Stakeholder engagement and communication This procedure contains actions associated with effective stakeholder engagement throughout the portfolio management function. All portfolio communication actions, such as notifying stakeholders about portfolio performance, are organized through this approach.

Figure 3

### Portfolio Management, Program Management, and Project Management

Portfolio management is considered an integrated approach that consists of both the project and program elements which can be maximized by operational efficiency bringing a satisfactory outcome for the projects in the global organizational context. Portfolio management primarily consists of the strategic objectives of the programs and the projects which are integrated under the framework of programs within the organizational context. Project management can intersect with the operational management of the organizations and the projects along with the programs mainly focusing on the choice of the right set of programs for the overall project management (Haefner et al., 2021). Projects



Source: (oblollyconsulting.com, 2022)

Figure 4. Relationship among portfolio, program, and project management

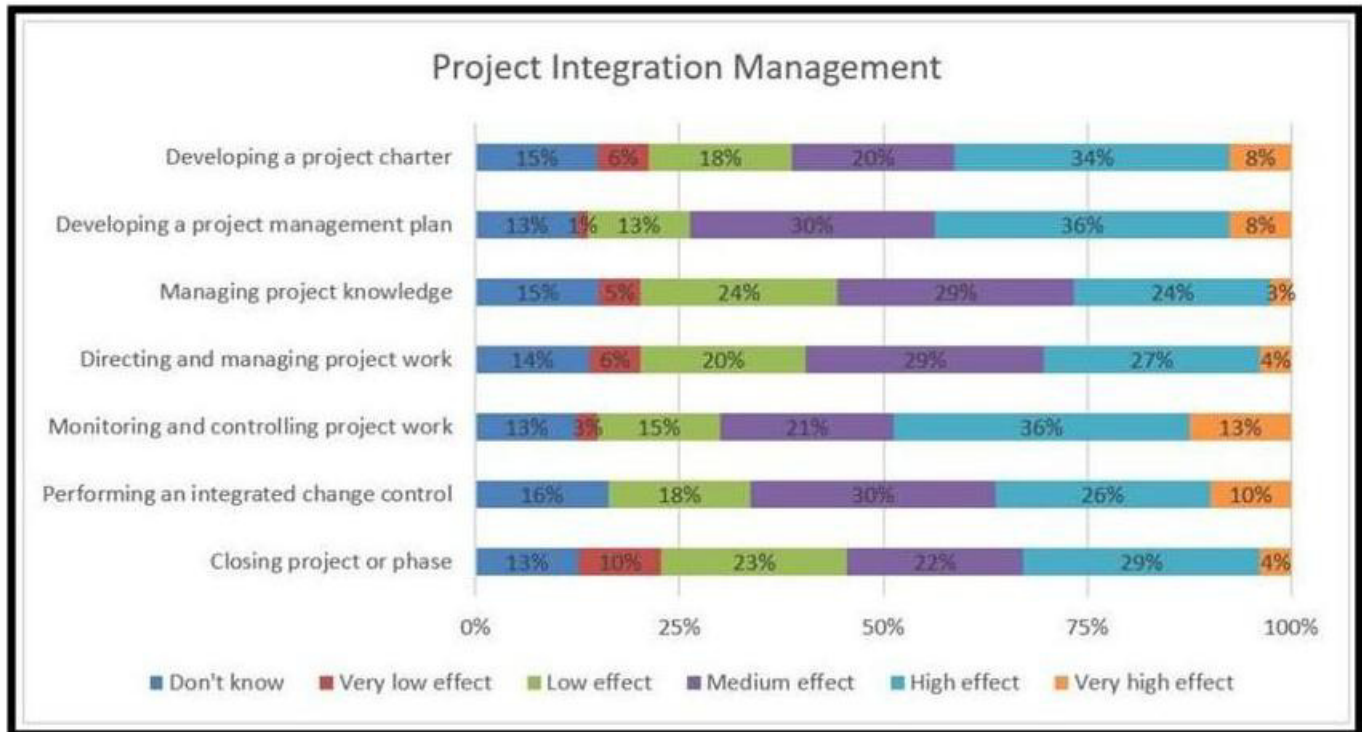
represent the single-focused behavior of the various programs associated with the meeting of various organizational objectives (PMI, 2013) Figure 4.

There is also a strong relationship with the management aspects and concepts of portfolio, program, and projects as they are all controlled by a similar group of projects mostly intersecting with each other. They are also mostly managed and coordinated as a group rather than independently. The characteristics and features of the relationship between the two variables can be considered the main elements which can help in integrating the functions of both variables in the organizational context. Projects, however, have a narrow scope for specific deliverables and functionalities, and programs on the other hand have a change that can meet the benefits of the expectations related to the organizational goals and objective development (Kitsios and Kamariotou, 2021). Portfolio management is primarily associated with business scope and opportunities that changes and transforms according to strategic organizational goals. (PMI, 2013).

#### Artificial Intelligence (AI) and Portfolio Strategic Management (PSM)

The strategic plan for the portfolio is the cornerstone for

building a strategy that aligns with the company's strategic direction as a whole. Artificial intelligence helps the portfolio manager to study current and future programs and projects and determine their suitability for the company before including them in the portfolio by checking all internal organizational variables along with the political, social, economic, and other factors that may affect the investment decision. Therefore, artificial intelligence helps the project portfolio manager build a strategic vision and structure of proposed programs and projects that can achieve benefit, return, and strategic alignment. Artificial intelligence components and elements can be primarily and secondarily used by organizations in applying textual research related to various types of financial reports and helpful documents and statements related to the organizations. Portfolio management experts can implement various strategic techniques to focus on the data implementation aspects rather than the research elements which can provide a wider range of benefits for the organizations (Ko and Kim, 2019). AI can also help in enhancing the access of investors in the financial markets through the automated process of choosing stocks and bonds along with other forms of investments that are primarily based on a larger and diverse set of data. (Zhang and Chen, 2017).



Source: (Fridgeirsson et al., 2021).

Figure 5. AI implementation in portfolio and project integration

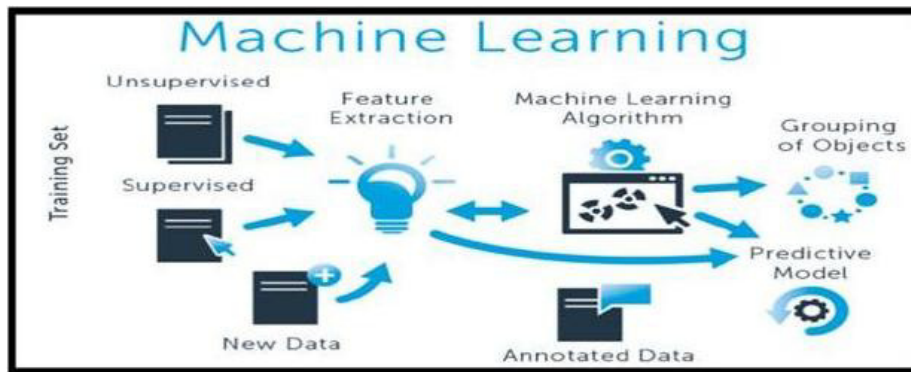
### Artificial Intelligence affects developing the Portfolio Charter and Portfolio Roadmap

AI can significantly help the development of portfolio charters and roadmaps by allowing individuals to arrange for personalized learning and information materials which can help in deciding their objectives and propositions. The individuals can also gain a significant set of information based on the learning styles and preferences of the overall portfolio management. The individual portfolio of the people can be allowed to get a personalized approach and content which can help the individuals in meeting the criteria set by the company. AI can help in revolutionizing the leverage of the technological aspects of project and portfolio management (Krakowski, Luger, and Raisch, 2022). Initial aspects of the AI implementation in the project and portfolio management can help enhance the value creation of the organization's project and enhance the feasibility and viability of the overall portfolio management. Artificial intelligence (AI) is a rapidly-growing field of study and technology. Artificial intelligence affects the development of the Portfolio Charter & Portfolio Roadmap. When creating these programs & projects, it is essential to use artificial intelligence technology to generate project ideas and evaluate their viability. However, this does not mean that project managers need to become computer scientists to

use AI technologies; they can rely on AI consulting firms to help them set up and manage programs and projects using AI-based technologies. Predictive analytics are also provided by artificial intelligence. The system not only gathers information about previous programs and projects but also makes precise projections about the timing and direction of project and program development. Additionally, it can give managers and team members more visibility by alerting them when a project or program is veering off course. (insights, 2022). Figure 5

### Artificial intelligence can help in Manage portfolio Strategic Change

AI implementation in the projects, programs, and portfolio management can allow the change management to optimize the approach and enhance decision-making prospects which can benefit the programs and portfolio management related to the various projects at the organizational level. AI can potentially help in accelerating the change process by utilizing the best available talent and resources within the project management of the organization. The management of the change aspects within the organizational context will become easier for the managers which can help in enhancing the overall productivity associated with change plans. AI implementation in projects, programs, and



Source: (Seedahmed, 2019)

Figure 6. Machine Learning: application of artificial intelligence

portfolio management can allow the change management process to become more efficient and effective. Real-time data and analytics can inform project and program managers of key milestones and critical dependencies, allowing them to better manage resources and identify risks that are impacting the programs. Increased visibility throughout the project lifecycle allows organizations to improve communication and collaboration across the organization and improve decision making.(Zhang and Chen, 2017).

### Portfolio Governance Management and Portfolio Optimization are affected by Artificial Intelligence

Portfolio governance management and optimization can be enhanced by speeding up the decision making which can make more complex problems simpler for the management. Data analysis can become more unbiased due to the simplification of the process of implementing AI (Wu et al., 2022).Machine learning models can prove to be a specific benefit for managers in enhancing portfolio management and optimization as they can combine the aspects with other models or unbiased networks which can eventually help in improving the overall effectiveness of the implementation. Portfolio managers can specifically be benefitted from the aspects of the execution of trade aspects, the generation of various innovative ideas, and the allocation of assets. Sizing the position and testing the strategic effectiveness of the implementation models can also be considered as a benefit of machine learning that can be capitalized on and utilized by the portfolio managers in the project management context. The Portfolio Governance Committee may make numerous strategic decisions, such as postponing a program or project, merging projects, or adding new resources to maximize the benefit. All these decisions are based on data analysis through artificial intelligence systems.(Lock and Wagner, 2018). **Figure 6**

In other words, Portfolio Governance Management

and Portfolio Optimization are affected by Artificial Intelligence. AI can help to identify and correct mistakes, recommend changes in portfolio composition or investment strategy, etc. By making portfolios more efficient and reducing costs, AI can improve the overall portfolio management process, thereby improving the performance of investment portfolios. Sixty-three percent of organizations adopt AI technologies to reduce costs, according to a study by MIT Sloan, IBM, and McKinsey (Insights, 2022).

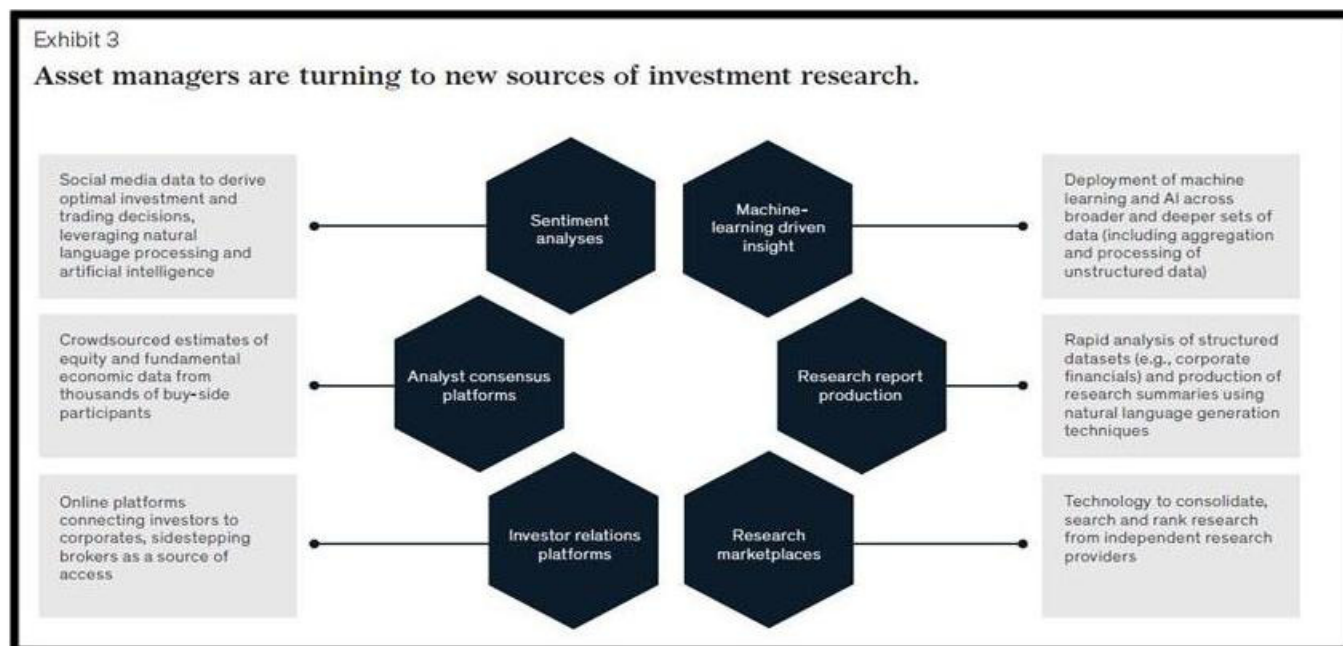
### Oversight of portfolios with Artificial Intelligence

Artificial intelligence in portfolio management can provide oversight to the aspects by providing automated insights related to the management evaluation of reading the portfolio status reports, performance tracking of investments, and recommendations for improvements on the existing portfolios. Implementing artificial intelligence into portfolio management helps the organization make better decisions by comparing the data on the current market situations and making practical recommendations for managing the funds effectively by balancing the risk and return factors to achieve the desired return on investments. This will also help to make the organizations more agile and efficient by reducing the overall investment costs and, at the same time, increasing returns. One of the most prominent challenges organizations face is managing the large pool of their capital and resources, which need to be allocated effectively to generate maximum returns to the investors and maintain competitiveness in the market.(Zhang and Chen, 2017).

### Managing portfolio value with Artificial Intelligence

AI can significantly help in the management of portfolio value by offering solutions that can potentially transform the allocation of credit-related risks and result in the





Source: (Bragg, 2019)

Figure 7. Role of AI in managing Portfolio Value

creation of a fair and inclusive system that is integrated and comprehensive. Portfolio value can be measured by the use of machine learning as a part of the AI components which helps in predicting cash flows and adjusting credit-related scores (www.forbes.com, 2022).

AI can significantly help in the management of projects and portfolio value. AI applications can be used for various purposes, such as optimizing workflow, identifying potential risks and opportunities, detecting activity, etc. AI can automate many repetitive tasks and allow project managers to focus on more strategic activities.(Lock and Wagner, 2018). Figure 7

### Example in Saudi Arabia

PIF giga-projects are designed to create new ecosystems and unlock new sectors in Saudi Arabia and are expected to generate high returns over the medium and long term (PIF, 2022). There are currently four giga-projects in the Kingdom. These projects mainly rely on Artificial Intelligence to increase the expected benefits. PIF reports that artificial intelligence is at the core of Saudi Arabia's flagship business and tourism venture, NEOM, which includes THE LINE, a futuristic city. The planned city of NEOM aims to radically reinvent the way we live, work and govern in a world where the nature of work is changing rapidly. As part of its commitment to future technology, NEOM is using technology to provide an innovative solution to some of the challenges facing businesses today – like managing project schedules,

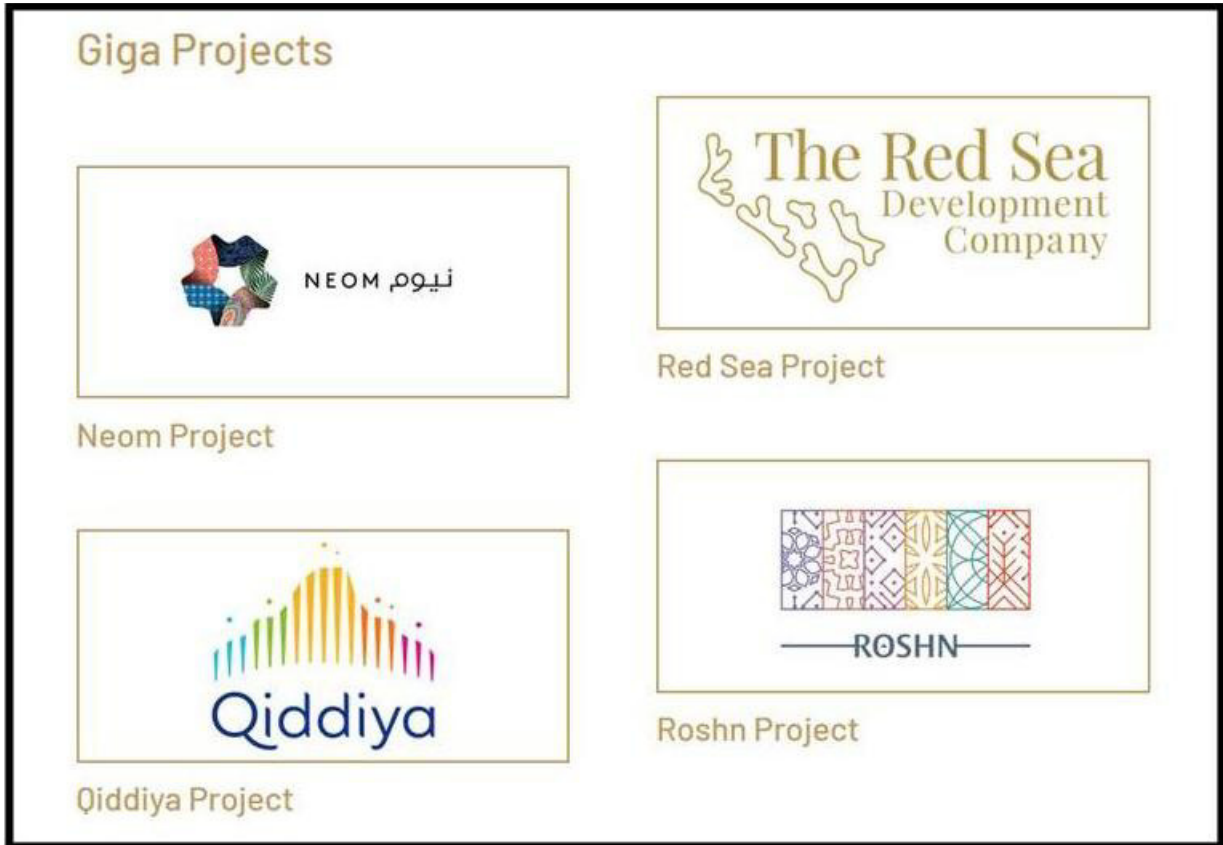
identifying and eliminating bottlenecks in supply chains and optimizing the use of human resources. Figure 8

### Management of portfolio communications can be enhanced by Artificial Intelligence

AI can significantly help in managing portfolio communication management by analyzing the various patterns of speech and detecting the various errors which would have been otherwise overlooked by the human resource aspects. The creation of predictive analysis and various types of Omni channel communication in portfolio management can enhance the communicability and connectivity of the entire system (www.forbes.com, 2022). Customer service and marketing related to portfolio management can also be enhanced and benefit from the application of AI which can increase communicative prospects. Management of portfolio communications can be enhanced by Artificial Intelligence (AI). This allows organizations to automate and streamline the process of managing project communications. It enables portfolio managers to more effectively communicate with their teams and stakeholders, as well as enable better decisions through improved data analysis. Figure 9, 10

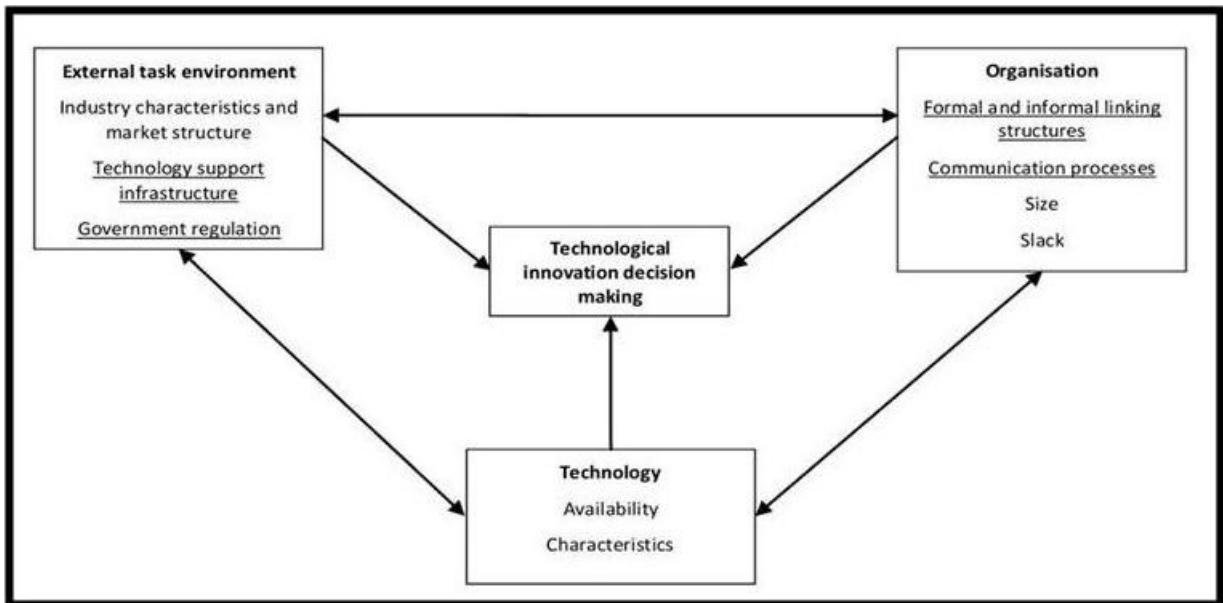
### Managing of portfolio risks with Artificial Intelligence

Managing portfolio risks with Artificial Intelligence (AI) is one of the critical challenges for today's portfolio



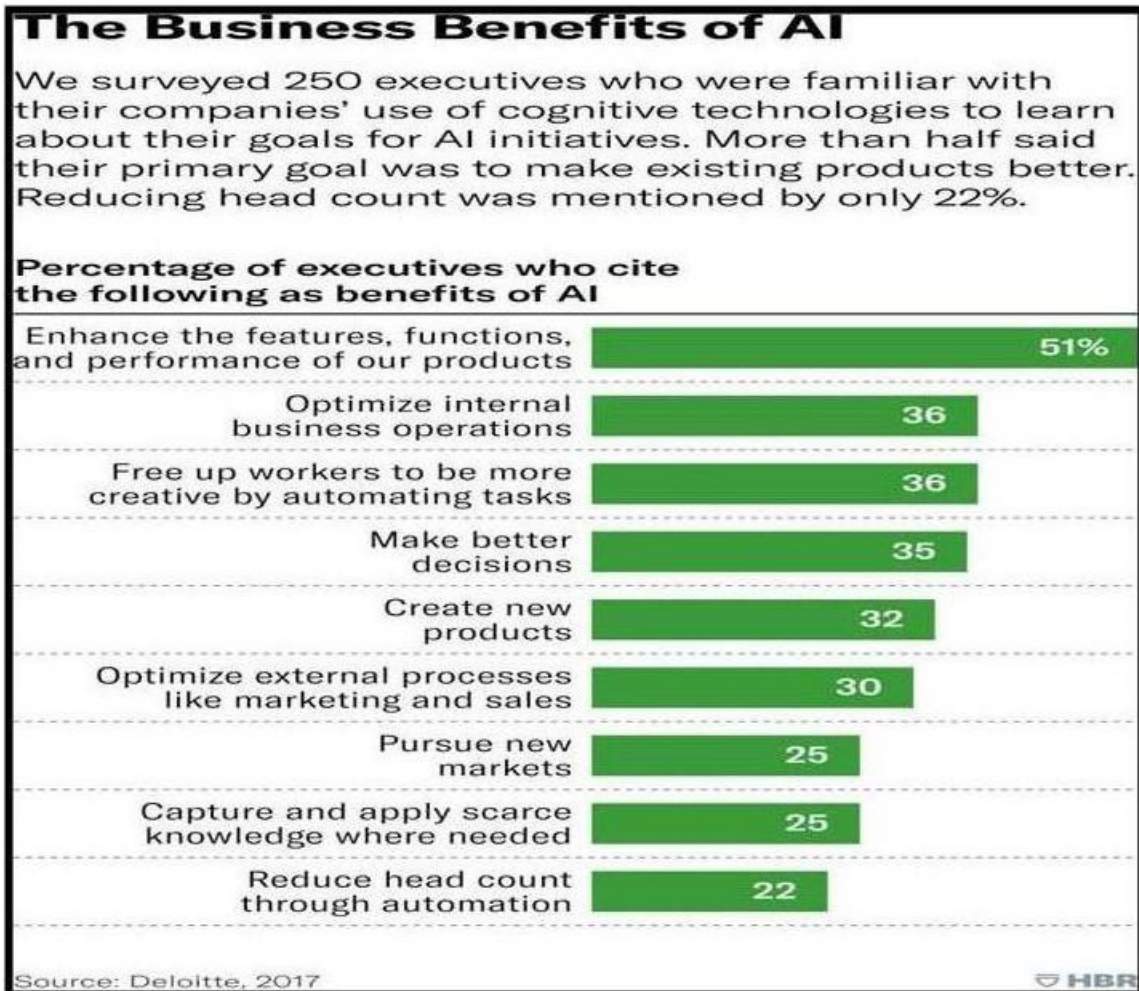
Source: Public Investment Fund (PIF, 2022).

Figure 8. Saudi Arabia Projects



Source: (Zerfass, Hagelstein and Tench, 2020)

Figure 9. Role of AI in managing Portfolio communication



Source: (Davenport and Ronanki, 2018)

Figure 10. Portfolio communication global feasibility

managers. AI can identify potential risks early in the project lifecycle and recommend corrective measures, thereby reducing risk. AI-based tools can also save component managers (program and project managers) significant amounts of time and help them increase work efficiency. Therefore, portfolio managers need to understand the potential of AI technologies and how they can manage portfolio risks and streamline the portfolio management process. AI can help in managing various types of portfolio risks by allocating assets with a specific risk index. This index contains a minimum risk element in the overall portfolio-based investments and provides a higher set of guaranteed returns. The facilitation of the fundamental analysis by the AI components and elements through textual or quantitative data analysis can help in the generation of novel investment strategies for the portfolios. AI also provides the ability to evaluate and analyze unstructured data related to the organizations' operational behavior in the context of risk management

and elimination (Wu et al., 2022).

### **Incorporating Artificial Intelligence into portfolio management information systems (PMIS)**

A portfolio management information system contains various features and functions that are derived from the AI systems that make a clear relationship between the two aspects and variables. The multiple elements of AI, like machine learning and reasoning, can be included in the portfolio management information system, which helps analyze the implementation's deeper aspects. It can provide managers with high-quality information and reliable results for effective decision-making and planning. Therefore, a project portfolio management information system and the inclusion of AI features can help portfolio managers make better decisions and provide their outputs with higher quality and efficiency. It

can also help them achieve the organization's goals and fulfil their objectives more effectively. Thus, the implementation of an AI system in a project portfolio management information system can be beneficial to the project managers as well as the organizations they work for.

## CONCLUSION

Artificial intelligence is closely related to the aspects of portfolio and project management which helps in evaluating the various benefits of implementing AI in project management systems. Differences and the relation between projects, programs, and portfolios can be measured by the proper implementation of AI in the organization's operations and functions. PMI methodology is an important aspect of portfolio management that helps in assessing the integrated benefits of AI implementation in various types of projects and programs. Strategic management and change in the organizations can be maximized by the implementation of various components of AI which can also help in enhancing the productivity of the organizations. Optimization and management of governance in the portfolio systems can be achieved by AI elements which can also provide valuable oversights and insights into the entire procedure and function. Portfolio value can also be managed by AI implementation as it can help in providing various types of benefits to organizations. The portfolio risks can be mitigated and addressed with the help of various AI inputs which can help in creating a framework for effective solutions.

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