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management**

تطبيق الذكاء الاصطناعي في مشاريع الحكومة السعودية

Applying artificial intelligence in the Saudi Arabia government projects

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Abstract:

Artificial intelligence or AI is an effective technology providing a number of opportunities in different sectors. It helps individuals to perform various activities more efficiently compared to human beings. Among different roles of artificial intelligence, it has a great role in project management. The study includes the importance of AI in handling government projects especially in the context of Saudi Arabia. In this study various advantages of AI such as data analysis, real time tracking, predictive analysis, automation, etc. is discussed. It is effective for a project manager to initiate an appropriate decision-making approach for handling the project. On the other hand AI has also a significant impact on risk assessment and risk management in a project. With the help of different theories and frameworks various challenges and opportunities of AI integration in project management are demonstrated in the study. There are also insights for implementing the process of AI in handling Saudi Arabia's government projects as well as handling possible risk involved in it. The study includes both qualitative and quantitative research methodology where the primary data analysis reflects perspectives of individuals for AI in project management are analyzed in this study. The discussion portion highlights the findings of the data for understanding the role of AI in project management. Various recommendations are also provided to get better insight about the AI integration process in government projects in Saudi Arabia.

Chapter one

1.1 Introduction

Project management is the process of managing a team's efforts to fulfil project objectives according to barriers such as finances, time, and scale. Nowadays, AI has mostly used technology in project management designed to help with ongoing activities such as setting goals and planning (Gil et al., 2021). Artificial intelligence creates and optimizes timetables for projects from the start according to available resources and other information. AI approaches dominate project management in Saudi industries such as construction, information technology, and the **government sector**. **Saudi Arabia's Vision 2030** is a strategy framework that aims to reduce the country's dependency on oil, diversify its economy, and grow public service areas (Khan & Iqbal, 2020). It involves sectors like medical care, educational needs, better infrastructure, and travel. That acknowledges the need for integration of **Artificial intelligence in project management** for better workflow of government projects. The study aims to examine how AI can be successfully implemented in various government sectors to boost productivity, enhance government services and encourage innovation. The research also involves analysis of existing AI usage, identification of difficulties, and providing recommendations or strategic solutions to mitigate the issues.

1.2 Context of the Research

Artificial intelligence is becoming necessary for improving government projects, especially in Saudi Arabia (Alshahrani et al., 2021). It is found that the Saudi Arabian government has initiated **Vision 2030**, which aims to modernize the public sector. It also aims to improve the efficiency of government projects by scaling large projects at one time. Artificial intelligence is effective in transforming the role and allows **informed decision-making**. The effective use of artificial intelligence in improving government projects includes optimizing resource allocation and enhancing project outcomes. Integration of artificial intelligence in project management for the government sector allows for predictive analysis that has chances to

minimize potential risks and critical issues. It is analyzed that the successful incorporation of artificial intelligence is effective in **boosting productivity**, enhancing public services, and stimulating innovation. The research also investigates the option for government operations to implement artificial intelligence there, identifying problems, and suggesting strategic solutions. Another significant benefit of Artificial intelligence is that it has the capacity for optimizing resource allocation in government project management. In the context of the Saudi Arabian government, there are lots of issues in the government project such as **ineffective use of resources, and short deadlines**. So, it is impactful for the Saudi Arabian government to implement Artificial Intelligence to examine the availability and usage of their resources. It is also significant for contributing to cost savings, on-time project completion, and minimal wastage of resources. Artificial intelligence for project management of the Saudi Arabian government helps to fulfil resource requirements, planned work based on resource availability, and reallocation of resources in a dynamic environment. It is highlighted that artificial intelligence allows for transparent **collaboration and communication** between stakeholders. Effective collaboration for government projects allows for frequent involvement between different departments such as contractors and outside organizations (Lehtinen & Aaltonen, 2020). Artificial intelligence also allows for tracking project histories which is beneficial for exchanging information. It guarantees that all stakeholders have access to the project data. It is also included that artificial intelligence allows for analyzing communication patterns during project management. It is beneficial for **misunderstandings** or barriers, which allows project managers to resolve problems before they occur. However, the implementation of artificial intelligence includes multiple barriers and technological issues. It is demonstrated that artificial intelligence for government project management requires a trained workforce and efficiency over AI tools (Shang et al., 2023). It is the responsibility of stakeholders and project managers to effectively use artificial

intelligence (AI) technologies. Saudi Arabian government must allocate resources for the training and development initiatives among the stakeholders of artificial intelligence. **Privacy and data security** are also significant issues for implementing artificial intelligence in the government projects of Saudi Arabia. This is because sensitive data related to government projects has a threat with cyber risks. So, it highlights that stakeholders have to guarantee the ethical use of artificial intelligence to minimize the misuse or illegal access to Saudi Arabian's government projects. It is concluded that the implementation of artificial intelligence in Saudi Arabian government projects can become more successful through the efficient and effective application of AI in project management.

1.3 Background of the research

Traditional approaches in government projects are the old ways of creating and managing projects without taking advanced technological help (Glyptis et al., 2020). This is an effective and most widely accepted method worldwide but has major drawbacks also. Digitalization worldwide has changed the perception of project management in every sector and accepting technologies helps in this case to solve issues more effectively. Traditional methods to manage big government projects take time to complete and create many errors that can be avoided with technological interventions. Implementing the technologies in governmental sectors like health, education, construction, and others can open new paths to improve services. Various sectors in government projects need different types of modern technologies like AI to successfully manage tasks. The government has a vast collection of citizen data that can be used as big data to understand each project outcome and calculate completion timing and other important factors (Allen et al., 2020). Restricting the key personnel in the Saudi Arabian government can reduce the factors of improvement in project management. Artificial Intelligence with huge data sets can help to make correct decisions for government personnel in complex project problems. Effective project management also requires a huge

amount of budget and often resources are misused due to miscalculation or proper management. This fault can be managed with the help of AI for future project management. Modern or digital approaches are gaining popularity in Saudi Arabia as more people are knowing about this subject. This can be beneficial for the government as people are becoming aware of these technological advancements.

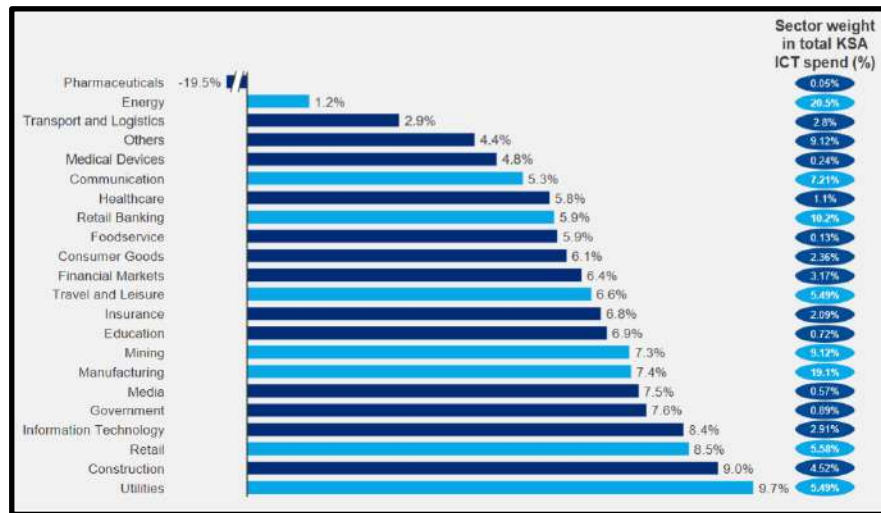


Figure 1.3.1: Information and Communication Technology Growth in Different Sectors of Saudi Arabia

Source: (MCIT, 2023)

Government data of Saudi Arabia support the statement that the country is embracing digital enhancement in many sectors. Statistics show the growth of government sectors using technology became 7.6% in the year 2020 where they spent 0.89% more resources on technological advancements than the previous year (MCIT, 2023). As the whole country is going towards digital innovations the government should use this for its higher advantages. The study by identifying these factors can focus on employee encouragement and help to reduce costing of government projects with the help of AI implementation. This technological advancement by using big data can reduce project costs and effectively reduce human errors. Combining with traditional project management methods this hybrid approach can be beneficial for the Saudi Arabian government to achieve e-government planning.

Artificial Intelligence being an analytical machine algorithm is less prone to error, and bias and can make better decisions than humans (Schwartz et al., 2022). This is an important criterion of this technology to include in government project management. Reducing corruption in government and bringing more transparency requires more technological intervention in the system. This can be managed by AI if successfully implemented. AI also reduces financial risk, corruption and misallocation of resources by a great percentage.

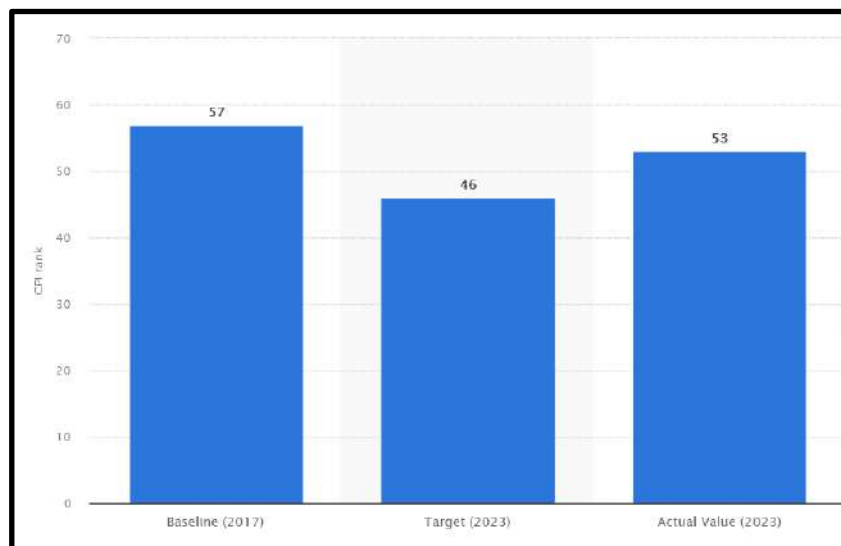


Figure 1.3.2: Corruption Perception Index of Saudi Arabia

Source: (Statista, 2024)

Data shows Saudi Arabia ranks 53 positions in the corruption perception index or CPI in 2023 where the global average is 46 (Statista, 2024). This shows that the country has not achieved an average score globally. This is an indication that Saudi Arabia needs to bring more transparency in governmental project management. AI can help in this scenario by reducing human intervention and minimizing bias to achieve a global score in CPI. The study, through bringing information about this ranking showcases the importance of research on this subject. Minimization of these risks can also improve the decision-making process by the organizations and other stakeholders linked with the selective government projects. The government also needs to focus on **Machine Learning** and **Natural Language Processing**

techniques as they are integrated parts of AI. These technologies can help to understand public demands and other important key factors necessary to enhance transparency in the project management process. The government of Saudi Arabia initiating many digital approaches to improve technological advancements. Implementing AI in project management can create more scope for managing successful government projects, completing them in time and developing necessary projects.

The study is conducted to showcase the existing issues of AI implementation in government projects. Problems like traditional approach, resource constraints, budget, and lack of knowledge are some of the issues present in this aspect. To mitigate these issues the study needs to dig deeper to clearly understand the problem background. Understanding these problems can clear a view through which the issues can be solved. Implementation of AI in government projects can help Saudi Arabia reach the goal of “**Saudi Arabia Vision 2030**” more efficiently (Alqublan, 2021). As this goal created by the government does not involve any single sector, using AI vastly can smooth the way to achieve a more robust improvement of government projects in the country.

1.5 Research Problem

Traditional methods for handling government projects in Saudi Arabia face various obstacles decreasing the efficiency, accessibility, and overall efficacy of public administration. One of the major concerns is **inaccuracy in project execution and supervision** (Zadeh et al., 2024). Another key difficulty is the **absence of flexibility in government activities**. Therefore, the Saudi Arabian government should take initiatives to eliminate errors in data input, misunderstanding, and wrong guidance. It can have major consequences such as delays in projects, price hikes, and weakened job quality.

As the main sponsor and beneficiary of these programs, the government is a key stakeholder in this aspect. Project Directors and Teams are responsible for project planning, execution,

and evaluation (Nicholas & Steyn, 2020). Implementation of AI can scan enormous amounts of data to deliver immediate information and **statistical analysis**, allowing for **better decision-making** and mitigating issues (Li et al., 2022). AI can also improve communication by automating reporting, enabling real-time collaboration tools and decreasing the risk of errors and miscommunication. Routine tasks can potentially be handled with AI, allowing human resources to focus on more strategic areas of management of projects and enhancing overall efficiency. Despite such benefits there is a lack of the practical guidance of implementing AI in the Saudi Arabian Government project which is the main challenge of this research. The study will explore the possible solutions of this issue to increase the credibility of this study.

1.7.1 Scientific Importance

1.7.1.1 Knowledge about contribution of AI research in the Public Sector

The study provides a great knowledge about the AI's integration approach in large-scale public sector projects especially in Saudi Arabia. It also provides insight into the implementation of AI in government projects along with its benefits in project management. Through this study, individuals can also understand the ways AI can help to enhance the structure of government projects through optimizations. This study comes up with various theoretical and practical studies through which one can be aware of the subordinate barriers of implementation and operations of AI in different public sector projects. The study also reflects the importance of AI in the effective decision-making process, forecasting risk management approach in public areas.

1.7.1.2 Framework for Integration of AI

The study includes various frameworks which help to identify potential challenges and opportunities of AI in government projects in the context of Saudi Arabia. These particular frameworks are essential to understand the role of AI in resource utilization, task automation,

predictive analytics, etc. in large-scale projects that can be aligned with the specified governmental goals (Abdellatif & Alshibani, 2019). This study also provides insight into the implementations of AI scientifically in the public sector projects which are further scalable to various government projects globally.

1.7.1.3 Data-driven decision-making models

The study demonstrates the role of AI in data analysis, predictive analytics and real time tracking in various projects that further emphasize the decision-making techniques of public sectors. The study is also essential for understanding the importance of AI in processing data and data driven decisions making models effectively. The study also provides insight into the outcomes of the AI implementation in projects of different public sectors.

1.7.2 Practical Importance

1.7.2.1 Improving operational efficiency

Implementation of AI in the project management of the Government of Saudi Arabia is essential to reduce overbudgeting, time management and handling operational processes like allocation of resources can be streamlined minimizing the dependencies (Alannasary & Hausawi, 2019). This streamlining can help the government in the case of large-scale projects which require enough planning and execution process helping in increased efficiency and better results.

Improvement of Transparency and Accountability 1.7.2.2

This study highlights that through the integration of AI in government projects project managers can track project progress, reduce resources wastage and gain stakeholder trust. It further enhances accountability and transparency in the project while gaining the trust of the stakeholders by providing transparency and accurate progress (Alshihri et al., 2022). This improvement also minimizes the chances of fraud and corruption as well as builds trust

between the government and the public. The study also gives knowledge about the ways to mitigate the barriers that come along with this advanced integration.

1.7.2.3 Risk Management and Strategic Planning

There is also great impact of AI in risk assessments of public projects through real time tracking and predictive analysis (Alsuliman, 2019). AI can also provide systematic solutions to managers to mitigate potential risks and help to complete the project on time by analyzing the traditional risk involved in project management. This study further highlights the potential possible ways through which the Saudi Arabian government can be beneficial by integrating AI into their projects impacting better project outcomes.

1.4 Research Aim and Objective

1.4.1 Aim

The study aims to find various applications of AI in project management globally and how it can help the Saudi Arabian Government manage their projects more effectively. The study also focuses on providing solutions to existing problems by analyzing different data available on AI applications in project management.

1.4.2 Objectives

- To analyze the usage of AI in Existing global government Projects.
- To recognize the areas where Saudi Arabian Governments can implement AI in project management.
- To identify the challenges and benefits AI poses during the implementation in project management.
- To create effective AI integration strategies for project management.

1.9 Research Questions

RQ 1: How AI technologies are currently being utilized in global government projects?

RQ 2: What specific areas of administration of Saudi Arabia can target and implement AI technologies to improve project management?

RQ 3: How does integrating AI into project management develop challenges and provide benefits to managing the project?

RQ 4: What are the possibilities for AI use in Saudi government projects?

RQ 5: What are the legal and ethical consequences of using AI in government projects?

RQ 6: What are the suggestions for a successful AI integration approach in Saudi government project management?

1.10 Research Hypothesis

Hypothesis 1: The inclusion of AI in the Saudi Arabian Government's project management can increase efficiency and save costs.

Hypothesis 2: Lack of skills and infrastructure can be a barrier to AI adaptation in government project management.

Hypothesis 3: AI can actively improve accountability and transparency in Saudi Arabian government projects.

Hypothesis 4: Factors like ethical legal constraints, algorithm bias and data privacy risks can create a challenge for implementing AI in government project management.

Hypothesis 5: Data-driven risk management can help in reducing project risk and the chance of occurrence significantly in the Saudi Arabian government's project management.

Hypothesis 6: Specific investment and proper framework policy can be helpful for successful AI integration in government project management in Saudi Arabia.

1.11 Structure of the Dissertation

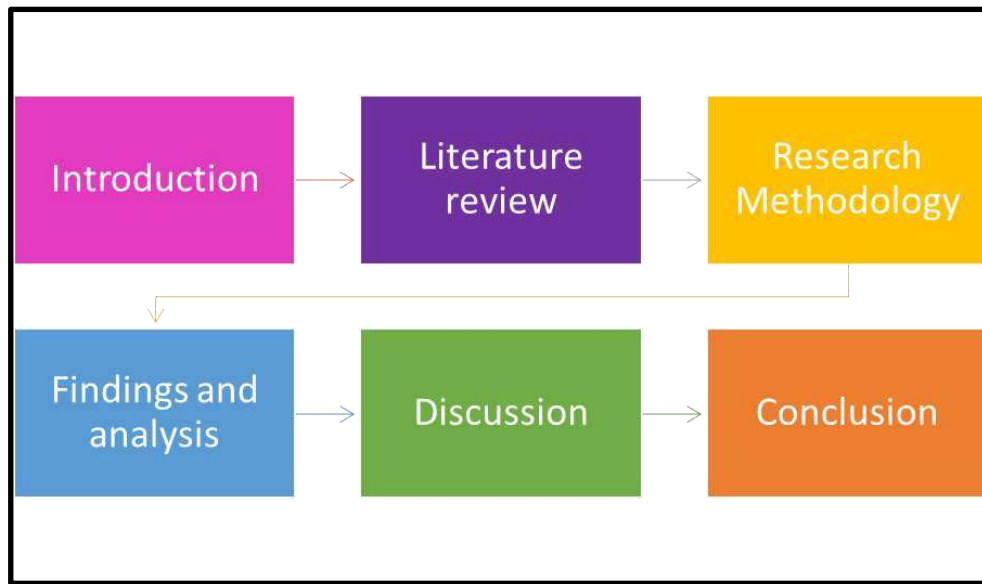


Figure 1.11: Structure of research

Source: (Self-designed)

Introduction: The introduction presents a summary of project management and the importance of integrating AI into project management for improved productivity. The first section also includes a summary of Saudi Arabia Vision 2030, the research challenge, the study's scope, and its importance.

Literature review: The literature review section includes an analysis of various existing studies covering AI usage in global government projects, and project management sectors in Saudi Arabia. Additionally, there is an identification of the problems and advantages that AI presents and recommendations for mitigating them.

Research methodology: The research methodology chapter involves a mixed-methods approach to conducting secondary research. This technique uses both qualitative and quantitative data to offer a comprehensive assessment of AI applications in Saudi government initiatives.

Findings and analysis: Furthermore, the study's findings outline important changes identified by project managers following the incorporation of AI and its effects.

Discussion: The discussion section summarizes the whole study findings and determines the whole study outcome for future implications.

Conclusion: Finally, the research summarizes the key findings, guides Saudi Arabian organizations on how to implement AI ethically, and suggests areas for further research.

1.12 Researcher's Personal Information

I have gained little knowledge about project management while completing an academic assessment. Though I have never been involved in a project directly, I am eager to learn smart project management approaches. However, I believe my critical thinking, communication and decision-making skills can contribute towards developing this research effectively and achieving a desirable outcome. The main reason behind choosing the research topic is to explore the diverse applications of artificial intelligence. Along with that, this topic is aligned with the innovative project management approach which is based on government involvement. It can help me to critically think about the use of AI based tools in decision making and addressing project risks and improve Saudi Arabian projects.

Chapter Two

Previous studies

2.1 Chapter Introduction

The study states about the use of AI in Project management to improve Saudi Arabian government projects. The previous chapter was introductory where the significance and research rationale was discussed along with the research aims and objectives respectively. This chapter is important for the study because this will help in avoiding duplication of the theory and help in building a proper framework for the study. Additionally, it will also help in understanding the gaps in the research and provide knowledge on the topic. The chapter uses secondary sources of data to provide the key factors. The chapter also consists of literature gap along with a theoretical framework. There are four themes discussed in this chapter which help in establishing knowledge on the topic of the chapter finding out the research gap and future scope of research respectively.

2.2 Theme 1: AI Usage in Global Government Project

2.2.1 Resource Allocation by Usage of AI

The study by Yigitcanlar et al. (2021), it is illustrated that Artificial intelligence has a significant role in urban area innovation and design. The conceptual study mentioned that this adoption can ensure the desired urban innovation outcomes in the future and emulate many technological opportunities in terms of the principles of urban development. Also, this research discussed tools such as machine learning and other advanced platforms to conduct big resource allocation. This sharpened the perspectives of the **adoption, development, deployment** and **managing** the AI tools for the well-being of urban development. However, the research could have elaborated on how higher adoption of AI usage impacts urban development by resource allocation effectively. However, it can be impactful to the researchers keen to gain core knowledge about the effect of AI implementation on principles of governance and urban innovation.

Kamyab et al. (2023), demonstrated that the utilization of proper usage of AI can lead to resource allocation and relocation as well. The struggle-time real-time **data acquisition, effective data analysis** and **decision-making** become easier with the help of AI. The study also draws attention to the capacity of AI in big data relocation of the natural approaches in this research. The research could illustrate the tools which are used to conduct these approaches for a better vision of the researcher and keen learners. Also, thematic research has a gap in the algorithm information which could emphasize the study more. However, the article highlighted several aspects to enhance the knowledge about the usage of AI in project management.

2.2.2 Potential risk management

According to Odejide & Edunjobi (2024), Artificial Intelligence has a crucial role in the transformative potentiality of risk management and personalized marketing. Also, it mentioned that implementing AI in the decision-making vision making or the risk management of the governmental project is a positive addition. The presence of AI in the risk management approaches makes the task more safe and secure. In addition, AI analyses algorithmic data such as customer **data points, including purchase history, website behavior** and **social media interaction**. The research could elaborate on the role of AI in potential risk management which can conduct government projects. Moreover, the information on artificial intelligence in the governance of the project in risk management is turbid in this research. However, the research has incited many important aspects about the capacity of AI in potential risk management which can help other researchers to gain initial knowledge about it.

On the other hand, Hohma et al. (2023), illustrated that with the growing prevalence of artificial intelligence systems for the development of **specific** and **standardization**, this technology is increasingly important. The research examined the concrete strategies and

challenges of the usage of advanced and **automated risk management technologies** as risk governance methods. Moreover, the research has mentioned five characteristics of AI in risk management methodologies such as balance, expendability, representation, transparency and long-term orientation. Despite this, the research has some factors that are missing in this analysis such as the range of mitigating the risk of projecting the works and the challenges while using AI in risk management. However, the article has a crucial role in engaging initial information in the research about the risk management potentiality of AI.

2.2.3 AI Forecast the timeline prediction

The study by Gruetzemacher et al. (2021), it is showcased that forecasting AI progress is significantly important in predicting the uncertainty of research plans or other performances. Despite sufficient information and census regarding the diverse direction of AI in forecasting the research plan, the research has intellectually illustrated the functions of AI in **forecasting progress**. The research analyzed that the AI progress in forecasting utilizes the **Delphi techniques** to expose the aggregate expert's opinion while prioritizing the methods. The statistical methods become more promising and recognized to prefer the judgmental techniques in forecasting prediction. In this area, the study has several information gaps such as in the forecasting operation of the AI and the tools used in these approaches. However, the research highlighted many essential factors in the capacity of AI in terms of forecasting the timeline prediction which can help the researchers to enhance their knowledge about this topic.

As mentioned by Zhang et al. (2023), Artificial intelligence has sharpened modern life from transportation, **health care, science, finance, defense** and **national initiatives**. The analysis mentioned that the forecast of AI can improve the prospects of policies and decision-making. In this article, it is mentioned about their survey of AI and machine learning researchers on their beliefs and progress of AI forecasting. The result of the survey illustrated the **50%**

likelihood placed on AI and machine learning researchers based on human-level machine intelligence by **2060**. This research helps to analyze that the capability of the AI in future may enhance rapidly, and it can reduce the chance of persistent certainty of the success of the program. Yet, the survey is not strong evidence for the forecasting of AI. Still, the information contained in this research about the forecasting of AI is useful for researchers and keen learners of this topic.

2.2.4 Automated update in communication

As mentioned by Hepp et al. (2023), demonstrated that the area of automated communication between the machine or AI and humans is still turbid because it is limited to the questionnaire method. The study aims to fully grasp the transformation of the **media environment** related to the automation of communication. Also, it highlighted the possibility of conducting direct interaction between humans and intelligent machines such as AI or machine learning. Also, the study focused on the questions asked about communicative artificial intelligence for dynamic and societal communication. However, the study has more areas to provide information such as the **current communication methods, platforms** and their **effectiveness** in societal approaches. However, the research materials and information provided in this study are useful for the researchers to gain initial knowledge and help to research more about the topic.

On the other hand, Zerfass et al. (2020), discussed the academic discourse of lacking from the perspective of partitioning and the AI can change the communication profession regarding this. In this study, the research illustrated the empirical analysis of **AI communication** and the **methods** of the professionals while using AI for official purposes. Moreover, the study surveyed the AI communication expertise and provided quantitative **data** through some questions asked by the respondents. Analyzing the result of the survey, it is obtained that the understanding level is limited in AI as per the communication

professionals. **Lack of competencies** and **organizational struggles** are mentioned as the key risks in the research findings. However, the information is impactful to the researchers and professionals to enhance their willingness to implement the functions of the AI communication capacity.

2.2.5 Data-driven Activities

According to Jain et al. (2023), artificial intelligence which is powered by data and trained with machine learning is rapidly growing nowadays. Though the deployment of machine learning causes irrational, **biased** and **discriminatory** results, still vital areas are advancing such as the **value-based design** methodologies that have emerged in current times. The research aims to discuss the participative data-centric strategies of AI that offer epistemological and ethical concerns with ML deployment. In terms of the perspective data method analysis, the study elaborated on machine learning solely, over the other tools of the advanced technologies within AI. However, the research has enlightened several important factors and challenges in the data-driven activities of AI, which can help the researcher in future.

As per the study by Johnson et al. (2021), it is showcased that **big data** and **artificial intelligence** or **BD&AI** become crucial factors to enhance the transformative opportunities of competitive growth. However, the research identified that the BD&AI talent shortage and skill gap of the labor requirements affect competitive growth in several aspects. The bibliometric analysis examined the **opportunities**, **gaps** and **trends** of BD&AI using authentic information related to the study materials and built-up co-occurrence diagrams within the **SWOT analysis** (Benzaghta et al., 2021). However, the study could provide their analyzed data and the range of the gaps, opportunities and trends in big data and artificial intelligence in data-driven activities. However, it can help to identify the areas of implementation for the professionals.

2.3 Theme 2: Project management aspects of Saudi Arabia where AI can be implemented

2.3.1 Health & Safety project management at the Construction site

According to Khahro & Khahro (2024), occupational accidents should always be considered as they may impact the project and industry. The study claims that in construction industrial work there is a high chance of accidents occurring and many records in several countries already exist. In terms of this, there are dynamic technologies to avoid this haphazard and provide health and safety services in this technological era. The research has integrated AI to monitor the H&S at the construction site in Saudi Arabia. However, the analysis observed that there is a lack of advanced services to conduct an integrated approach. However, the analyzed data and information can help the researchers frame the decision-making and monitor the health and safety practices regarding AI in construction sites.

Waqar et al. (2023), discussed that on the construction site, there are many chances of health risks, injuries and accidents, therefore, Health and Safety concerns are necessary for the industry. The integration of AI can mitigate the chances of accidents and help in monitoring the site or detecting the risk. The authors used several factors to identify the prior research and consensus of the industry. In addition, the exploratory factor analysis, structural equation modelling and rigorous analysis emphasize the interpretation of the impact of AI in health and safety programs on construction sites. Moreover, it added the six constructs of Health and Safety management systems such as **adaptability, reliability, operation, management, integration** and **knowledge**. However, the research did not include the factors that are used in the research analysis which could provide more information to the researchers. However, the article is impactful because of the intensive information with several analyses and models which can help other researchers to study this.

2.3.2 Oil and Gas Department Projects

According to the study by Hassan (2020), it is mentioned that Saudi Arabia is becoming the global technological hub regarding **Vision 2030** by diversifying its economy. Its core transformation and implementation are built by the integration of artificial intelligence specifically at a new mega-city named **Neom**. The city operates through **robotics** and **AI**, which seamlessly indicates the growth of economic sectors in future. The research claims that the economic transition from the hydrocarbons to the AI is a more economic approach and it reduces the hazards of oil and gas houses in Saudi. However, the researcher is unable to provide the information to construct the Oil and Gas hubs with the help of AI. However, the article elaborated on many aspects of the progress of AI integration in Saudi Arabia which encourages the researchers to gain more knowledge about the topic.

Another side, Al-Hajri et al. (2024), demonstrated that global digital transformation emerged in the Gulf of Cooperation Council or GCC. A comprehensive assessment of the digital technologies within AI has been provided for the past decade in GCC's oil and gas sector. The analysis showcased that GCC experienced substantial growth with the help of digital transformation tools. Among the involved countries of GCC, after the UAE's AI usage of 35%, the Saudis can be seen using it at 29%, along with other countries of the Gulf. As per the study, the percentage of global digital transformation including usage of AI is **29%** in the **oil and gas** industry. The research is based on a broader aspect of Gulf of Cooperation Council countries rather than focusing on Saudi Arabia. However, the research highlights several pieces of information for the researcher which can be implemented while developing the gapping areas by the utilization of AI in the oil and gas industry in Saudi.

2.3.3 Appropriate decision-making in project management

According to Bakr et al. (2023), artificial intelligence or AI has transformative potential for private sectors through decision-making activities. The research outlined the measurement

of the potentiality and usefulness of AI in the private sector to project managers. The study indicates that the project managers faced many difficulties and limited activities while applying AI in decision-making though the major perception is positive about it. The research is based on data of **100 respondents** from the private sector including the biggest companies in the Kingdom of Saudi Arabia. As a result, the study found significant knowledge about AI-driven project management in decision-making. Though, the paper has focused on the largest companies whereas major companies in **Saudi Arabia** have not adopted AI yet. However, the materials and information of the study are impactful in researching the potentiality of AI in decision-making in the private sector of Saudi.

The study by Mahmood et al. (2023), demonstrated the opportunities for the utilization of artificial intelligence in project management in the private sector. The article contained primary and secondary data to emphasize the information gathered from the survey of the private sector in Arab countries. The significant result indicates that project managers are more capable of interpreting the data with the help of big data and AI by using advanced **technology** and **algorithms**. Moreover, the study illustrated that complex tasks can easily be interpreted within AI, and it enhances more sustainability of the project management life cycle process. However, the study lacks detailed information about the range of effectiveness of AI in decision-making approaches. Still, the valid information in this article can help the researchers to gain the initial knowledge for research materials.

2.3.4 Smart City Development Projects

According to Alamoudi et al. (2023), the cities in Saudi Arabia need to develop their cities with advanced methods due to the rapidly growing urbanization. There are many cities recognized as smart cities due to the **advanced technique adoption** as well as the investment in sustainable social, human and environmental development. Alongside this, the research conducted three methods to frame the decision-making of urbanization planning within

advanced technology adoption. In addition, the study sampling of **25** participants to evaluate the citizens' participation in developing the smart city. The result indicates that three component structures aligning the stakeholders' Management, citizens' participation level and citizens' participation recruitment are involved in the sustainable smart city plan of **Vision 2023**. The study discusses broader technologies than specifying AI in urbanization in Saudi Arabia. However, this research has significant key points which can help the reader by encouraging them to study more about the smart city involvement of Saudi Arabia.

As mentioned by Aljabri (2024), the Kingdom of Saudi Arabia is diversifying technological advancement and economic development by the adoption of artificial intelligence or AI. This research aimed to investigate the potential benefits of involving **AI in municipal services** and works within Saudi Arabia. The research interpreted the role of AI to enhance municipal operations, urban planning, citizen engagement, intelligent infrastructure management and many other approaches. However, the research paper could provide some algorithm data to illustrate the statements that are given in it. However, the research successfully fulfilled the requirements of this study materials about the benefits of implementation of AI in smart city management.

2.3.5 Implementation in Education System

The study by Melweth et al. (2024), illustrated that teacher burnout and the integration of technology is an important issue in the education sector of Saudi Arabia as it aims to reform the system and transform it into digitalization. The study conducted a cross-sectional survey of 50 teachers' perceptions of artificial intelligence in secondary schools and the result revealed an 18.4 average score which indicated the burnout risk due to emotional exhaustion. It is obtained that the teacher is confident in basic technical skills while lower proficient in online learning and technical troubleshooting. Moreover, the qualitative data shows that the teacher-centric integration includes **limited AI automation, extensive upskilling** of teachers

and knowledge of the teachers about the **localized contexts**. Hence, the study only focused on the risk segments of AI adoption at the secondary education level over the opportunities enhanced with the adoption. However, these inquiries provide evidence to reform the AI system in human-centered education through implementing the applications.

As per Alshihri (2024), the study identified the implications of artificial intelligence in the public universities of Saudi Arabia. Using several descriptive methods, the study has analyzed many factors by interpreting the data and information. The study claims that the adoption of AI in colleges and universities can form many issues in application. In this order, the study analyzed that the colleges should **increase** the level of **application of AI**, enhance the **technical specialists** and **overcome the issues** faced while operating it. Despite this, the light of the findings remains turbid for the researchers, for example, how the issues can be reduced. However, the information contained in the study is valuable for the researchers who are working on the development of AI in the education sector.

2.4 Theme 3: Identification of the challenges and benefits AI poses during the implementation

2.4.1 Challenges of AI implementation

In the study McGrath & Kostalova, (2020) stated that there are new requirements for managing a project and mostly hybrid methods are being followed nowadays. The study is relevant because, in the modern advanced world of technologies, artificial intelligence can be used to have proper decision-making along with the monitoring of the project for the initiation days. The resource allocations can be also done by AI which seems to be an advantage for project monitoring and proper planning. The literature gap persists in the study because the study has shown the required methods that can be used to do proper project monitoring but failed to research the specific tools required to do the same. Future research should mostly focus on the specific tools required to align with project management.

According to Regina et al., (2022) it is stated that implementation of AI in project management can lead to proper planning and execution along with driving the correct data. With the implementation of AI in the government of Saudi Arabia, the advantages could be monitoring the long cycle process of large projects in the government starting from allocation to execution. The literature gap persists in the study as it has only stated the advancement and requirement of AI implementation in project management and construction with the government but didn't throw any light on the ways to overcome the barriers while adopting the process of AI. Future studies should focus more on the adoption of AI by overcoming the barriers by testing practical scenarios.

2.4.2 Higher Implementation Cost

According to Lengoiboni et al. (2019), it is said that implementing AI and cloud-based systems depends on the technological advancements and cost-effectiveness of the government. It is not only about implementing but also needs to understand the usage and processes of use. The government of Saudi Arabia can implement AI technology with which they also need to monitor and train their employees to understand and get used to using the technology. There is negligible research done on the satisfaction of the experience of the user using the AI-integrated systems. Future studies to focus more on the practical experiences of the user, including the managers. The feedback from them could be ingested for the betterment of the usage of technologies.

In the study, Chakraborty (2023), stated that the implementation of advanced technologies like AI in the enterprise structure can help to improve customer satisfaction for retail sales. This implementation gives good returns on the investments along with future business scopes. Implementation of the integrated AI system in government projects can lead to efficient and data-driven decision making which further leads to better outcomes on government projects. The literature gap persists as the research done on the projects was very

limited to getting proper feedback data and negligible presence of data on AI implementation on government projects. The future study should pivot around the practical implementation of the integrated AI system in the government project to understand the efficiency.

2.5.3 Shortage of skilled labor

In the study, Sharma (2022), stated that there are quite a lot of challenges faced by the Indians while integrating AI into the technology. Managerial issues, poor connectivity, lack of skilled labor and privacy concerns were the most typical challenges faced. Implementing AI in project management by the Saudi Arabian government would also face the same issues while cost and shortage of skilled labor would be an irreplaceable issue. The study has a literature gap as it does not give a proper idea of the ways to overcome the cost and its feedback on the project management services. Future studies should try to find strategies to understand and make AI integration more efficient for government-related projects with practical implementation.

In contrast, Owoc et al. (2019) stated that the integration of AI into the education system is good as it has all the necessary tools for education which is enough efficient for usage. While there are challenges in the implementation of AI integrations, a five-stage strategy implementation model seems to be helpful for implementation. The Saudi Arabian government also can allow this five-stage implementation process to enhance its strategy for project management. Project management can be efficient in the government sectors if the Saudi Arabian government can overcome the challenges of AI adaptation. The study does not cater to proper and practical information about the implementation of AI in the educational sectors. The future scope should focus on implementing AI in various sections and the outcome or feedback collecting and addressing. This could further make the AI smoother.

2.5.4 Enhanced Decision-Making

According to Duan et al., (2024), there are challenges faced when it was tried to implement the processes of human making decisions with integrated AI technology. There were issues regarding the processing of decisions like human beings' decision-making. The government of Saudi Arabia should check on this insight and perform a properly integrated AI system for their project management. The challenges faced during the decision-making processes of AI should not be overlooked during the implementation of AI. The study does not contain enough data on AI integration with the decision-making processes of Humans. Future research scope should lie in making the betterment of the AI integration with effective decision-making processes.

In contrast, Buçinca (2021) stated that forced intervention in the workflow of AI systems has minimized the dependency on simple AI systems. The government of Saudi Arabia can understand from the study that the decision-making process can be better with the cognitive forced intervention in AI. They can ensure that the recommendations for managing and executing their projects come from AI which could be more reliable. The literature gap persists as the study does not show proper context based on cognitive intervention and AI work systems. The future scope of the study should focus on minimizing the dependency on AI systems for all types of decision-making and providing proper user experience.

2.5.5 Advancement in Data Analysis

Chen et al. (2019) state that AI-powered technique is used for understanding and measuring the DSM in smart homes. The homes that have implemented AI with cloud analytics have more efficient decision-making techniques along with energy-saving policies integrated. The Saudi Arabian government can implement the AI-driven data analytics system which may help them to have more specific data driver decision-making along with automatic resource allocations. The literature gap persists as the study has not enough data about the integration

of this type of AI system specifically in the large-scale projects handled by the government. The future scope should focus on more valid data generated from the integration of AI in real-time projects.

On the other hand, Arinez (2020) stated that AI has a transformational feature which is integrated into machine learning that helps the system to solve more complex problems. While integrating AI into large-scale project management Saudi Arabian government can get more efficient outcomes on large data structures and autogenerated recommendations can make the project more successful reducing time consumption and human errors. The study does not have enough data about the integration of advanced AI systems in large-scale projects having dynamic environments. The future scope of the study should focus on building specific tools in the AI-integrated system which will be more applicable to government-based projects.

2.5.6 Personalization

Daqar et al. (2019) stated that the integration of AI in the Palestine market significantly increased the smooth customer experiences in the sector of bank and customer service. The Saudi Arabian government can be beneficial in enhancing customer satisfaction with the use of integrated AI. The stakeholders can be more attached to the government for AI providing real-time data on project progress and analytics. The literature gap persists as the study does not contain enough data based on the integration of AI technology into dynamic projects for management. The future research scope should focus more on combining AI into dynamic projects for management leading to more stakeholder engagement and data driver decisions. Also, Gao & Liu, (2023) stated in their study that the customers are satisfied while marketing for the AI integration in technologies and purchase automation. By integrating personalized AI integration in the government sector for managing projects Saudi Arabian government can make efficient stakeholder communication with transparency. Till now, there is no more

data present on the integration of AI in the management of large-scale projects in the market. Future research scope should rely focusing on applying personalized AI to large-scale project management to see the benefits and the challenges faced over time.

2.6 Theme 4: Implementing effective AI integration strategies for project management

2.6.1 Identifying clear objectives

As per the study by Merhi (2023), it is indicated that the implementation of AI in organizations allows benefits due to the decision-making and achieving the goals in the project management approaches. In this study, it is illustrated that the success rate of the decision-making and assessing the project is not possible without the implementation of AI integration. This study identified nineteen factors that rely on AI implementation and categorizes them into four categories. The category includes factors of **organization, technology, process** and **environment** that influence the implementation of AI systems. The most important category among these four categories is technology along with ethics, the most important among the nineteen factors. However, it is observed that most of the factors that are mentioned in this research are not discussed in detail, which creates a gap in the paper. Yet, the research identified several points which are useful to the researchers to analyze the implementation of AI in finding the real objectives of project management.

The Study by Peddisetty & Reddy (2024) illustrated the application of AI systems which are used in change management to predict the risks and prevent challenges. Generally, it occurs due to the complex nature of the organizational environment. This research built up the information based on several methodologies and literature to leverage AI prediction and data proactive management while implementing the AI system. The study applied mixed methods in qualitative and quantitative data analysis to interpret the effectiveness of AI-driven management that can help to identify the objectives of the project management. However, the article could reflect more on qualitative data analysis to provide better knowledge and

information about the AI systems to set project objectives. However, the information given in this research paper can help keen learners be encouraged to further research the role of AI systems and identify clear objectives for project management.

2.6.2 Enhancing Organizational Efficiency

The research by Bhima et al. (2023), shows that the role of AI is crucial in enhancing organizational efficiency. The implementation of AI helps in the potential **automation tasks**, predicting the objectives by analyzing the historical data or bolstering the decision-making. AI integration liberates organizations from mundane tasks through its automation facility. Alongside this, the predictive analytics of AI systems enable organizations to foresee trends and foster a competitive edge for decision-making. The study included the **Three-folded strategy** to emphasize the information. The three factors include the prioritization of AI training among the employees, establishing cross-sectional teams to navigate complexities and embedding ethics in AI systems to maintain trust. However, the study could focus on the specific AI systems used in the firms to enhance the efficiency of project management. However, the chosen article has potentially informed about the role of AI in enhancing organizational efficiency.

As per the research by Shamim (2024), organizations increasingly rely on project management methodologies such as **transformative tasks, deliverables** and **achieving objects**. In this term, AI has a significant role in the project management process to improve the organizational efficiency in decision-making. The study investigated the potential benefits, challenges and implications of operating the AI system in organizational tasks. Alongside this, the study identified the procedures of AI in optimizing the project plan, resource allocation, schedule setting, risk management and communication with stakeholders. Analyzing the article, it observed the algorithm data could highlight the

information given in this research. However, the article has illustrated many important factors that can help researchers in future analysis of organizational efficiency due to AI.

2.6.3 Existing system integration

According to Merhi & Harfouche (2024), organizations consider artificial intelligence as a mechanism which can improve supply chain resilience worldwide. The study is conducted to identify, define and evaluate the practices of AI integration in project management. The study showcased twelve enablers in this analysis along with the conceptual modelling while discussing the implementation of AI in the production systems. In addition, the research has categorized the enablers based on the **technology, organization** and **environment** framework and analyzed the enablers while collecting the data from eight experts. As a result, the technology category found the most existing systems than organization and environment. But the qualitative data is missing in this study which could highlight the factors mentioned in this article. However, the AI systems in the supply chain in organizations and the key enablers can help the learners gain more knowledge about the subject.

On the other hand, Tatineni & Katari (2021), illustrated that machine learning promotes transformative solutions all over the industries. Yet, operating the machine learning transition from the development to the production approach meets some challenges. The gap between the science approaches and operations can be disclosed by the integration of the existing workflows. Also, this study aims to investigate the potentiality of AI-driven technologies such as MLOps practices. Alongside, this study maintained the three pillars of the existing systems such as **continuous integration, continuous deployment** and **continuous monitoring** in the context of machine learning. In addition, the study includes the approach of employing automated machine learning to automate features of engineering, hyperparameter tuning and model selection. In terms of disclosing the gap between science and operation, the study solely mentioned the features of machine learning. However,

detailed information about automation can guide researchers to integrate AI with machine learning in project management.

2.6.4 Address ethical and privacy concerns

As per the study by Zhang et al. (2021), artificial intelligence and its significant applications disruptively transform human lives in the modern days within its ethics and privacy factors. This analysis identified the ethical and privacy issues related to AI while using the system in daily living activities. The study analyses the changing interest of society in AI ethics over time through scientific evaluation. Also, the study applied 15 selected AI techniques to 17 major issues to identify the core formation of the issues with the help of some authentic articles. However, the article could elaborate more on the core ethical issues and specify them for the learners. However, the study highlights the issues in conducting AI systems related to ethics and privacy which can enrich the researchers' knowledge and encourage them to implement these segments.

Based on Mylrea & Robinson (2023), there are many concerns regarding **ethical, moral** and **legal** safeguards besides the advancement of AI systems. However, AI ethics need to manage the technologies to improve the metrics of security and privacy which can enhance the ethical manner. The study proposed to implement the AI Trust framework and maturity model to manage ethical and confidential aspects. Alongside this, the study utilized some methods to identify the information and enhance transparency and trust in AI applications. Despite this, the study reflects some gaps in the explanation of solutions to the general ethics and privacy of AI systems. However, the paper is impactful to the researchers in the discussion about the ethics and privacy of AI along with project management in private sectors.

2.6.5 Implementing a training program to use AI-based tools

According to the Arab News (2024), the application of AI is taking over job applicants, reducing the physical presence of the employees. The employee with minimum education

can get omitted from the company due to their effectiveness. Vision 2030 for Saudi Arabia is implementing AI in large-scale project management due to enhanced efficiency. But this can also harm the jobs of the employees and can create gaps on the basis of skills. With adequate training of the employees to use the AI the risk factor of losing the job can be mitigated. The literature gap persists in the study as it emphasizes only the benefits of AI while avoiding the negative impacts that would affect social lifestyles, especially in Saudi Arabia. Future studies should focus on creating a balance in society with the presence of AI reducing the chances of job loss.

In contrast, BBC (2024) stated that tools like ChatGPT, and OpenAI are improving the work culture of the organization while they sustain the fear of job loss. AI can take over the jobs done by the employees enhancing the creation and the skill set respectively. If the Saudi Arabian government is implementing AI in project management, it can be beneficial with informed decision-making from the initial stage of the project planning. Informed risks and recommendations can be a plus while implementing AI. The literature gap exists in the study as it does not give proper insight into the effect of AI integration on large-scale public sector projects especially in Saudi Arabia. The future scope of the study should focus on getting an in-depth analysis of integrating AI with government project management to understand the benefits and disadvantages.

2.7 Theoretical Framework

2.7.1 Waterfall model



Figure 2.7.1: Waterfall Model

Source: (Self-created)

The Waterfall model is a type of framework required for software development and is said to be one of the earliest models used in project management. The waterfall model is taken into account by the researchers when there is adequate data to analyze through the model. This model is divided into specific phases and is not repetitive. The phases include **analysis of the requirements, coding, designing the system, testing of the data, deploying the integration and maintaining the correct data**. By using the steps, the researcher can first analyze the requirement of AI in project management study followed by designing its impact on Saudi Arabia government projects. This can be followed by coding by the researcher which can be tested with the collected data for the research. The integration phase provides insights into the use of AI along with other technologies for project management. The maintenance phase is essential to provide knowledge to the researchers to monitor and evaluate the project success rate. However, this model can be used in projects in which there

is sufficient information provided and need not change any types of data in the previous stages for continuous testing.

2.7.2 Agile project management

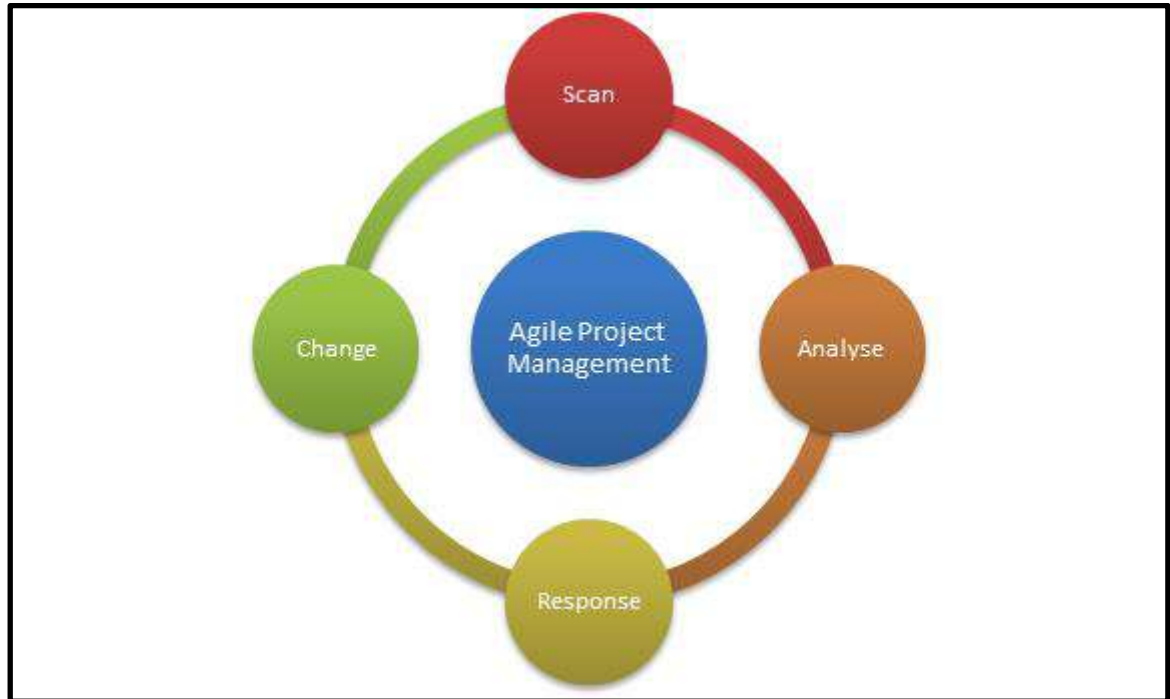


Figure 2.7.2: Agile Project Management

Source: (Self-created)

Agile project management is known to be one of the flexible models used in the software development process. Unlike the traditional models used in project management, daily improvements can be made to the requirements of the research. Continuous testing can be done by repetitive changes of data. Several types of elements fall under agile project management like scanning, analyzing, response and change. These elements help a researcher in several ways by letting the individual understand the importance of the given data. Scanning lets the researcher scan all the data required to do the study which is followed by analysis. In the analysis part, the researcher can analyze the scanned data seamlessly with the support of Machine languages. The output that would be received by the researcher could be creditable and acceptable for the research. The analysis is followed by a response in which

the output and relevant findings will be provided to the researcher based on which he can perform the study. In this step, if the findings provided do not seem useful by the researcher, the individual can change the analyzed data and repeat the cycle before initiating the research. It will also help the research to meet the customer's needs, providing customer satisfaction.

2.7.3 Artificial intelligence theory

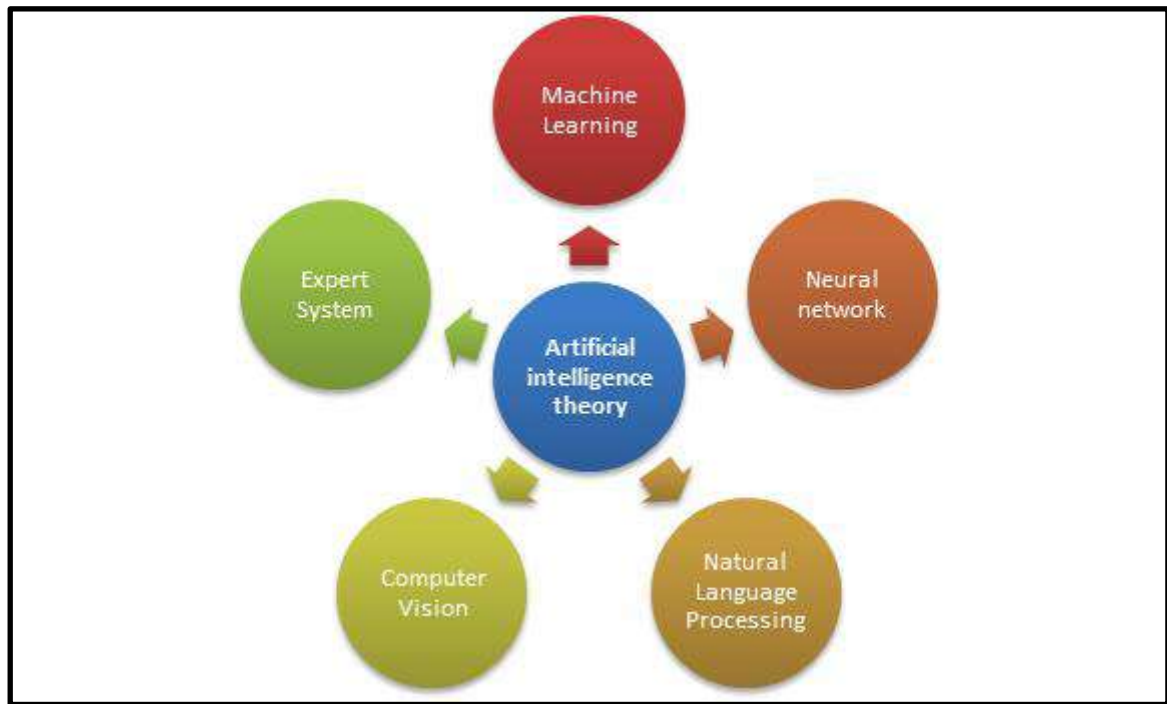


Figure 2.7.3: Artificial intelligence theory

Source: (Self-created)

Artificial intelligence theory is devised to understand the broader range of ideas and their implications in the human world. There are various types of AI concepts in the theory like machine learning, neural networks, natural language processing, computer vision and expert systems. Through the use of machine learning (ML), the individual can be helpful as it can process large quantities of data seamlessly analyzing the correct output. The neutral networks lead similarly to the human brain which can learn and process vast amounts of data like neurons. This would help the researcher to feed a large amount of data for managing various activities related to government projects in Saudi Arabia. Natural language processing will

help the researcher in analyzing large datasets and getting the information from the same along with continuous improvisation on the translation of language. Through the help of computer vision, the researcher can analyze types of images and graphs and have a more detailed analysis of these inputs helping the research to have more credible data.

2.8 Literature gap

2.8.1 Limited availability of topic-specific study

The Availability of proper resources is essential to conducting a study effectively. However, the availability of specific studies on this particular topic is limited. The lack of information about Saudi Arabia's project management approach and AI implementation is a significant limitation of this study. Also, the previous research done by the author reflects benefits and limitations of AI application in projects. However, it does not provide guidance for practical implementation techniques of AI in project management.

2.8.2 Improper Understanding of AI Impacts on Stakeholders' Engagement and Decision-making

A proper understanding of AI is very crucial to making effective decisions in project management (Merhi, 2021). Alongside it can affect the researcher's understanding of the impact of artificial intelligence on stakeholder engagement. In this research researcher effectively analyzed the implementation of AI in project management but failed to integrate the impact of stakeholders and their decision making through this technology. Therefore, this study aims to provide insight about the stakeholders of the Saudi Arabia Project and their decision-making process after implementation of AI.

2.8.3 Lack of Efficient Ideas about Saudi Arabia Government Projects

The Government of Saudi Arabia has many government projects regarding different sectors. Saudi Arabia, the next-gen country is a hub of international projects where the government mitigates so many different establishments to concrete the country's future. Most of the

researchers have focused on the use of AI in industrial project management. There is very limited research on the use of technology in any government project management. It creates an obstacle to completing this research which the research needs to overcome.

2.9 Chapter Summary

This chapter includes the literature review while discussing three themes in the section. These themes are segregated into smaller sections with the existing theories discussion. The chapter also includes a theoretical framework where three models named waterfall model, agile project management and artificial intelligence theory are discussed. This is included in its importance to the researcher helping them in their research work. Three literature gaps are also discussed for the topic in this chapter. The researcher has analyzed the advantages and disadvantages of using AI along with the areas of improvement in different sectors. The learner can also get quite a lot of information about the usage of AI in different sectors in comparison to the public sector large-scale projects.

2.10 Conceptual Framework

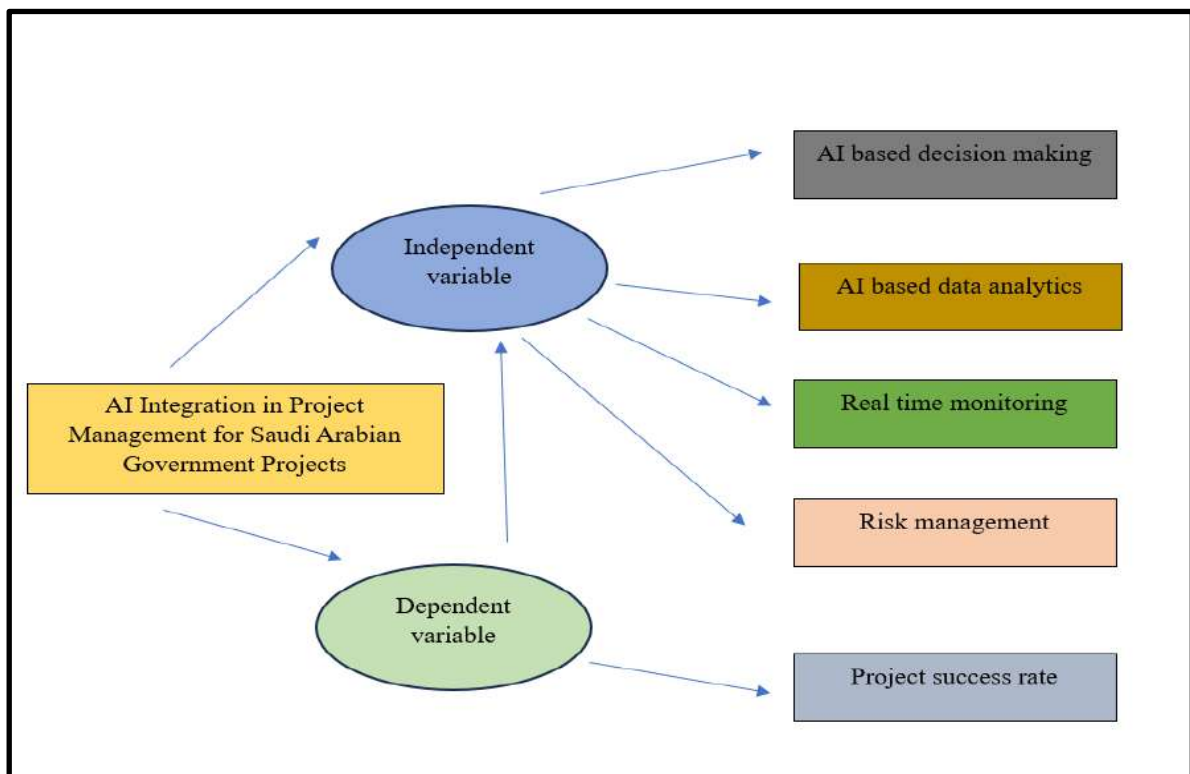


Figure 2.10.1: Conceptual framework

Source: (Self-designed)

The conceptual framework is said to be the relationship between the main concepts and theories used to conduct the research (Varpio et al., 2020). This research of AI integration in project management for the Saudi Arabian government includes two variables respectively such as independent and dependent variables.

Dependent Variables: The dependent variable in the conceptual framework specifically varies with the independent variable. There are four independent variables identified by the researcher including **AI-based decision-making, AI-based data analytics, real-time monitoring and risk management**. The dependent variable of this research is the project success rate varies with the independent variables.

Independent Variables: Independent variables are considered as the cause based on which dependent variables are observed. In this research the independent variables are **project efficiency and project success rate**. The success rate of the Saudi Arabian government project's success rate depends on the AI-based decision, risk mitigation, predictive analysis and effective monitoring process.

Chapter Three

Study methodology

3.1 Chapter Introduction

Research methodology is a set of procedures and guidelines for enhancing data collection and research analysis. The process is used to select and implement the best procedures for gathering information from reliable sources and integrating it into the topic (Al, 2020). The research methodologies used in this study support the technique to examine how artificial intelligence is used in project management to improve government projects in Saudi Arabia. The methodology includes aspects such as research onion, philosophy, approaches, and design to analyze the topic and collect accurate data and information (Iovino, & Tsitsianis,

2020). However, the methodology section also covers data sampling, data analysis and examination of the data along with ethical concerns and the research period of the whole study. The methodology chapter assists readers in determining the study's reliability and validity as well as offering details on data collection and analysis techniques. An appropriate methodology assists the readers and future researchers in generating more reliable studies on the topic of AI's impact on project management. The study employs a **mixed-method approach** using secondary research as its main method of study. Implementation of both qualitative and quantitative data helps to provide a broad understanding of Artificial intelligence used to enhance project management in government initiatives in Saudi Arabia. The study attempts to give a comprehensive assessment of the present landscape, advantages, difficulties, and strategic suggestions for AI integration. Qualitative data enhances understanding of AI applications in government programs by providing insight and depth (Hasija & Esper, 2022). whereas quantitative data allows for the statistical measurement and analysis of trends, patterns and correlations.

3.2 Research Onion

Research onion was designed in 2007 by Saunders, Lewis and Thornhill for the researchers providing a framework with comprehensive methodologies and guiding principles. The research onion consists of several layers which ensures that the researcher goes through all the layers to complete the research (Orth & Maçada, 2021). It also helps to ensure that the research done by the researcher follows the systematic framework of the research onion. It consists of different layers which are philosophies, approaches, strategies, time horizons, choices, techniques and procedures. Philosophy is the outermost layer on which generally the study is dependent. This is followed by approaches which is the second layer based on which the research questions are framed and analyzed. This is followed by strategies which should be based on the formed research questions and surveys. This layer is followed by

choices which determine whether the research study is based on quantitative, qualitative or hybrid methods of data collection (Mardiana, 2020). The next layer called time horizon determines the time period on which the study would be conducted. The study can happen at a single point of time or an extended point of time depending on the subject and the research questions framed. The next layer is the techniques and procedures which state the processes that are used for collecting and processing the data. The research onion helps the researcher to have structured guidance while conducting the research on a specific topic. The learner can try to align their research methodologies, data collection methods and the choice of philosophy by understanding the onion. The selection of research strategies and understanding of the time horizon based on the topic of the research can be done by the framework of the research onion. Research onion provides clarity to the researcher ensuring all the six layers of the research onion are followed stating the reduced risk of not being coherent in nature. This framework also allows the researcher to take account of all the dimensions ensuring the study to be full coverage starting from research philosophy to techniques and procedures.

3.3 Research Philosophy

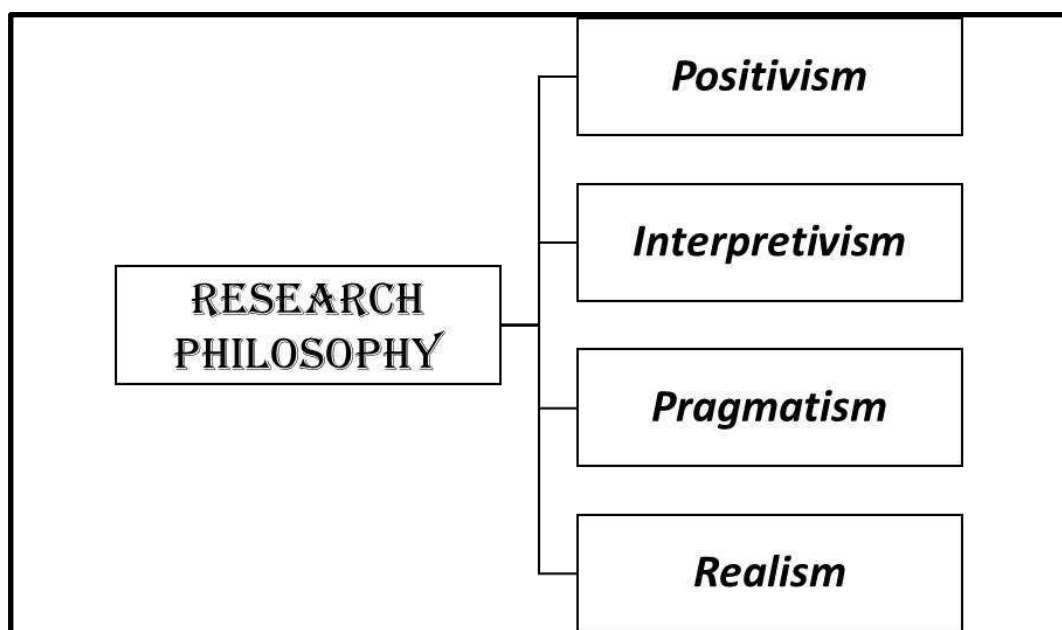


Figure 3.3.1: Types of Research Philosophy

Source: (Self-designed)

Research philosophy identifies the researcher's assumptions, and the methodological techniques used in the study. This refers to doing research based on real-life experiences and information gathered by the researcher. It provides the foundation for research methodology and makes an impact on strategies and approaches integrated throughout the research process. Research philosophy focuses on determining the best techniques for study, ensuring alignment with the research topic and objectives of the research (Omodan, 2024). Researchers assess several views and approaches, resulting in better knowledge to gain significant insight into the whole study. It ensures that the study design is understandable and logically reasonable which increases the credibility and trustworthiness of the outcome of the study. Understanding different philosophies helps researchers to tailor their approach to different study environments. The key function that research philosophy plays in changing every aspect of the research process has a huge impact on the accuracy of the study (Tamminen & Poucher, 2020). Research philosophy integrates effective methods and data-collecting strategies according to the research for appropriate study. The direction of the study is shaped by the researcher's point of view and presumptions about reality and knowledge which make an impact in the research philosophy. There are four research philosophy categories such as **positivism, interpretivism, realism, and pragmatism philosophy** (Mbanaso et al., 2023). Positivism philosophy focuses on factual information that is collected using sensory observation may result in an accurate understanding of the whole study's goals. Interpretivism philosophy depends on the concept that real, diversified, and has an impact socially (Mir & Greenwood, 2021). The concept of Realism depends on the assumption that there is a reality with underlying processes, and most of it unnoticed by the researcher. Pragmatism philosophy states that the choice of research philosophy is mostly

decided by the research topic and the need of the study. Choosing the appropriate research philosophy requires evaluating factors such as the nature of the research question, objectives and hypothesis. It includes the sort of examination being explored which frequently determines the right philosophy. For example, positivism philosophy is appropriate for research seeking quantitative findings but interpretivism is more suited for investigating complicated social issues. Research objectives also play an important part in determining whether the study intends to investigate, explain, or predict phenomena. It helps to choose a suitable methodology from qualitative, quantitative, and mixed methods approaches. Combining qualitative and quantitative data also referred to as mixed-methods research, can lead to a more comprehensive knowledge of the study (Akerblad et al., 2021). When examining the effects of AI on project administration in Saudi Arabian government projects, the adoption of research philosophy has a significant impact on the study's findings. The **positivism philosophy** is employed by the researcher in this study. The concept of positivism describes an event where the data are naturally quantifiable and observable. Selection of this research philosophy requires the researcher to conduct surveys, analyses, and real-time experiments to obtain data that could be trusted for support in the whole study.

Justification

The researcher adopted the **positivist philosophy** for conducting the whole study which involves factors like selecting and analyzing data and making it more appropriate for research. The main goal of the study is to analyze the influence of artificial intelligence on project management in Saudi government projects. The positivist philosophy helps in evaluating the efficacy of AI technologies in improving Saudi Arabia's government project. This philosophy has a focus on objective assessment that is excellent for research that needs measurable and accessible effects (Cohen, 2020). Positivism philosophy enables the use of standardized tools and processes like surveys and statistical analyses (Mohajan, 2020). This

level of consistency is important for developing information that can be analyzed and implemented across other government programs. Positivism promotes the acquisition of empirical facts and thesis which are critical for understanding AI's influence on project management. The philosophy also focuses on causality which is important for identifying the cause-and-effect of AI adoption and project success. The Saudi government is likely to favor impartial, data-driven insights that may guide the best policy choices for new initiatives. So lastly, the Positivism philosophy helps the researcher in analyzing the characteristics of AI and allows for an in-depth investigation of AI efficiency in project management.

3.4 Research Approach

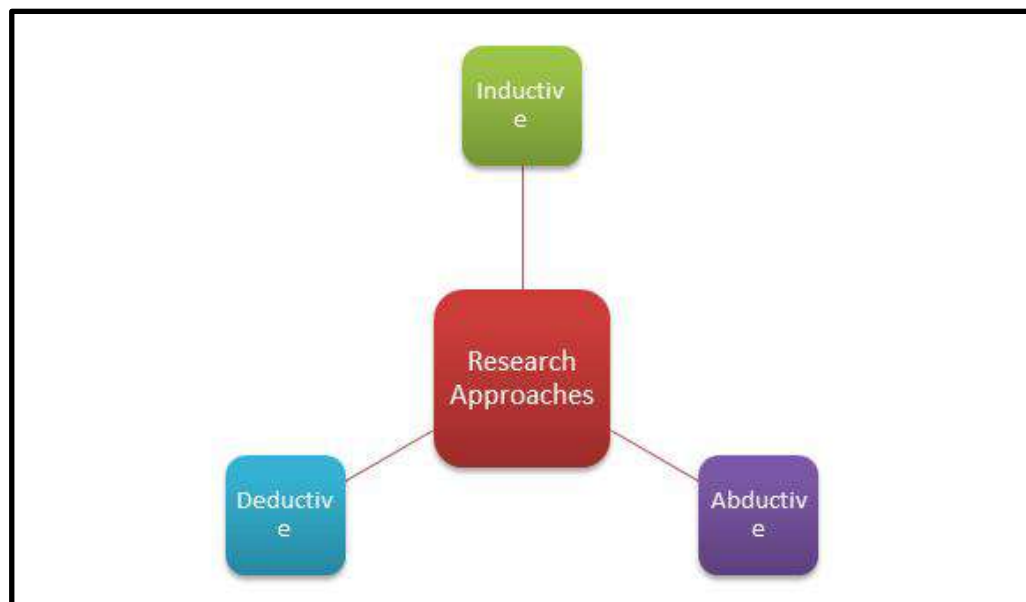


Figure 3.4.1: Types of Research Approach

Source: (Self-created)

The plans and the processes that are being followed to complete research are said to be the research approach. The research approach includes all the processes that are being used in the course of data collection, sampling, and analysis for the research. It is said to be the structure followed by the researcher which includes all the steps and processes followed for the interpretation, collection and analysis of the data required in the research (Mulisa, 2022).

The data which is collected for doing the research is aligned with the selected research

approach. The research question along with sampling and methodologies has to be aligned with the chosen research approach. The research approach gives a proper framework for the researcher to conduct the research and ensures that the collected and used data are quite consistent and valid. This helps in ensuring research is conducted with all validated systematic data and can take into account the findings of the study. The data collection techniques and methodology are aligned with the research approach which makes the research more applicable, and the findings become more credible. Selecting the correct research approach leads to selecting the correct applications that would be used for methodology and data collection along with analyzing data. This helps in enhancing the quality and credibility of the overall study making it more accurate and its findings more applicable. There are three types of research approaches such as **inductive, deductive and abductive** (De Oliveira, 2023). The inductive approach is used in the research to create broader impacts with the present theories and data on the database. This is used to generate new theories and explanations. The deductive approach is used when the research has to work on confirmation of any present theories or data. The research done by deductive approach is more organized and creditable. The abductive approach is the approach used by the researcher when there is incomplete data present doing the research and the researcher has to build theories on that incomplete data (Taherdoost, 2022). This approach is more creative and based on creating hypotheses and proving those in the study.

Justification:

The deductive Approach is used to understand the hypothesis in a very structured framework. For the topic of AI in Project Management to improve the Saudi Arabian government deductive approach is used by the researchers. The deductive approach is mostly based on hypothesis testing with new forms of data through observations and theories. By deductive approach, the researcher can experiment with the present theories of AI and project

management. The researcher can understand the theories and logic already published to test the new approaches of AI implementation on the public sector project in Saudi Arabia. The researcher can also create new hypotheses on topics like efficiency, and cost-saving and then can reevaluate the theories associated with AI implementation in project management systems. Using this approach, researchers can also get a clear insight into how AI can affect the efficiency of large-scale projects held by governments. As government projects are more systematic and data-driven, the researcher can look into how AI will impact the areas and identify the field of improvement. The vision for Saudi Arabia in 2030 is a great scope of implementing AI in the public sector in large-scale projects. By using the deductive approach, the researcher can get a clear insight into how effective the implementation could be by 2030 depending on the current theories and insights.

3.5 Research Design

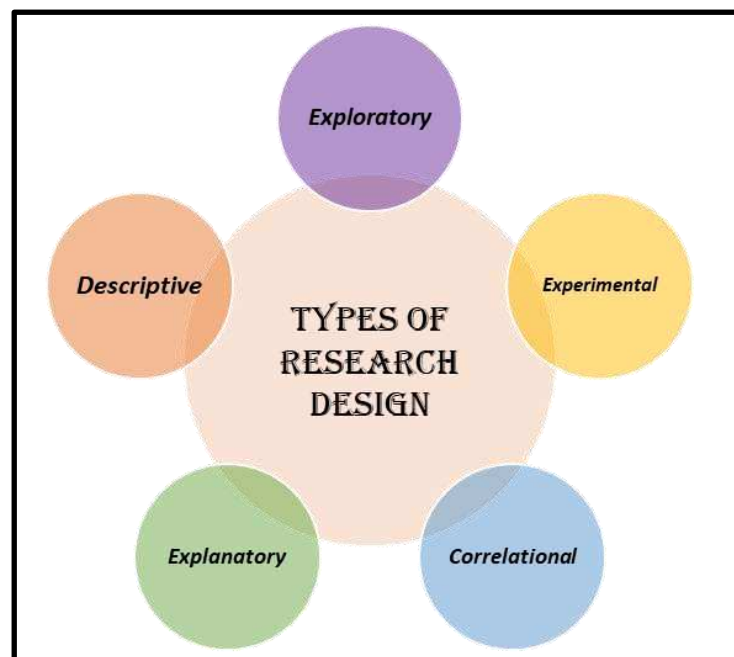


Figure 3.5.1: Various types of research design

Source: (Self-designed)

The research design applies to the general approach and method of analysis that a researcher selects to combine all of the study elements cohesively and logically. The design of the

research ensures that the research subject is aligned with the overall objective of the topic and effectively examined (Tomaszewski et al., 2020). A well-structured research design guarantees that the research questions are properly answered while also meeting the study's objectives. Research design plays a vital role in guiding the research process and a well-defined design of research gives a significant road map for the overall study. The research design increases the validity and ability of the study by ensuring the methods used to gather data from sources and generate effective outcomes (Rose & Johnson, 2020). The design of research also allocates resources significantly which minimizes the wastage of time, and researcher effort and reduces expense. The appropriate design guarantees that the information gathered is relevant, correct and enough to answer the study objectives. The research design delivers findings that are useful, valid and relevant to the research topic. The research design establishes a structure to address research questions and validate data. The research design process includes several steps such as the research goal, sampling strategy and data collection methods. It also covers the data analysis plan, timing, and legal requirements for the project. The research design is mainly of five categories such as **descriptive, exploratory, explanatory, correlational, and experimental** (Thomas & Zubkov, 2020). The Exploratory research design is used to analyze research issues and helps in acknowledging key insights and identifying the nature of the issues. The descriptive research design determines the characteristics of the population or information, and it generally answers the questions of the study. The explanatory research design analyses the reason and effect between two variables of the study. The correlation research design focuses on the relationship between two or more variables of the study, mostly determining their impact (Huntington, 2021). The experimental research design mostly identifies the hypothesis and tests it to determine the effect on another hypothesis of the study. To conduct this study the researcher has used descriptive research design.

Justification

The key reason behind choosing the **descriptive research design** is to identify the current state of artificial intelligence integration in project management in Saudi Arabian government initiatives. The primary role of descriptive design is to give a detailed and accurate explanation of factors that exist within artificial intelligence that influence the project management practice of the government of Saudi Arabia. The research design maps out the artificial intelligence adoption rate in government initiatives and identifies its usage and implications. The descriptive research is also effective in generating an overall understanding of the impact of artificial intelligence on the timeline of the project, expense, overall efficiency and technological impact (Fridgeirsson et al., 2021). The descriptive approach also provides detailed information on several aspects of AI like automation, mitigating deadlines, allocation of resources, developing new initiatives and enhancing overall efficiency. This design focuses on the benefits of AI as well as key challenges faced by project management managers through using AI in operational activities (Siedlecki, 2020). The study desires to investigate Saudi Arabia's specific environment, covering cultural, administrative, and governmental aspects which influence the use of artificial intelligence in managing projects. Overall descriptive research approach was appropriate for the study as it gave a complete and accurate assessment of the present level of AI usage in project management recognizing Saudi Arabia settings.

3.6 Sampling

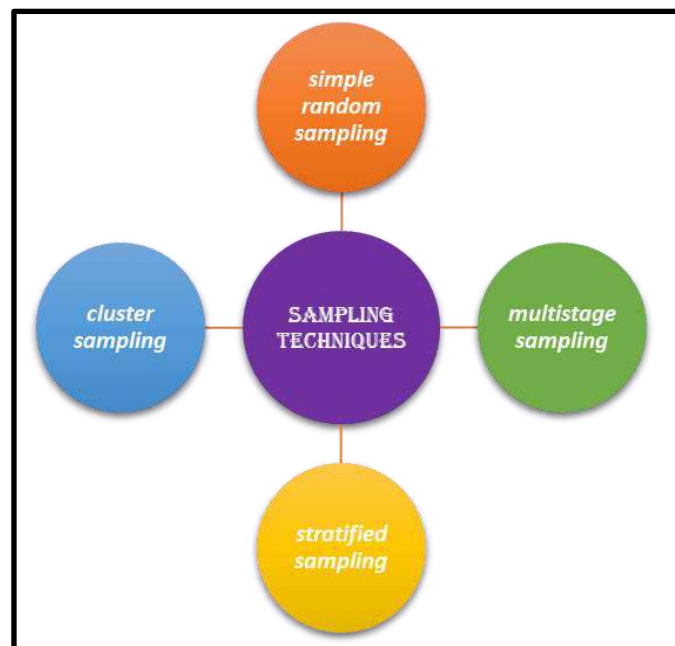


Figure 3.6.1: Types of sampling techniques

Source: (Self-designed)

Sampling is a strategy that selects a small number of participants or data from a much larger population or information for better findings from the collected data (Rahman et al., 2022). The approach is critical for reducing bias and enhancing the uniqueness of study findings. Sampling is a basic approach used in research to get examples and take the best sample for better outcomes from the study. Accurate samples from the collected data help to provide the best analysis of the overall study. Knowledge of **sampling methodologies** is required to design effective research. This study involves sampling methods, recognizes and explains certain sampling strategies, and offers advantages as well as challenges in the study. This enables researchers to investigate a big group using a subset of the population. In sampling, population units such as people, cases and data points are chosen during sampling (Stratton, 2021). There are various significances of employing sampling in the study such as it helps in decreasing the time, effort, and resources required for data analysis. It makes data collecting and analysis more manageable and practical. The sampling is classified into four groups

based on the format of the sample. These include **simple random sampling, stratified sampling, cluster sampling, and multistage sampling** (Khan, 2020). First, simple random sampling is a method in which each respondent has an equal chance of being chosen. Second, stratified sampling is an approach of separating a population into subgroups based on particular criteria, ensuring that approaches are consistent within each category. Third, cluster sampling divides the population into groups based on geographic or social characteristics (Simkus, 2022). Finally, multistage sampling is a complicated kind of cluster sampling that is performed over multiple phases. However, there are several implications also included in sampling like larger samples produce more accurate and dependable results, but small size samples face issues in giving accurate results. However, the size of the sample is determined by the study question, desired accuracy, and available resources (Lakens, 2022). Sampling error generally occurs when there is no use of appropriate sampling techniques according to study needs. So, **conducting surveys, examinations, or observational studies**, and selecting the appropriate sampling strategy is critical to ensuring the validity and reliability of the study results. This study employs a **random sampling** method for better results in data analysis and finding the best outcome.

Justification

Integrating **random sampling** into research on the influence of AI on project management in Saudi government initiatives helps in developing a systematic strategy to choose data points that are accurate for the overall study. The reason behind choosing random sampling is the study needs data on AI efficiency, decision-making, resource allocation, risk management, and overall project results. In this study, the researcher used the mixed method to collect information such as academic journals, reports, government documents and news articles lying under quantitative data. On the other hand, **surveys** are used as qualitative data-collecting methods. So, after gathering the data, the researcher analyzes it to look for patterns,

correlations, or causal linkages between AI integration and project management outcomes (Ward, 2022). Lastly, random sampling makes optimal use of resources while also providing a comprehensive insight into AI's impact on project management in Saudi Arabia.

3.7 Data Collection

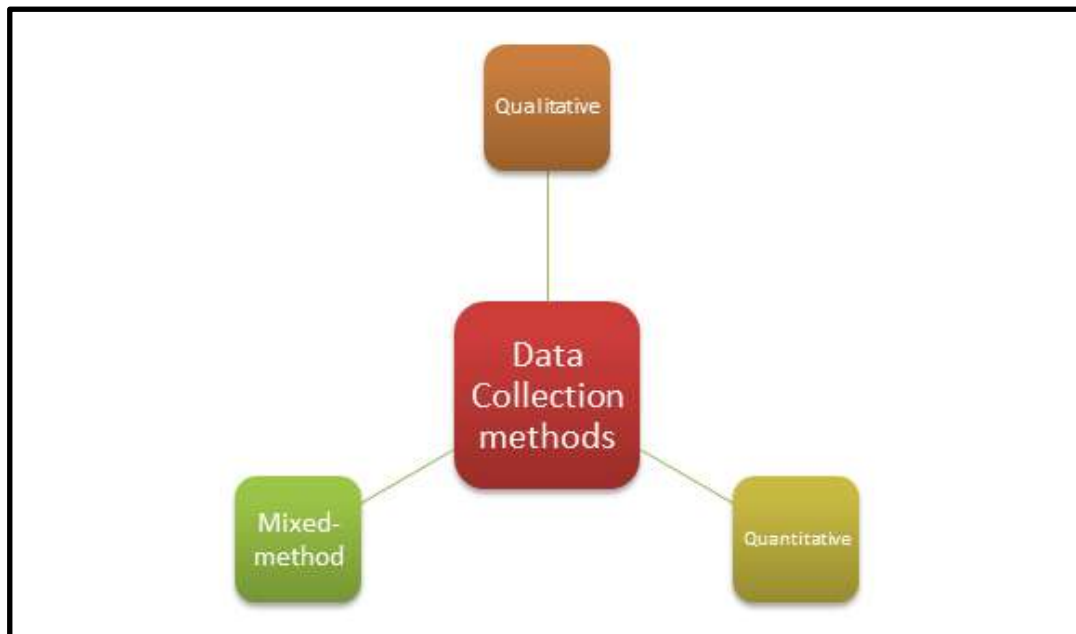


Figure 3.7.1: Data collection methods

Source: (Self-created)

Data collection is a process through which the data is collected for the research that lets the researcher answer defined research questions and the specific hypothesis. The method of data collection gives more credibility and makes the study applicable to the learners. Data collection is required in research to make it more informed along with drawing valid conclusions based on the theories, hypothesis and formed research question. There are three types of data collection methods which are quantitative, qualitative and mixed methods. The qualitative data collection methods are more physical and have more fieldwork. This data collection method is based on interviews and the analysis of the interviews performed. To perform the qualitative method of data collection, the researcher has to make valid questions which match the hypothesis and objective of the research. A focus group can create

segmentation on age group, profession or income status which would make the findings and the conclusion of the study more credible and valid for the learner. The quantitative method of data analysis depends mainly on the surveys. Also, proper questionnaires can help in analyzing the data required for the research study. The data collected has to be analyzed according to the requirements of the research aims and hypothesis. The third method is known as the mixed method data collection where both the techniques of data collection are used to complete the research work. Using the mixed method data collection makes the study more authentic and applicable to the learners and also helps to draw more specific findings and conclusions from the study. The data collection method is required for the study to ensure the validation of the hypothesis with informed data analysis. The decisions taken after analyzing the data are mostly correct and validating due to accurate data collection which makes the study more credible. New experiments and findings along with discoveries can be made with the analyzed data which leads to understanding the present trends, and patterns which are important for the hypothesis of the research. Through the data collection, a researcher can understand and intervene in the present data related to trends and analysis. The data collected for the research according to the research aims, goals and hypothesis made the study more accurate and validated by the type and source of the data gathered.

Justification:

A mixed method of data collection is used to do this particular research. There were **20 questions** which were asked to a focus group. This focus group was segmented into divisions based on education, location, the title of the job and departments. The qualitative data collection methods used authentic sources like academic journals, reports, news articles and government documents mainly from the websites of the World Bank and the ministry. The quantitative data collection method used surveys primarily to collect the data for analysis. The mixed method is used for the topic use of AI in Saudi Arabian government projects as it

can analyze both the qualitative and quantitative perspectives of the data used. The quantitative method can analyze the present theories and data to understand and analyze the effectiveness of AI integration on project management and the cost it can incur. The qualitative data collection method would help to analyze the surveys to understand the challenges and advantages that would come up while integrating AI into project management. By applying the mixed methods, the researcher can understand the advantages of implementation of AI in project management as well as the room for improvement. The perspective of the users will also benefit the research to analyze the quality of the work that can be done by the implementation of AI in government projects.

3.8 Data Analysis

Data analysis encompasses the goal of discovering useful information and helping in decision-making through data **inspecting, cleaning** and **modelling** (Tang & Meng, 2021). It includes various techniques and methods to interpret complex datasets, patterns, trends and data-driven decision-making. Data analysis provides actionable insights and evidence to support strategic patterns and operational decisions.

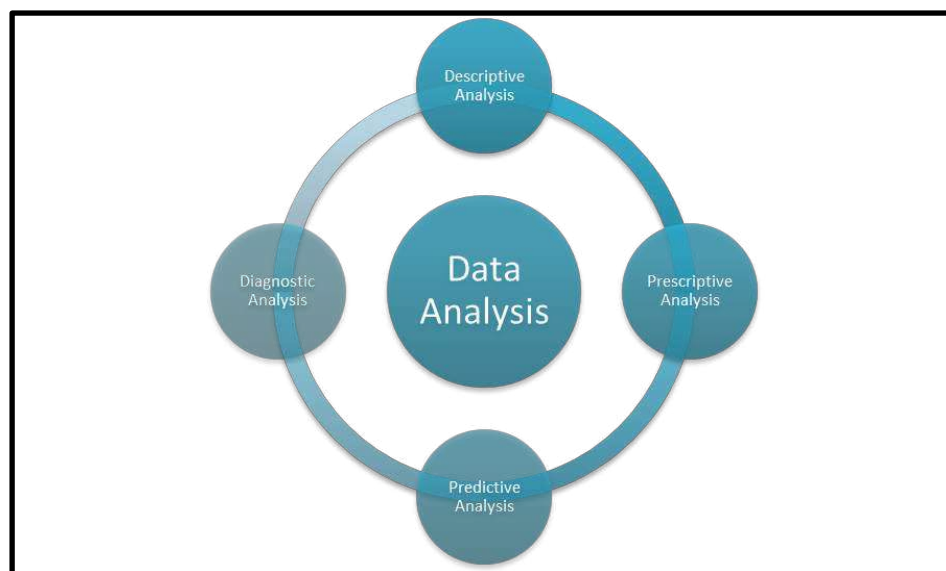


Figure 3.8.1: Types of Data Analysis

Source: (Self-created)

Data Analysis can be categorized into several types regarding the method of interpretation and purpose. The important types of data analysis are descriptive, diagnostic, predictive and prescriptive analysis. Yet, there are many other variations of data analysis, as the research used thematic and content analysis to conduct the study.

In this research, different data analysis methods were used to analyze the collected data. For qualitative data analysis, the researchers used thematic analysis and content analysis.

Thematic analysis is a type of analysis where previously stacked data are collected and analyzed as themes for an in-depth understanding of the research subject (Finlay, 2021). On the other hand, **content analysis** uses textual data from various sources where recent datasets are also present to provide insights about current trends, issues and other key factors. Both thematic and content analysis was done through the tools available online. The main tools used for qualitative analysis were Google Scholar, IEEE Xplore, Jstor, Saudi Data and Artificial Intelligence Authority or SDAIA. Along with that, different publication reports, and news articles have been used in the study.

The researchers also chose quantitative data, and it was analyzed through tools like **NVivo and SPSS** software. This software is used in the study to analyze the subject and its various parks. SPSS is an analytical tool developed by IBM to analyze various statistical data through advanced analytical methods (Pallant, 2020). The tool is used to correctly identify data points and insights that are helpful for research result creation.

Justification

Thematic analysis was used in this study to analyze the importance of AI in the Saudi Arabian government's project management. This was also important to showcase what are the issues AI can raise during the implication as described in various studies. Thematic analysis helped in this study in identifying previously collected data from other sources. Sources like news articles, reports, government data, and journals have shown AI implications in different

projects and how it has become a major trend in recent times (Sun et al., 2020). It was important to understand as the implications of AI in government projects require a thorough understanding of its various aspects to successfully gain benefits from it. Thematic analysis in this study served this purpose and was justified for choosing this specific method. Content analysis, which is another method closely related to thematic analysis, helped this study identify the insights from the content collected from various sources. This was beneficial for the research to understand broader aspects of AI implementation in project management. Analyzing different government data through content analysis was also helpful in understanding the current condition of government infrastructure to use artificial intelligence in project management. This also helped to identify the proper ways to use NLP, computer vision and machine learning methods in project management. These methods are integrated parts of AI content analysis and thematic analysis helps to link the connection of these tools in successful project management that can be done by the Saudi Arabian government. Using software like **NVivo and SPSS** was helpful in this study to analyze critical and large sets of data collected from various sources. Using this software reduced the total time taken in the study and provided bias-free results which was essential for a more impactful study result (Nunes et al., 2021). This software also helped the study to clean and categorize the data in proper sections for a clear understanding of the impact of AI in government project management.

3.9 Research Technique

The research technique is a process in which the data are collected and interpreted, and findings are performed by the researcher. The study on the topic use of AI in Saudi Arabian government projects has used a mixed methodological approach while collecting and analyzing its data. So, this study consists of the perspectives of both qualitative and quantitative methods analyzing the importance of AI implementation in the project

management of the Saudi Arabian government. A thorough analysis of articles which were taken from Google Scholar about the integration of AI in the project management perspectives. The analysis of published articles has been done to understand the room for improvement in this segment. Authentic sources like Scholar, IEEE Xplore and JSToR have been used to get the journals and maintain their authenticity. News articles have also been analyzed which are taken from the international media house that deals with the AI implementation. Through this analysis, researchers can get enough ideas about the advantages and disadvantages of AI implementation along with the people's perspective analysis. This type of newspaper was collected from channels like BBC and Arab News. Nvivo is used to understand and analyze the data collected from the qualitative methods. During the collection of quantitative data, a survey is conducted by the government officials of Saudi Arabia to analyze the perspective of AI integration and understand the challenges that could be faced. The responses to the survey will be taken into a numeric database utilizing a Likert scale so that the analysis could be more acceptable and credible in nature. SPSS would also be used to analyze the data collected from the quantitative data collection while regression analysis is also done to understand the relationship among the variables. The mixed method approach of the research can help the researcher to understand and analyze the topic in-depth. The qualitative methods provide an in-depth insight into the current usage of AI from different perspectives. The quantitative methods provide insight into the challenges and advantages along with the areas of improvement. Using both methods helps in understanding the objectives and subjective part of the topic.

3.10 Research Timeline

Gantt Chart								
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Selection of topic								
Developing clear objectives and research questions								
Literature review analysis								
Methodology selection								
Findings and Analysis								
Discussion								
Conclusion								
Recommendation								

Table 1: Timeline of study

The research timeline is a strategic plan that showcases how the researcher conducts the overall study, from initial topic selection to the development of the final study (Hirakata et al., 2022). During the first week, the researcher focuses on selecting the research topic. In the second week, the researcher works on creating specific objectives and formulating research questions. Further, the literature review analysis spans from the third week to the fourth week. Additionally, the researcher selected the methodology of research during the fourth to fifth week. The findings and analysis were also done during the fifth and sixth week.

The discussion part was done during the sixth and seventh week. Further, conclusions were summarized during the seventh week. Lastly, the final phase of recommendation was done in the eighth week.

Research community

The community of this research is the focus group of 100 people. This focus group was segmented into divisions based on education, location, the title of the job and departments. All of the participants were from different sectors and holding different positions within their organizations.

Research limits

3.11 Ethical Considerations

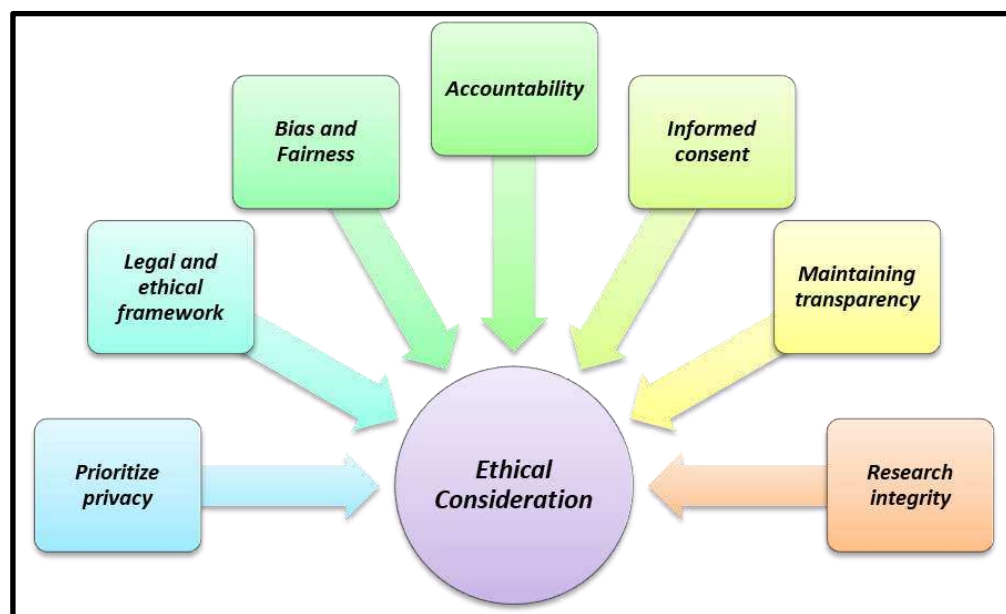


Figure 3.11: Ethical Consideration

Source: (Self-created)

Ethical Consideration indicates evaluating the moral implications of actions, decisions and policies (Char et al., 2020). It is a crucial approach in research to protect the data and information of the respondents and also helps to maintain transparency in the research interpretation. The study interprets some ethical considerations while analyzing the

implementation of AI in project management in **Saudi Arabia**. It includes privacy, legal and ethical frameworks, bias and fairness, accountability, informed consent, transparency, and research integrity.

Prioritize privacy: The research analyzed by ensuring the confidentiality and protection of the sensitive project data. Maintaining the **privacy** of the information and sensitive data **Prioritized**, especially the government data and identification should be handled very confidentially. Artificial Intelligence Authority regulations and global best practices encompass personal data that is encrypted, anonymized and used only for the intended purposes (Lu et al., 2024). Therefore, breaching the data and personal information can create a loss of public trust and cause legal charges against the researchers.

Legal and ethical framework: Establishing the legal and ethical framework is crucial because it is robust to the legal and ethical guidelines for the research of government projects. The protection of personal data and information is involved in the regulation of the **Personal Data Protection Law, 2023** (SDAIA, 2023). These frameworks must ensure the guidelines for the issues developed while conducting the research methodologies and must collaborate with the legal authorities and experts. Therefore, it stands as one of the important ethical considerations in the research procedure which was mentioned by the researchers.

Bias and Fairness: The research perpetuates the **biases** in the research data collection from the respondents and focuses on **fairness** with every individual because there are several choices among people (Ferrara, 2023). The bias in the algorithm can lead to the inequality treatment of different economic, social or ethnic groups which is potential discrimination and unfair for the rule of the research. In this research, unbiased datasets of the individuals helped to get accurate and detailed information for the fulfilment of the research objectives.

Accountability: One of the most important ethical considerations is **accountability** which is the fundamental approach in research interpretation (Ortega-Rodríguez et al., 2020). In

terms of accountability, it ensures the researchers are responsible for **integrity, accuracy** and **transparency** towards their work and the respondents. Accountability involves the clear attribution of responsibility of the research procedures for the data collection, interpretation, analysis and reporting. The researchers must be accountable to their institutions, funding organizations and ethical standards and avoid misconceptions in the research.

Informed consent: Informed consent is a crucial ethical consideration in the research because it indicates the importance of respondents' rights and autonomy which must be protected (Xu et al., 2020). In this concept, individuals and the participants understand the purpose, procedure, potential risks and benefits of the research. Individuals of the respondents knew about the purpose of the survey, and they cooperated with the researchers to fulfil the research objectives.

Maintaining transparency: In the research procedure, transparency is a critical and undeniable ethical consideration (Valdovinos, 2022). Transparency defines that clear communication and openness are essential factors to build trust and loyalty towards the stakeholders or respondents in the case. Also, transparency in interaction promotes research integrity and accurate data analysis for research reporting. Alongside this, it indicates being honest about the research aims, limitations, potential conflicts of interest and other purposes. The concern for transparency and honesty among the researchers helped them get the information from the respondents in many aspects.

Research integrity: Research integrity is a core ethical consideration in research because it ensures the research process and outcomes are reliable, credible, transparent or trustworthy (Lasaite, 2023). Accessing research integrity involves adhering to the research ethical standards such as honesty in data collection, objectivity and rigor throughout the research procedure. The research integrity helped the researchers in identifying the research findings

that influenced the decision-making, and policies and maintaining the ethical framework in the research.

3.12 Research Limitations

Generalizability: The utilization of a small number of current studies on AI's impact on project management, particularly studies on Saudi Arabian government programs minimized the research reliability. Several empirical research involve generalizability in their data collection technique reducing the study's overall uniqueness (Degtiar & Rose, 2023).

Time and resource limitations: The literature fails to offer a comprehensive examination of AI's influence on project management involving government programs in Saudi Arabia. A comprehensive review of the existing literature, as well as data analysis, takes an extensive amount of time and money (Kent, 2020). Limitations in these areas can affect the scope and depth of the research.

Quick technological advancement: Nowadays Artificial intelligence and technology evolve rapidly, and new developments occurring in the study reduce the accuracy of research (Jiang et al., 2022). So, Keeping the studies up to date with the most recent developments and trends might be difficult.

Information limitation: There is a major study gap in understanding the influence of AI on project management, such as automation, operational efficiency, and problem-solving techniques. This had a significant impact on the study and reduced its accuracy overall. Privacy concerns and sensitive information of the Saudi Arabian government also pose a threat of information limitations (AlMindeel & Martins, 2021).

Data quality: There could be errors, gaps, and biases in the data collection and analysis in the overall study. Establishing the trustworthiness of the data analysis techniques and gathering data from numerous sources assists in reducing these errors, although they may not be eliminated.

Subjectivity in qualitative analysis: Qualitative research focuses on individuals and their thoughts, ideas, and views; therefore, the qualitative technique is considered subjective. The researcher's biases and viewpoints may impact the analysis and interpretation of the analysis of overall data. This problem may be reduced by ensuring openness in the analysis process and utilizing multiple reliable resources.

3.13 Chapter Summary

The research segment demonstrated the methodologies used in researching the implementation of AI in project management in Saudi Arabia. The process is involved to frame the research procedures effectively. The methodologies emphasized variant data collection methods, analysis and reporting processes along with the ethical approaches. All these processes support the implementation of the research objectives by gathering and analyzing the available information collected by the researchers. The research onion strengthened the information and methodologies mentioned in this chapter. The research philosophy, approaches and design supports presenting accurate data and information for the research. On the other hand, data sampling, and data analysis show the types of sampling and analysis along with the variations used in the research. Also, the research techniques outlined the methods and techniques used in the ethical considerations illustrated the importance of the ethical approach and purposes of this research. Alongside, the researchers determined the procedures of data collection and interpretation to the reporting processes aligning with the reliability and values of the collected data from the respondents. The methodology mentioned that the study employed mixed data collection which was appropriate while asking 20 questions to a group of respondents on the topic of AI implementation. The chapter supports upholding a comprehensive analytical framework and showcases the research procedures to conduct the study empirically. Additionally, the chosen methods helped the researchers to

predict, collect and study the data to fulfil the objectives of AI implementation in project management in Saudi government projects.

Chapter Four

Study methodology

4.1 Introduction

The findings of the study derived from the research methodology which is conducted for primary and secondary data collection. The purpose of the finding is to gain insight into the implementation of artificial intelligence for government projects in Saudi Arabia. A survey of various employees of government organizations was conducted by the researcher by aligning the questions with the research objectives. The finding of the study provides the foundation for the discussion chapter which helps to support relevant data.

4.2 Survey Response Analysis

4.2.1 Job title of participants

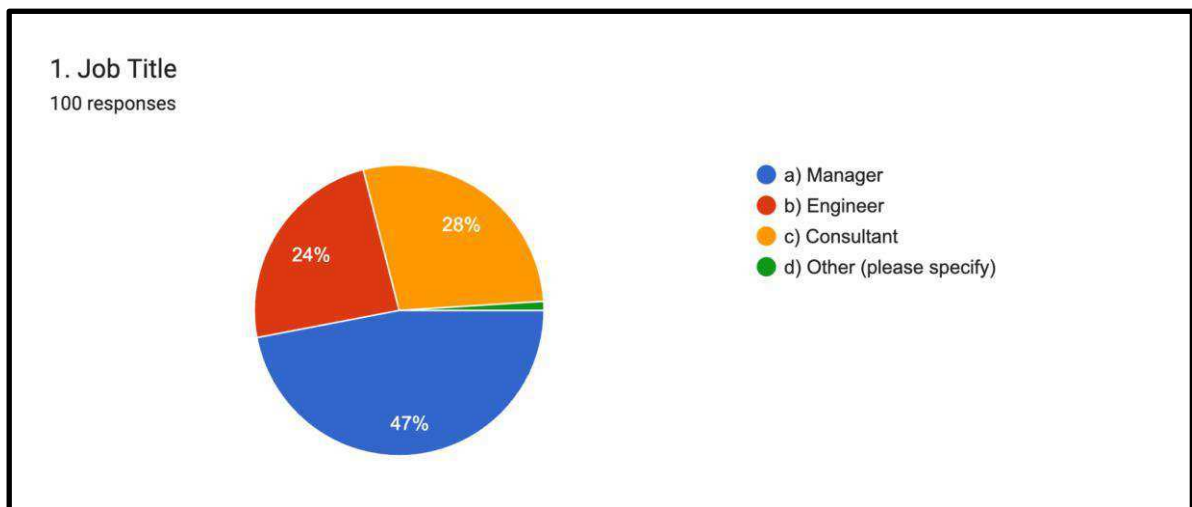


Figure 4.2.1: Job role of participants

n = 100

47% of the participants in this survey belong to the manager position in their job. Furthermore, 28% of the total participants are consultants and 24% of participants are engineers. The survey was conducted among experts in various sectors which can provide an enhanced perspective on artificial intelligence for the government project in Saudi Arabia.

4.2.2 Experience of participants in project management

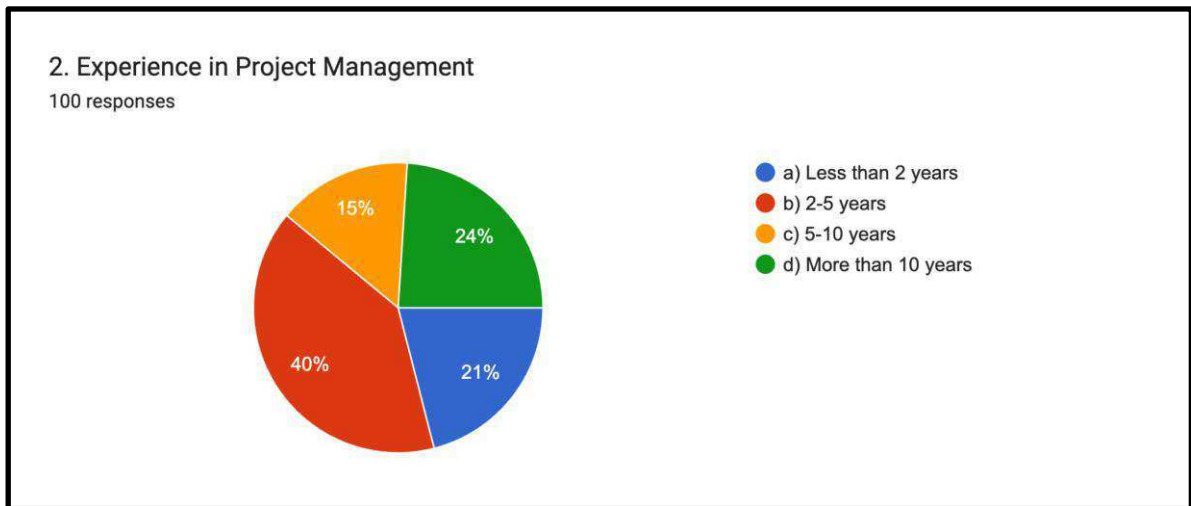


Figure 4.2.2: Experience of participants

n = 100

40% out of 100 participants had experience of 2 to 5 years in their respective positions. On the other hand, 24% of participants have more than 10 years of experience and 21% of the total had less than 2 years of experience. It signifies that the majority of participants have experience in their jobs and have a better understanding of artificial intelligence for project management.

4.2.3 Education level of participants

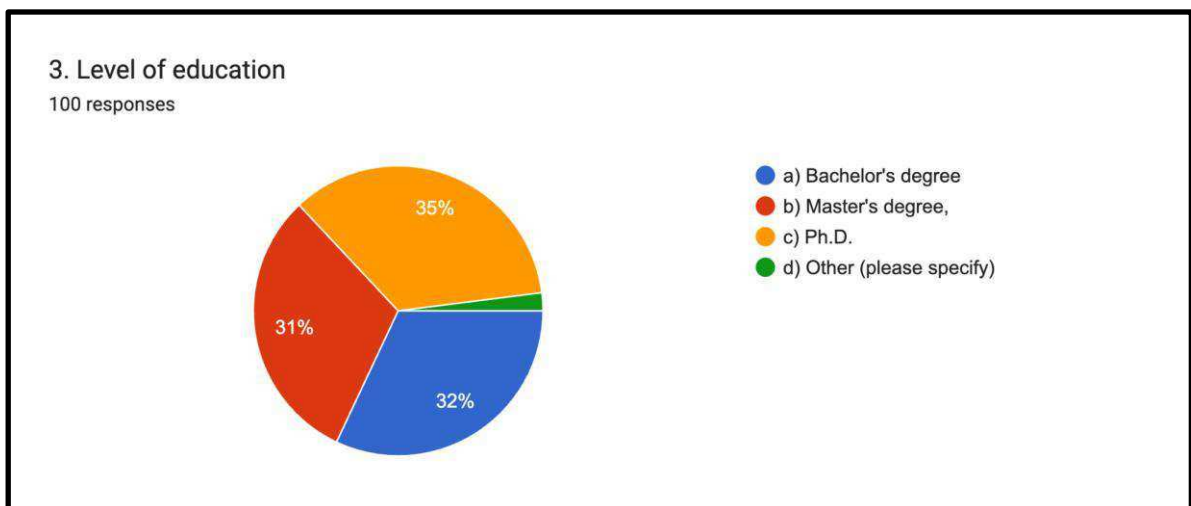


Figure 4.2.3: Completed education of participants

n = 100

32% of the total participants have bachelor's degrees in education whereas 31% of the total have a master's degree. The third survey also illustrates that 35% of 100 participants had a PhD in education. It indicates the majority of the participants are PhD holders.

4.2.4 Department or ministry of participants

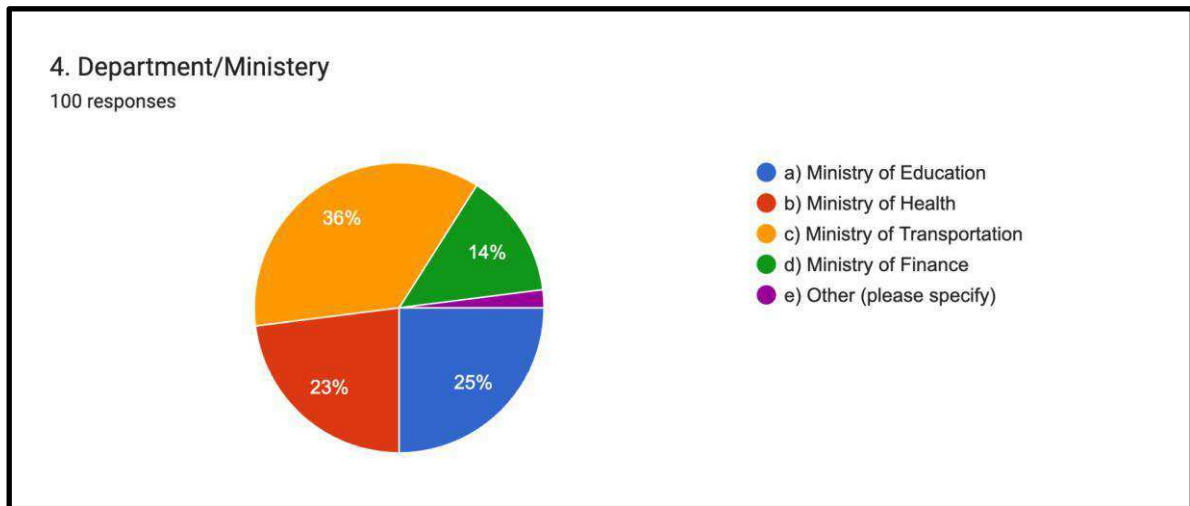


Figure 4.2.4: Working department or ministry of participants.

$n = 100$

The fourth survey shows that 36% of 100 participants are working in the Ministry of Transportation. It also shows that 25% of 100 participants are working in the education ministry and 23% of the total were employed in the Ministry of Health. It means there were different people participating in the survey who were working in different sectors.

4.2.5 Residing city

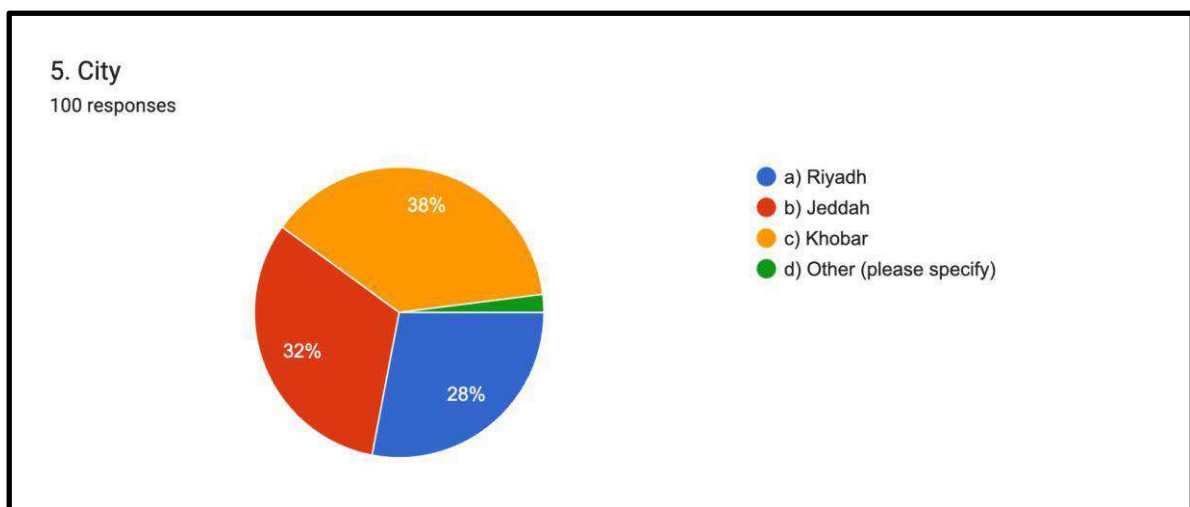


Figure 4.2.5: Belonging of participants

n = 100

The fifth survey shows that 38% of the total participants are from Khobar City, Saudi Arabia. It also shows that 32% out of 100 participants live in Jeddah City and 28% of the total belongs to Riyadh City in Saudi Arabia. It means the people who participated in the survey were from different regions in Saudi Arabia.

4.2.6 Familiarity with Artificial Intelligence (AI)

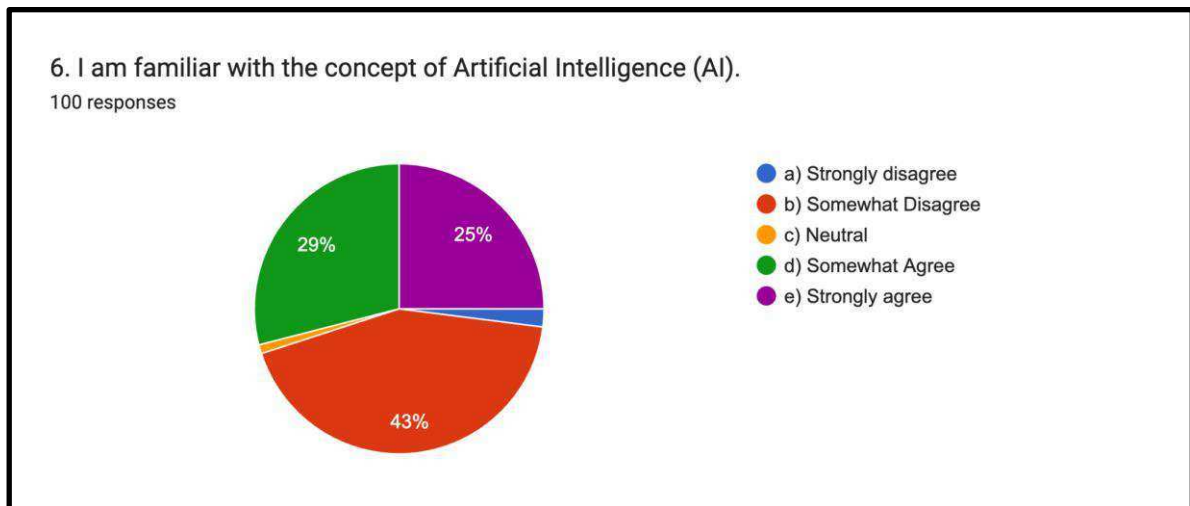


Figure 4.2.6: Participants response on their familiarity with artificial intelligence

n = 100

The sixth survey signifies that 43% of 100 participants disagree with the similarity of the concept of artificial intelligence. On the other hand, 25% of the total strongly agree and 29% of 100 participants somewhat agree with their familiarity with the concept of artificial intelligence. It shows that the majority of participants are well-known about artificial intelligence and its efficiency in government project management. This is due to the rapid implementation of AI-based projects in organizations. The survey also shows that more than 43% of people somewhat disagreed with the question. It means they are quite unfamiliar with the use of artificial intelligence in their organization.

4.2.7 Role of AI to improve project management efficiency in government projects

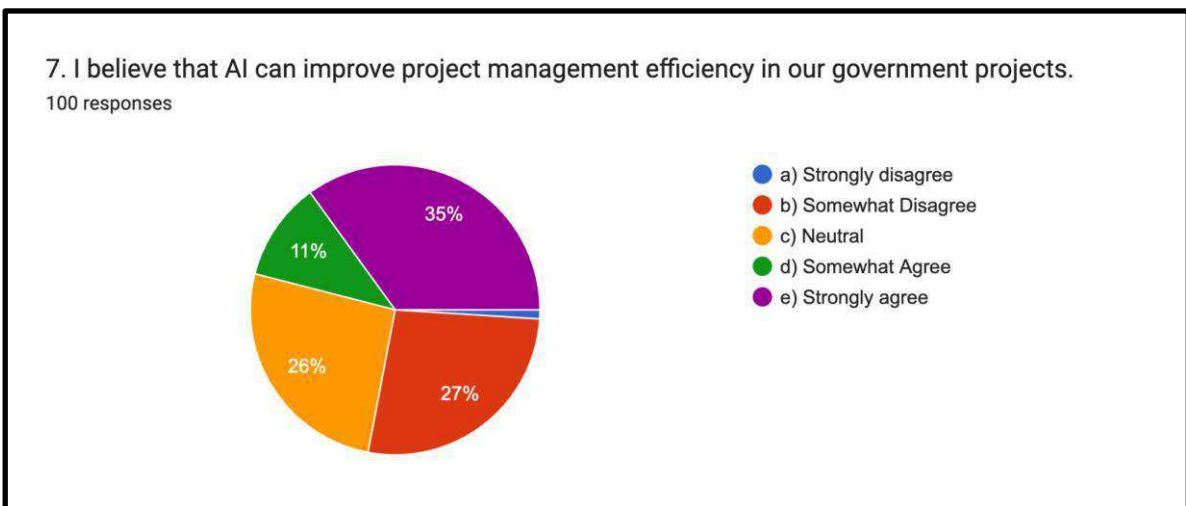


Figure 4.2.7: Improvement in project management efficiency with AI

n = 100

35% of the total 100 participants strongly agree that Artificial Intelligence can improve project management efficiency in government projects. Furthermore, 26% of the total were neutral in this survey and 27% of 100 participants disagreed with the efficiency of artificial intelligence in project management. The majority of participants in this survey favored the efficiency of artificial intelligence for project management improvement. It can be due to artificial intelligence automating manual work for employees and saving them time.

4.2.8 implementation of AI-based project management tools in the organization

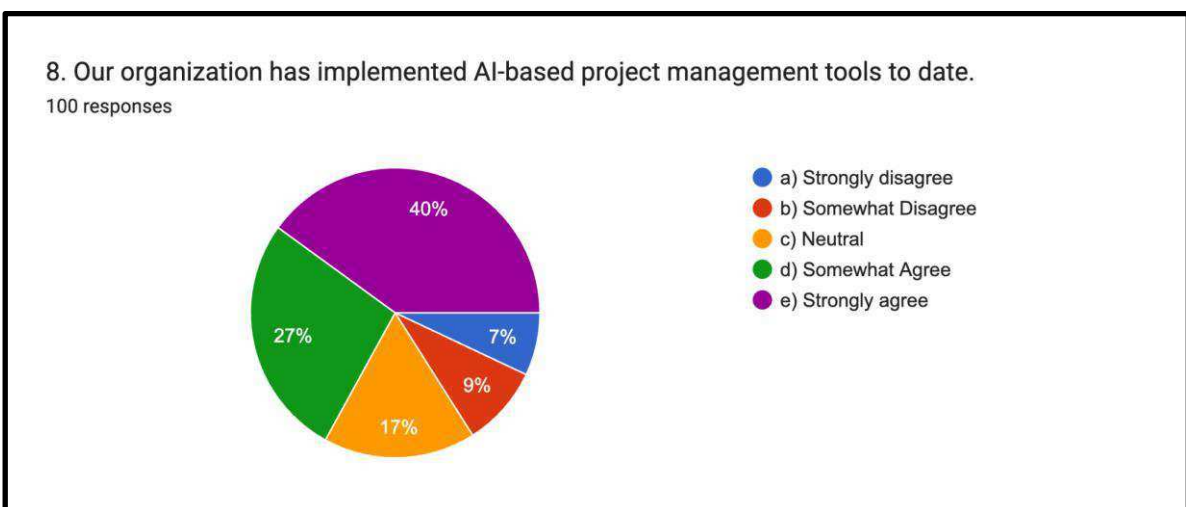


Figure 4.2.8: Implementation of AI-based project management tools in the organization of selected participants

n = 100

The eighth response in this survey highlights that organizations of 40% of participants implemented artificial intelligence-based project management tools. However, 27% of 100 participants somewhat agreed with the implementation and 17% were neutral in the survey. It also reflects that 9% of 100 participants disagreed with the implementation of artificial intelligence in their organization whereas 7% completely disagreed with the statement. A neutral response by the participants reflects that everybody is now aware of the implementation of artificial intelligence-based projects in government organizations in Saudi Arabia.

4.2.9 Essentiality of AI-based project management tools for government projects.

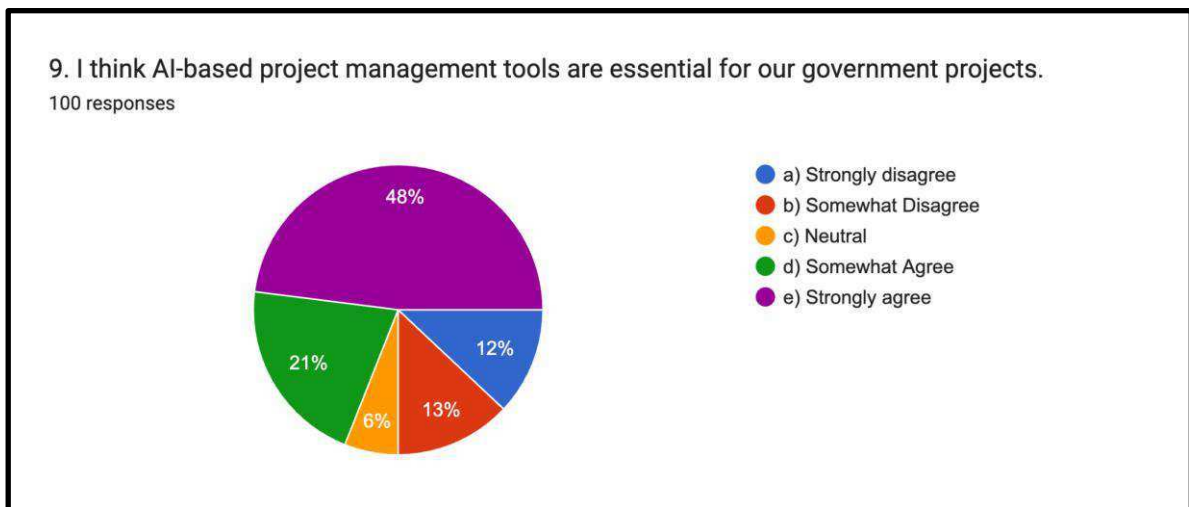


Figure 4.2.9: Perspective of participants for essentials of AI-based project management tool in their government projects

n = 100

As per the survey response, 48% of 100 participants strongly agreed with the essentiality of artificial intelligence-based project management tools in government projects. 21% of 100 participants somewhat agreed with it and 13% of them disagreed with the efficiency of artificial intelligence-based project management tools. Additionally, 12% of the total participants completely disagreed with the need for project management tools in the government project and 6% of 100 participants were neutral on this point. The efficiency of project management tools is beneficial for the managers in one project because AI can automate the majority of work for them. The first survey shows 47% of 100 participants were

managing in the survey. So, they might provide a positive response on the essentiality of AI-based project management tools for government projects.

4.2.10 The impact of the lack of AI-based project management tools leads to hindering the ability to deliver projects on time and within budget.

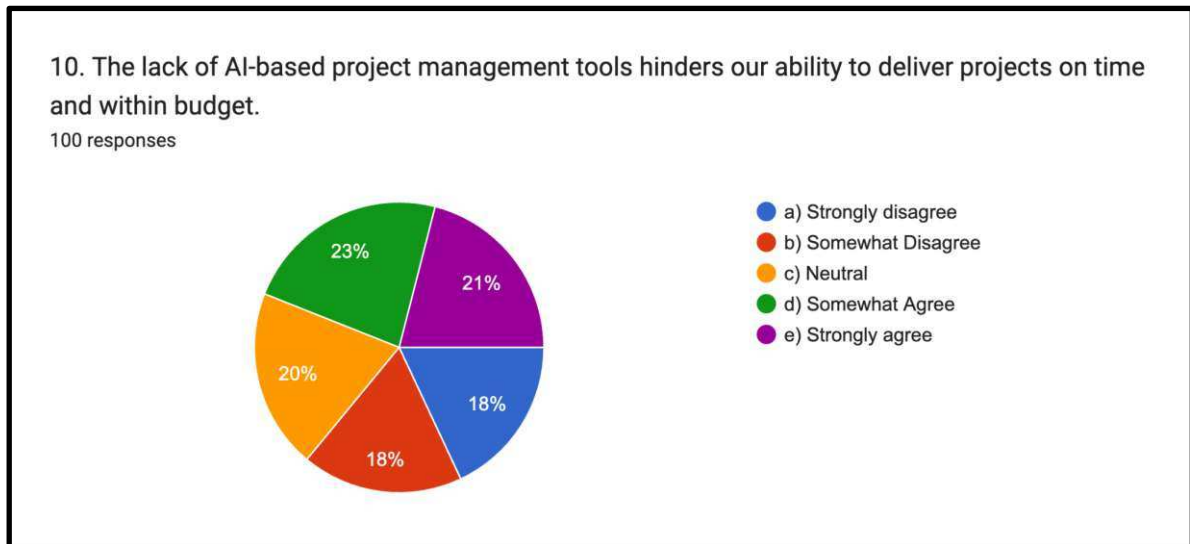


Figure 4.2.10: Hinders bring by AI-based project management tools to deliver projects on time and within budget due to lack of knowledge.

n = 100

The tenth response in the survey gave nearly the same result in all aspects. It shows that 23% of 100 participants agreed that the lack of AI-based project management tools minimizes their ability to deliver projects on time and within budget. Additionally, 21% of 100 participants' families agreed with the point and 18% of the total completely disagreed with the statement. Furthermore, 20% of 100 participants remained neutral during the response and 18% of the total disagreed with the lack of AI-based project management tools. The neutral response from the participants reflects that artificial intelligence is effective for project management but quite difficult to understand.

4.2.11 Adopt AI-based project management tools for government projects.

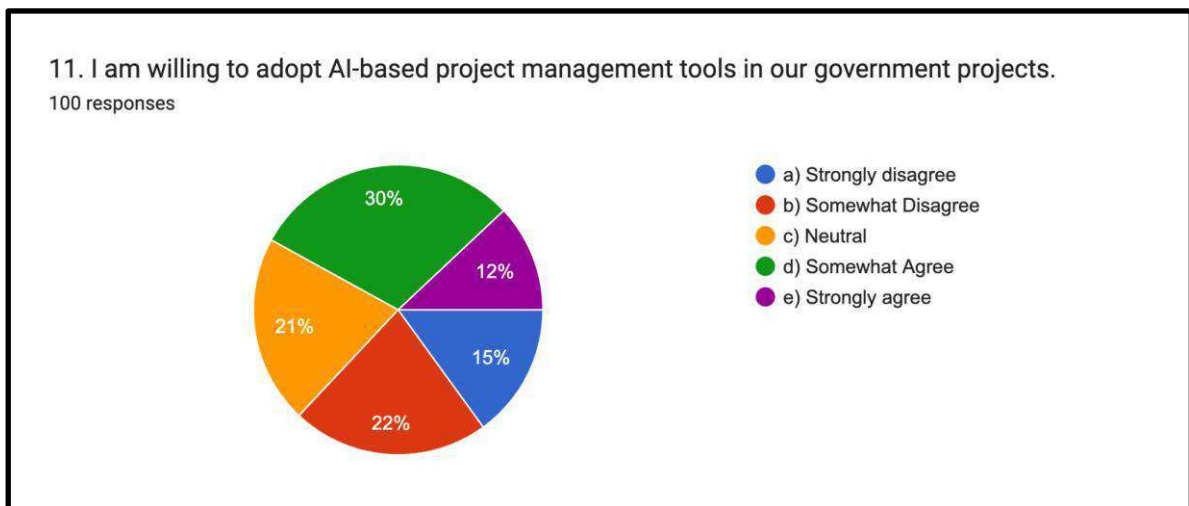


Figure 4.2.11: Willingness of participants to adopt AI-based project management tools in their government projects

n = 100

30% of 100 participants agreed that they are willing to adopt artificial intelligence-based project management tools for their government projects. Additionally, 21% of 100 participants were neutral with their perspective on adopting artificial intelligence and 22% of them disagreed with adopting AI. 12% of a total of 100 participants strongly agreed and 15% of them completely disagreed with the adoption of artificial intelligence-based project management tools in government projects. A positive response from participants signifies that employees in government projects are willing to adopt AI for increasing deficiency. It also integrates sustainability in its project management approach and saves time as well as the cost of the project.

4.2.12 efficiency of organization resources to implement AI-based project management tools

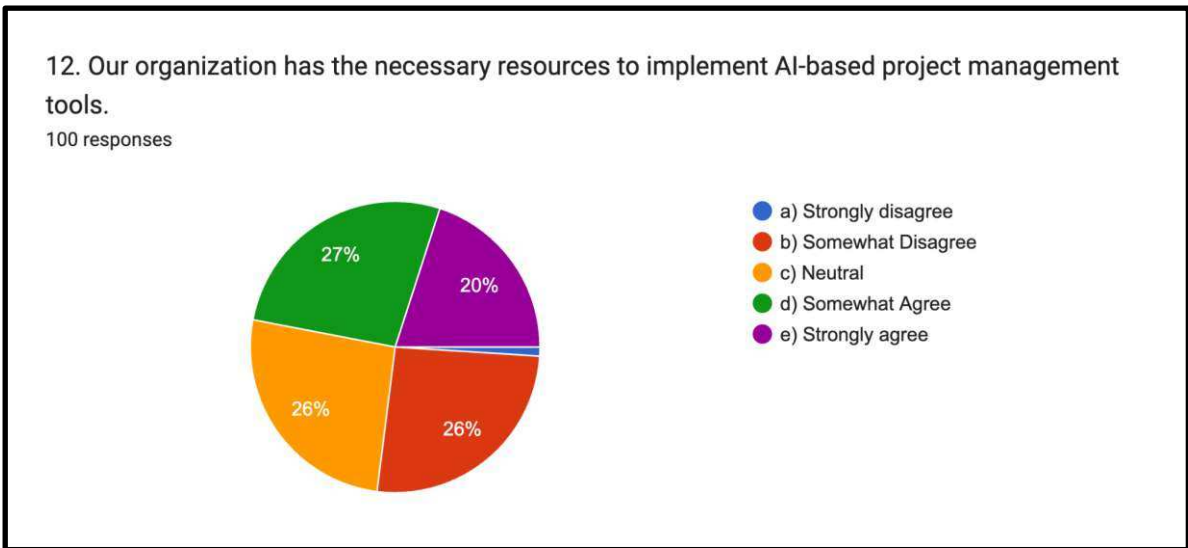


Figure 4.2.12: Resources in organization for implementing AI-based project management tools.

n = 100

The twelfth response reflects that a large number of participants responded neutrally to this question. 27% of 100 participants agreed that the organization has the necessary resources for implementing artificial intelligence-based project management tools. 26% of 100 participants were neutral or disagreed with identifying the resources in their organization for implementing artificial intelligence-based project management. Furthermore, 20% of the total agreed with this response. The majority of responses were not convincing as 40% of participants in the seventh survey responded that their organization has up-to-date tools for Artificial Intelligence.

4.2.13 Effectiveness of AI-based resource allocation tools to optimize resource utilization for government projects

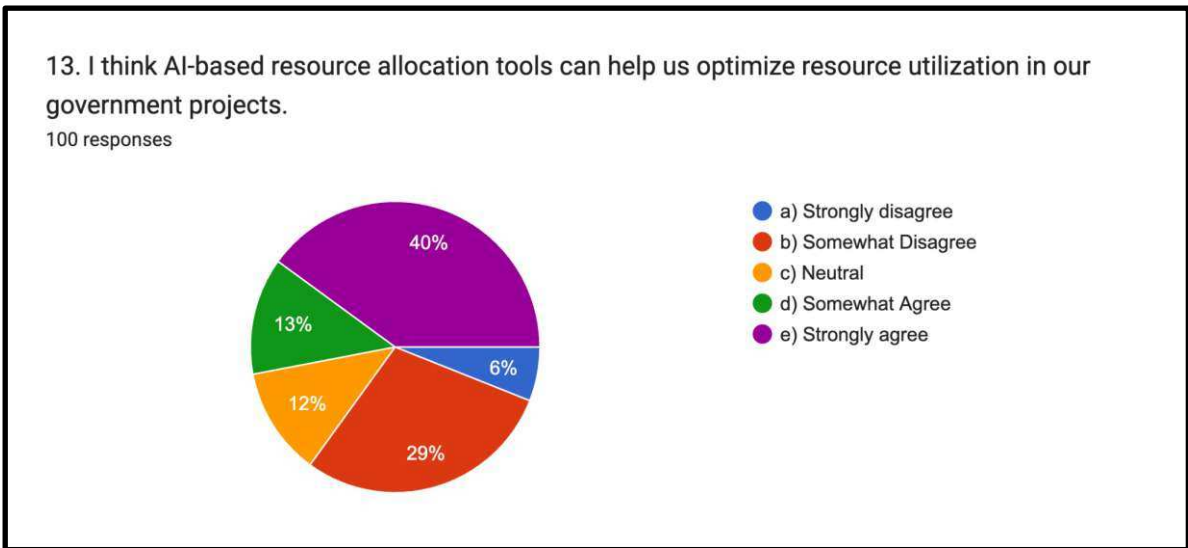


Figure 4.2.13: Help by AI-based project management tools for optimized use of resources in the government projects of participants.

n = 100

40% of 100 participants strongly agreed that an artificial intelligence-based resource allocation tool for project management optimizes the neutralization of resources in their government projects. On the other hand, 29% of the total participants disagreed with the statement and 12% of them were neutral during the response. The positive response from the participants was possible as artificial intelligence reduces inappropriate resource allocation practices and enhances organizational productivity. However, in the 11th survey, the majority of participants were willing to adopt artificial intelligence, and it could be the reason for their positive response to resource utilization in their project management.

4.2.14 Implementation of AI-based resource allocation tools for significantly changing current workflows and processes.

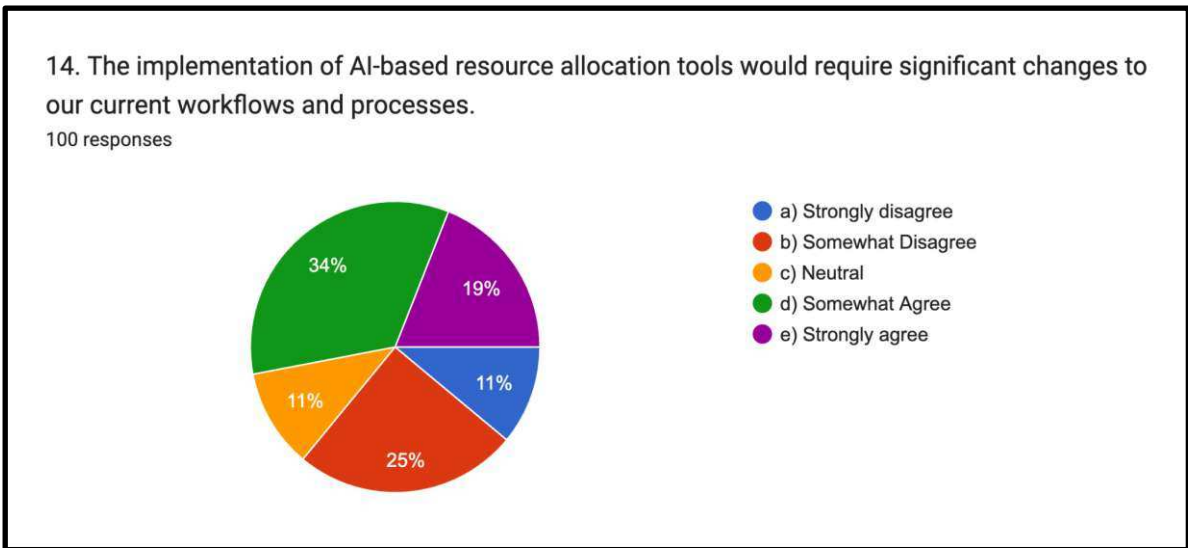


Figure 4.2.14: Requirement for changing current workflows and processes in the organization for implementing AI-based resource allocation tools.

n = 100

34% of the 100 participants agreed and 19% of the total work completely agreed with this response. The question was related to changes in their workflows and processes for implementing artificial intelligence allocation tools in their organization. 25% of 100 participants disagreed with it and 11% of the total completed disagreed with this response. The second survey shows that the majority of respondents in the survey were experienced and used the traditional methodology for workflows. It could be necessary for them to change the work methodology for implementing artificial intelligence-based resource allocation tools.

4.2.15 Role of AI-based project management and resource allocation tools to improve collaboration

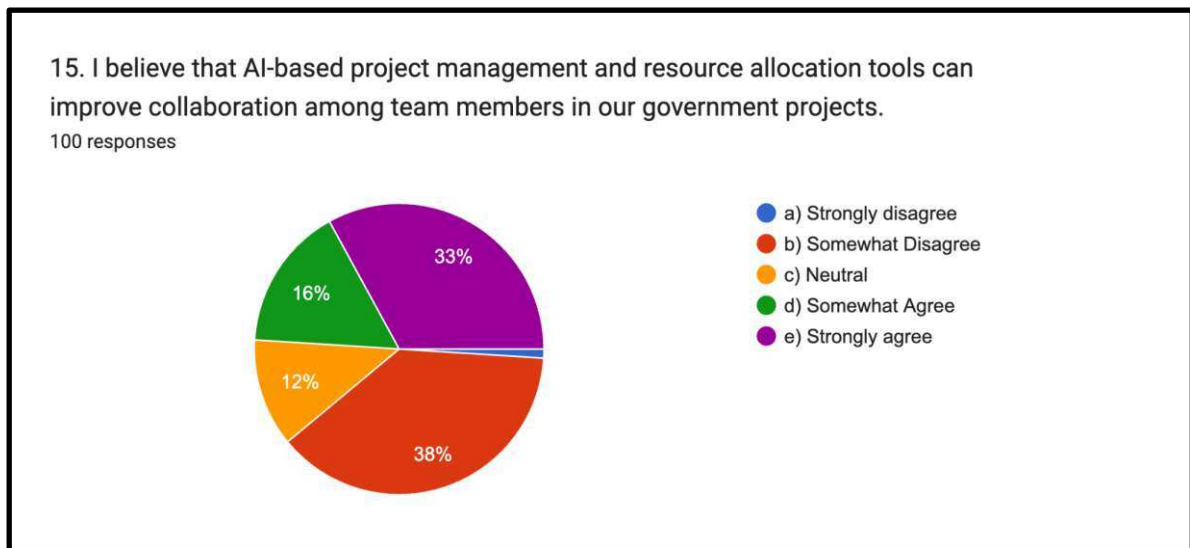


Figure 4.2.15: Help by AI-based project management tools for optimized use of resources in the government projects of participants.

n = 100

33% of 100 participants strongly agreed that artificial intelligence, which is project management and resource allocation tools improves the collaboration of the team members. On the other hand, 38% of participants disagreed and 12% remained neutral to this question. The negative response from respondents in the survey was possible because traditional methods of communication are more effective for improving collaboration among team members. Artificial intelligence-based project management is completely based on technology and lacks at the time of technology change in organizations. So, the majority of participants found that artificial intelligence-based project management and resource allocation tools are not effective for their team members in improving collaboration during government projects.

4.2.16 Challenges in organizations for implementing AI-based project management.

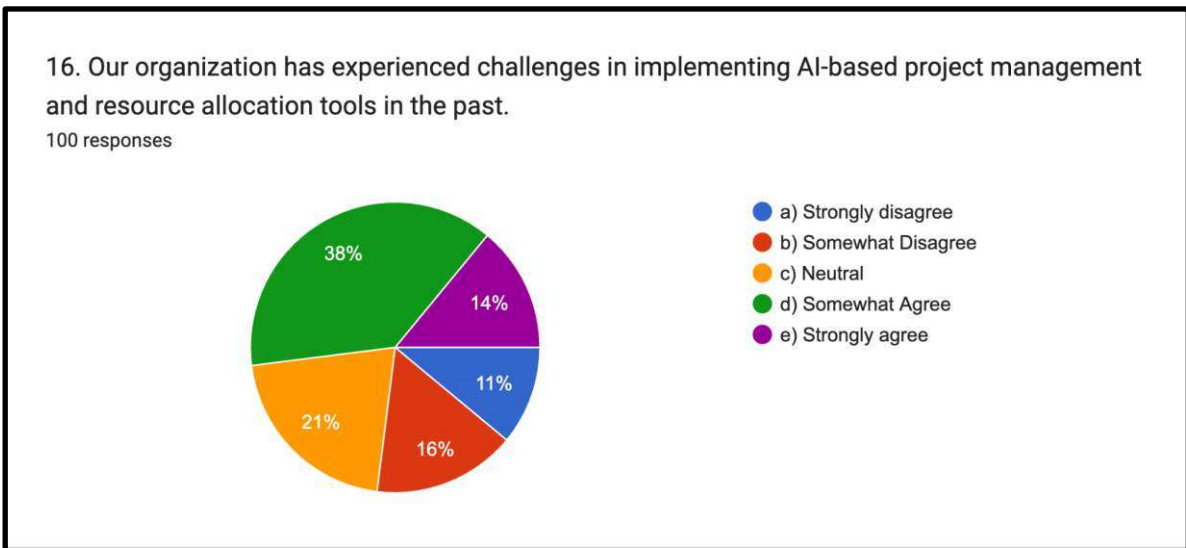


Figure 4.2.16: Challenges faced by organizations for implementing AI-based project management and resource allocation tools.

n = 100

The sixteenth response in the survey highlights challenges faced by organizations in implementing artificial intelligence-based project management and resource allocation tools. 38% of 100 participants agreed that their organization was facing challenges and 14% of the total were completely in agreement. On the other hand, 21% of 100 participants were neutral and 16% supported their organization by the statement. This is because organizations have to align multiple stakeholders such as suppliers and employees. It is the primary reason organizations bring barriers to the implementation of artificial intelligence-based project management and resource allocation.

4.2.17 Benefits of AI-based project management and resource allocation

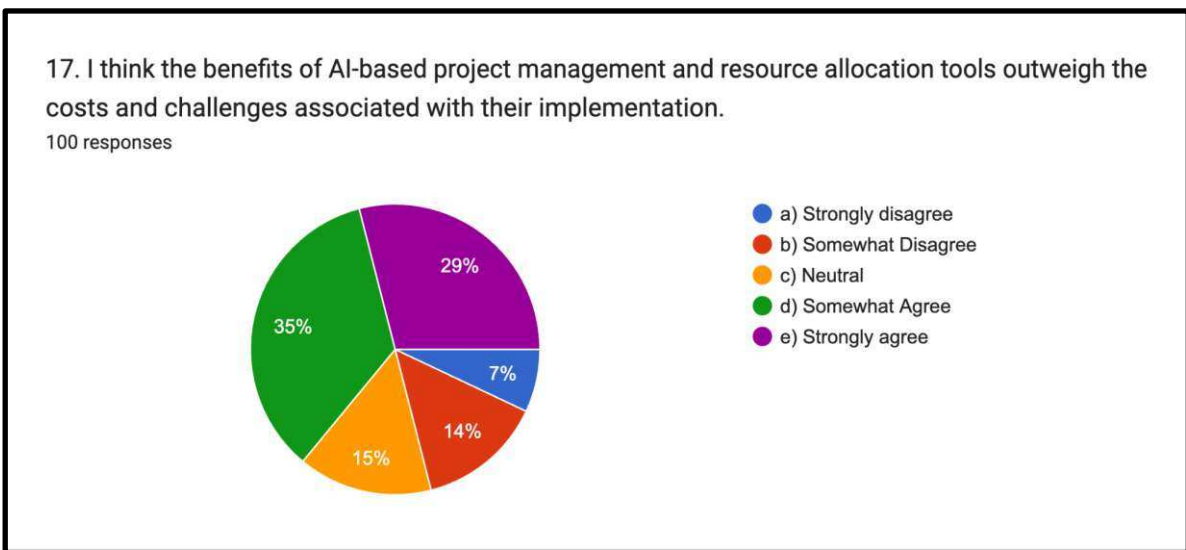


Figure 4.2.17: Primary benefits of implementing AI-based project management tools for reducing costs and challenges]

n = 100

50% of the total participants favor the benefit of artificial intelligence-based project management that helps to minimize costs and challenges. 35% of them agreed and 29% completely agreed with this statement. On the other hand, 15% of 100 participants were neutral and 14% of the total disagreed with the benefit of artificial intelligence-based project management. The positive response from the participants was possible because, in the furthest survey, the majority of participants stated about efficiency. It illustrated that artificial intelligence-based project management tools are effective for resource allocation.

4.2.18 Prioritization by the organization for adoption of AI-based project management

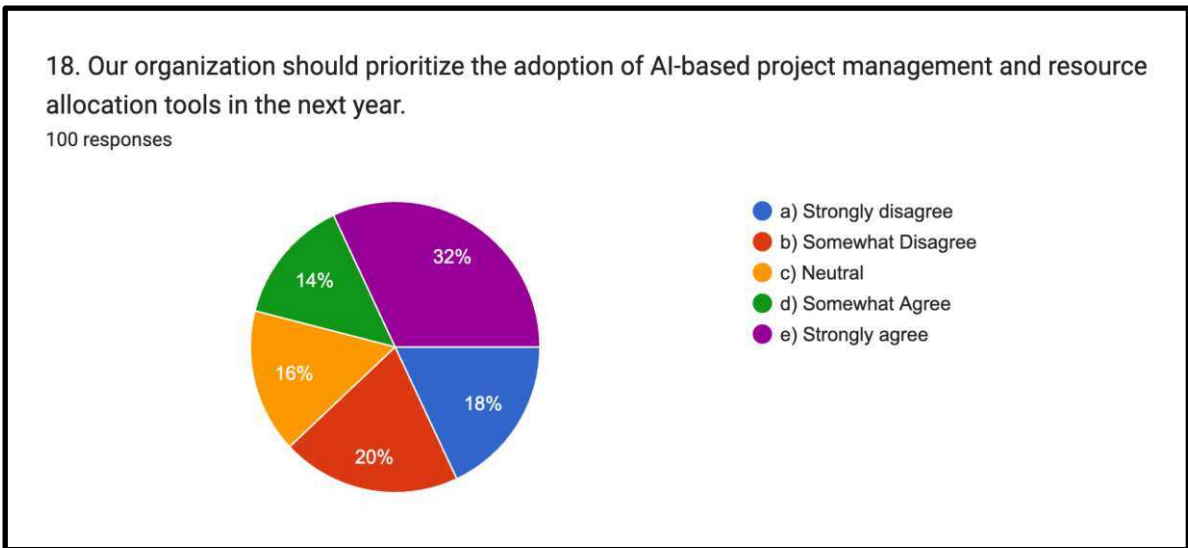


Figure 4.2.18: Adoption of project management and resource allocation tools for organizations by next year

n = 100

The 18th response of the Survey highlights that 32% of 100 participants want their organization to prioritize the adoption of artificial intelligence-based project management. 18% of the total participants completely disagreed and 20% of them disagreed with the statement. However, 14% of 100 participants agreed with the prioritization of Intelligence project management and 16% remained neutral. The survey response is linked with the response of thirteen surveys in which participants favored optimizing resource utilization through artificial intelligence. However, some participants responded negatively to prioritizing the adoption of artificial intelligence-based project management because they felt a lack of collaboration with their team members through artificial intelligence.

4.2.19 Confidence in AI-based project management and resource allocation for improving performance.

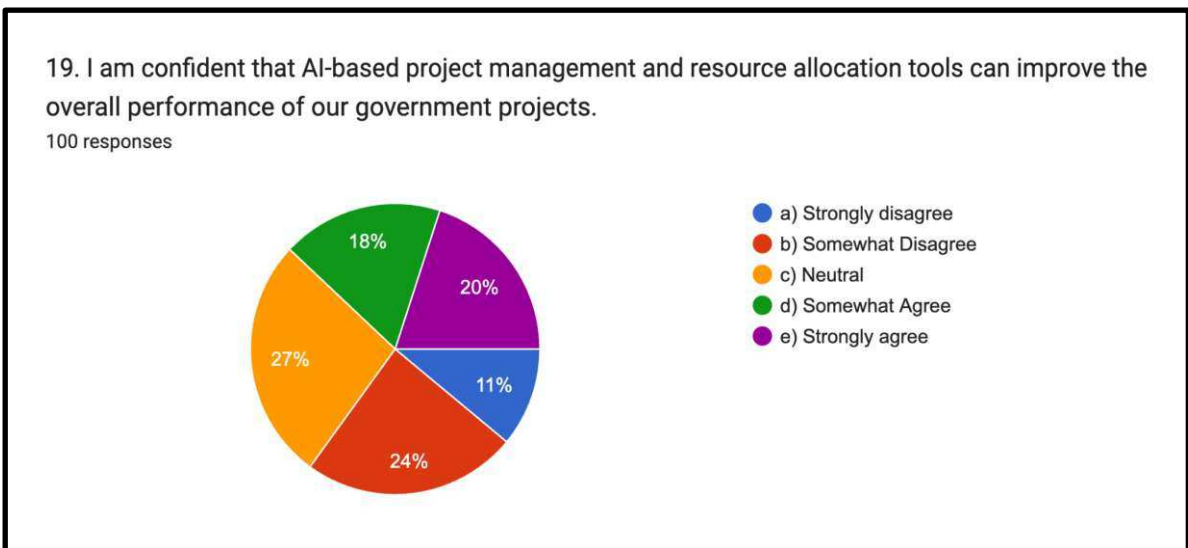


Figure 4.2.19: Confidence of participants in AI-based project management tools for improving the overall performance of their government projects

n = 100

24% of 100 participants disagreed with the improvement of the performance of government projects with the help of artificial intelligence-based project management and resource allocation. 11% of total participants completely disagreed with this point and 27% of them remained neutral. Only 38% of 100 participants either agreed or completely agreed in favor of improving performance with the help of artificial intelligence. The negative response from the people was identified because the majority of them were working with traditional workflows. They are aligned with existing project management tools which pulls them back to adopting new resource allocation methodology.

4.2.20 Positive impact of AI-based project management and resource allocation for increasing efficiency.

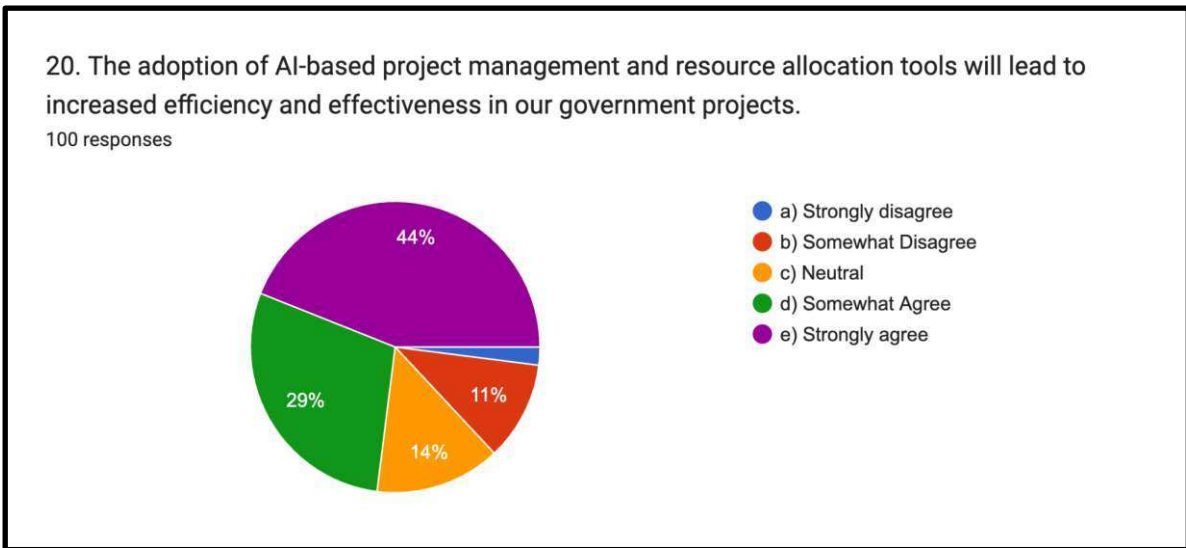


Figure 4.2.20: Adoption of AI-based project management and resource allocation tools for increasing efficiency and effectiveness

n = 100

44% of 100 participants completely agreed with increasing efficiency or effectiveness with the help of artificial intelligence-based project management and resource allocation tools. Similarly, 29% of the total participants agreed and 14% of them remained neutral. Only 11% of 100 participants disagreed on the point and some of them completely disagreed. The survey response stated a strongly positive view on the adoption of artificial intelligence-based project management resource education tools. It can be because participants also stated about minimized cost and challenges in the implementation during the seventeenth survey response. It reflects that artificial intelligence-based project management and resource allocation tools can increase the efficiency and effectiveness of government projects.

4.3 SPSS Analysis

4.3.2 Descriptive Analysis

The results of the survey on AI-based project management tools are generally positive, descriptively. For instance, the statement "I am familiar with the concept of Artificial Intelligence" means 3.32, indicating moderate familiarity. With a skewness of 0.017,

distribution is almost symmetric but leptokurtic with kurtosis -1.656, thus showing very high levels of familiarity. While the general agreement is that, AI can improve Project Management Efficiency with a mean of 3.54 and left skewed -0.030, leptokurtic distribution of -1.555 portraying more extreme positive views, it is the views on implementing AI tools—that take a little above 0 with a mean of 3.84 and moderate skew of -0.876 with near normal kurtosis of -0.236 portraying general agreement (Roni & Djajadikerta, 2021). The essential nature of AI tools (mean = 3.80) and their impact on project delivery (mean = 3.11) for this student showed very left-skewed distributions, characterized by extreme kurtosis values indicating somewhat extreme opinions (Pallant, 2020). Willingness to adopt the usage of AI tools and perception of necessary resources came out very similarly with means at 3.02 and 3.39, respectively. Overall, strong support is indicated by the high mean (4.05) of "AI tools will lead to increased efficiency," although the distribution shows a skew to the left (-0.970). Kurtosis toward normality (0.020) suggests consensus for its benefits. The data generally present a positive view on AI tools with some variation in opinions.

Descriptive Statistics									
	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
6. I am familiar with the concept of Artificial Intelligence (AI).	100	1	5	3.32	1.309	.017	.241	-1.656	.478
7. I believe that AI can improve project management efficiency in our government projects.	100	1	5	3.54	1.259	-.030	.241	-1.555	.478
8. Our organization has implemented AI-based project management tools to date.	100	1	5	3.84	1.245	-.876	.241	-.236	.478
9. I think AI-based project management tools are essential for our government projects.	100	1	5	3.80	1.456	-.865	.241	-.765	.478
10. The lack of AI-based project management tools hinders our ability to deliver projects on time and within budget.	100	1	5	3.11	1.406	-.132	.241	-1.264	.478
11. I am willing to adopt AI-based project management tools in our government projects.	100	1	5	3.02	1.271	-.128	.241	-1.097	.478
12. Our organization has the necessary resources to implement AI-based project management tools	100	1	5	3.39	1.109	.035	.241	-1.190	.478
13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.	100	1	5	3.52	1.418	-.248	.241	-1.525	.478
14. The implementation of AI-based resource allocation tools would require significant changes to our current workflows and processes	100	1	5	3.25	1.321	-.260	.241	-1.218	.478
15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	100	1	5	3.42	1.319	.042	.241	-1.689	.478
16. Our organization has experienced challenges in implementing AI-based project management and resource allocation tools in the past.	100	1	5	3.28	1.215	-.454	.241	-.764	.478
17. I think the benefits of AI-based project management and resource allocation tools outweigh the costs and challenges associated with their implementation.	100	1	5	3.65	1.234	-.683	.241	-.554	.478
18. Our organization should prioritize the adoption of AI-based project management and resource allocation tools in the next year.	100	1	5	3.22	1.521	-.136	.241	-1.475	.478
19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.	100	1	5	3.12	1.289	.032	.241	-1.071	.478
20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.	100	1	5	4.05	1.086	-.970	.241	.020	.478
Valid N (listwise)	100								

4.3.3 Linear Regression (for hypothesis 1)

The first hypothesis states, AI can increase efficiency as well as helps in saving cost; in order to prove this, this analysis has evaluated distinct factors relating AI adoption's impact in project management (PM). The significance of the role of AI in resource optimization, aspects most strongly influence project management process is observed using regression analysis (Golhar et al., 2021). The relation among aspects most strongly influencing the perceived value of AI, is determined using coefficient value obtained from the regression analysis.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.694 ^a	.482	.460	1.070

a. Predictors: (Constant), 20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects., 14. The implementation of AI-based resource allocation tools would require significant changes to our current workflows and processes., 13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects., 7. I believe that AI can improve project management efficiency in our government projects.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	101.157	4	25.289	22.073	.000 ^b
	Residual	108.843	95	1.146		
	Total	210.000	99			

a. Dependent Variable: 9. I think AI-based project management tools are essential for our government projects.

b. Predictors: (Constant), 20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects., 14. The implementation of AI-based resource allocation tools would require significant changes to our current workflows and processes., 13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects., 7. I believe that AI can improve project management efficiency in our government projects.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.699	.486		1.438	.154
	7. I believe that AI can improve project management efficiency in our government projects.	.098	.115	.085	.852	.396
	13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.	.620	.092	.603	6.734	.000
	14. The implementation of AI-based resource allocation tools would require significant changes to our current workflows and processes.	-.109	.096	-.099	-1.132	.260
	20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.	.229	.130	.170	1.764	.081

a. Dependent Variable: 9. I think AI-based project management tools are essential for our government projects.

As per the results, the model summary is shoeing a variance of 48.2%, which can be considered as moderate ($R^2 = 0.482$). This shows that AI-based PM tools are essential for government projects, are explainable using the predictor models, however, on a moderate level. The ANOVA F value, of 22.073, and P-value of <0.001 symbolize that, the dependent variable can be predicted (significantly) by independent variables (Roni & Djajadikerta, 2021).

AI-based resource allocation tools help optimize resource utilization (Q13), is recognized by the predictor with a p value of < 0.001, and coefficient of 0.620, indicating that it is significant predictor (Hu, 2020). This shows that the respondents who consider AI tool effective in resource utilization, also consider AI based tools are essential for PM. On the other hand, Q7, AI improves PM efficiency cannot be considered as a statistically significant predictor

as its $p = 0.396$, meaning the influence on dependent variable is negligible (Roni & Djajadikerta, 2021). In a similar manner, the adoption of AI based tools for increasing efficiency (Q20) and the workflow change variable (Q14) are also showing marginal or no effect on the dependable variable. As per Golhar et al., (2021), the hypothesis cannot be accepted completely based on this this information. May be the distribution of data or lack of information regarding the context are limiting the variables from influencing the dependent variable.

4.3.4 Binary Logistic Regression for hypothesis 2

Block 0: Beginning Block

Classification Table^{a,b}

Observed		Predicted		Percentage Correct
		21. AI Adoption Status	Implemented	
Step 0	21. AI Adoption Status	0	27	.0
	Implemented	0	73	100.0
Overall Percentage				73.0

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	
Step 0	Constant	.995	.225	19.499	1	.000	2.704

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	116.652	12	.000
	Block	116.652	12	.000
	Model	116.652	12	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	.000 ^a	.689	1.000

a. Estimation terminated at iteration number 18 because a perfect fit is detected. This solution is not unique.

As per the results of the binary logistic regression, classification table is showing a model that contains only the constant term will predict all cases as "Implemented," for an accuracy of 100% on "Implemented" cases but totally missing the "Not Implemented" cases. It indicates that the current model has some bias and a bad fit to data. The overall mean accuracy of 73.0% does indicate just how very heavily conditioned the predictive power of the model is when only including the constant term (Harris, 2021).

Omnibus Tests of Model Coefficients: Chi-square = 116.652, $p < 0.001$, showing that fit of the model significantly improved on adding predictors, thereby established that the predictors, especially skills and infrastructure, become key determinants in AI adoption (Gijbels et al., 2021). Model Summary shows a Cox & Snell R Square of 0.689 and a

Nagelkerke R-Square value of 1.000, thus showing that the proposed model with predictors explains variance to a high extent in explaining AI adoption. Of course, this perfect fit signal might give an indication of overfitting. Even though results do signify that an emphasis on skills and infrastructure is important for AI adoption, it requires further validation and fine-tuning of this model.

4.3.5 Correlation Analysis for hypothesis 3

This has to be done in the correlation analysis to ascertain whether AI really increases accountability and transparency on Saudi Government projects. This analysis finds how these perceived efficiencies and effectiveness linked to the role of AI in enhancing resource optimization, better collaborations, and increasing overall performances actually offer insights into how AI is affecting the practice (Tanvir Mustafy & Ur, 2024). These help us understand whether or not AI really results in better project management outcomes.

Correlations					
		13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.	15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.	20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.
13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.	Pearson Correlation	1	-.075	.253*	.442**
	Sig. (2-tailed)		.460	.011	.000
	N	100	100	100	100
15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	Pearson Correlation	-.075	1	.641**	.063
	Sig. (2-tailed)	.460		.000	.535
	N	100	100	100	100
19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.	Pearson Correlation	.253*	.641**	1	.313**
	Sig. (2-tailed)	.011	.000		.002
	N	100	100	100	100
20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.	Pearson Correlation	.442**	.063	.313**	1
	Sig. (2-tailed)	.000	.535	.002	
	N	100	100	100	100
*. Correlation is significant at the 0.05 level (2-tailed).					
**. Correlation is significant at the 0.01 level (2-tailed).					

As per the result ($r = 0.641$, $p < 0.001$), a significant correlation has been found between the belief that confidence in AI's role in enhancing overall performance (Q19), and AI improves

team collaboration (Q15). This suggests an increase in AI-based collaboration, is proportional to higher confidence in its performance. Moreover, a moderate relation has been found between confidence in using AI tools, and its impact on the effectiveness (Q20). This indicates more confidence in AI, hence confidence in delivering more in project efficiency (Watkins, 2021). This position is strengthened by the very high correlation demonstrated between AI creating an impression of optimizing resource utilization (Q13) and that of better efficiency (Question 20) $r = 0.442$, $p < 0.001$. The survey did not find the impact of AI on resource utilization (Q13) to be related significantly to collaboration (Q15) (Tanvir Mustafy & Ur, 2024). However, the overall trends testify to the fact that AI promoted accountability and transparency through improved project performance and resource utilization.

4.3.6 Chi-Square and One-way ANOVA for hypothesis 4

Chi-Square Tests				Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)		Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	102.365 ^a	16	.000	Pearson Chi-Square	104.260 ^a	16	.000
Likelihood Ratio	100.244	16	.000	Likelihood Ratio	101.143	16	.000
Linear-by-Linear Association	2.499	1	.114	Linear-by-Linear Association	.412	1	.521
N of Valid Cases	100			N of Valid Cases	100		
a. 19 cells (76.0%) have expected count less than 5. The minimum expected count is 1.21.				a. 17 cells (68.0%) have expected count less than 5. The minimum expected count is .11.			

Results from the Chi-Square describe the relationship of ethical/legal constraints and problems that limit AI adoption within government project management. The Pearson Chi-Square value remained at 102.365 and 104.260; further, each of the p-values is below 0.001, meaning the influence of legal constraints, algorithm biases, data-privacy risks, among others, being imposed on AI implementation is very high (Turhan, 2020). These challenges have been evidenced as very instrumental to hindering AI adoption. linear-by-linear association with values of 2.499 and 0.412 strengthens the relation of two categorical variables to at least a moderate-to-strong association, which shall be less than 0.05 on a p-

value. The linear-by-linear association value 2.499 is significant, and the p-value of 0.412 shows that the probability of getting the result by chance is. However, that the expected counts in as many as 76% and 68% of cells are less than 5 serves to indicate unreliability in the test and maybe is an indicator of distribution of data problems (Aslam, 2021).

4.3.7 ANOVA and Post Hoc Test for hypothesis 4

Based on the ANOVA and multiple comparisons data provided, we can conclude that factors such as ethical and legal constraints, algorithmic bias, and data privacy risks significantly impact AI implementation in government project management.

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.	Between Groups	80.559	4	20.140	22.777	.000
	Within Groups	84.001	95	.884		
	Total	164.560	99			
15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	Between Groups	59.241	4	14.810	12.438	.000
	Within Groups	113.119	95	1.191		
	Total	172.360	99			

As per the ANOVA table, a statistically significant difference between groups is present, it comes to AI-based project management tools' ability to improve performance ($F = 22.777$, $p = 0.000$) and collaboration ($F = 12.438$, $p = 0.000$). According to Ntumi (2021), When an ANOVA table reveals statistical relevance, it suggests that independent variable whose basis is project management tools based on AI; infers that performances and collaboration which depend on this variable have been influenced significantly such that improbable for such disparities amongst groups have arisen based on mere chance.

Multiple Comparisons							
Games-Howell							
Dependent Variable	(I) 16. Our organization has experienced challenges in implementing AI-based project management and resource allocation tools in the past.	(J) 16. Our organization has experienced challenges in implementing AI-based project management and resource allocation tools in the past.	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.	Strongly Disagree	Somewhat Disagree	1.432 ^a	.381	.016	.24	2.62
		Neutral	2.325 ^a	.427	.000	1.04	3.61
		Somewhat Agree	1.077	.383	.086	-.12	2.27
		Strongly Agree	-.461	.418	.803	-1.73	.81
	Somewhat Disagree	Strongly Disagree	-1.432 ^a	.381	.016	-2.62	-.24
		Neutral	.893 ^a	.282	.026	.08	1.71
		Somewhat Agree	-.355	.208	.440	-.95	.24
		Strongly Agree	-1.893 ^a	.267	.000	-2.68	-1.10
	Neutral	Strongly Disagree	-2.325 ^a	.427	.000	-3.61	-1.04
		Somewhat Disagree	-.893 ^a	.282	.026	-1.71	-.08
		Somewhat Agree	-1.248 ^a	.285	.001	-2.07	-.43
		Strongly Agree	-2.785 ^a	.330	.000	-3.74	-1.83
	Somewhat Agree	Strongly Disagree	-1.077	.383	.086	-2.27	.12
		Somewhat Disagree	.355	.208	.440	-.24	.95
		Neutral	1.248 ^a	.285	.001	.43	2.07
		Strongly Agree	-1.538 ^a	.270	.000	-2.33	-.74
	Strongly Agree	Strongly Disagree	.461	.418	.803	-.81	1.73
		Somewhat Disagree	1.893 ^a	.267	.000	1.10	2.68
		Neutral	2.785 ^a	.330	.000	1.83	3.74
		Somewhat Agree	1.538 ^a	.270	.000	.74	2.33
15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	Strongly Disagree	Somewhat Disagree	2.011 ^a	.385	.001	.79	3.23
		Neutral	1.494 ^a	.478	.034	.08	2.90
		Somewhat Agree	1.584 ^a	.411	.011	.32	2.84
		Strongly Agree	-.149	.381	.994	-1.36	1.07
	Somewhat Disagree	Strongly Disagree	-2.011 ^a	.385	.001	-3.23	-.79
		Neutral	-.518	.335	.543	-1.50	.46
		Somewhat Agree	-.428	.229	.348	-1.08	.22
		Strongly Agree	-2.161 ^a	.169	.000	-2.65	-1.67
	Neutral	Strongly Disagree	-1.494 ^a	.478	.034	-2.90	-.08
		Somewhat Disagree	.518	.335	.543	-.46	1.50
		Somewhat Agree	.090	.365	.999	-.96	1.14
		Strongly Agree	-1.643 ^a	.331	.000	-2.61	-.67
	Somewhat Agree	Strongly Disagree	-1.584 ^a	.411	.011	-2.84	-.32
		Somewhat Disagree	.428	.229	.348	-.22	1.08
		Neutral	-.090	.365	.999	-1.14	.96
		Strongly Agree	-1.733 ^a	.223	.000	-2.36	-1.10
	Strongly Agree	Strongly Disagree	.149	.381	.994	-1.07	1.36
		Somewhat Disagree	2.161 ^a	.169	.000	1.67	2.65
		Neutral	1.643 ^a	.331	.000	.67	2.61
		Somewhat Agree	1.733 ^a	.223	.000	1.10	2.36

^a. The mean difference is significant at the 0.05 level.

The Games-Howell test indicates statistically significant differences in the perception of AI with respect to challenges in carrying out the implementation. For the improvement in performance (Question 19), a mean difference of 1.432 ($p = .016$) between "Strongly Disagree" and "Somewhat Disagree" indicates slightly more positive views for those who somewhat disagree. Similarly, a mean difference of 2.325 with $p = 0.000$ between "Neutral" and "Strongly Disagree" shows that the neutral ones are more confident in AI (Bukar et al., 2021). For collaboration improvement, question 15, a mean difference of -2.011 with $p = 0.001$, between the "Somewhat Disagree" and "Strongly Disagree" groups, indicates more positive responses from the former group. A mean difference of -2.161, $p = 0.000^a$, between

the "Strongly Agree" and "Strongly Disagree" groups, indicates stronger optimism among strong supporters. These results support the hypothesis that it is the perception of ethical/legal-related constraints that creates implementation barriers to the successful application of AI on government projects (Zaker, 2023). Of these, there are various group means where the level of constraint perceived creates different attitudes towards the effectiveness of AI, hence pointing at real implementation challenges.

4.3.8 Regression for Hypothesis 5

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.726 ^a	.528	.508	.905

a. Predictors: (Constant), 7. I believe that AI can improve project management efficiency in our government projects., 13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects., 15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects., 20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	86.811	4	21.703	26.518	.000 ^b
	Residual	77.749	95	.818		
	Total	164.560	99			

a. Dependent Variable: 19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.

b. Predictors: (Constant), 7. I believe that AI can improve project management efficiency in our government projects., 13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects., 15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects., 20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.639	.433		-1.478	.143
	13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.	.222	.078	.244	2.850	.005
	15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	.609	.080	.623	7.633	.000
	20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.	.170	.111	.143	1.524	.131
	7. I believe that AI can improve project management efficiency in our government projects.	.059	.098	.057	.597	.552

a. Dependent Variable: 19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.

These results substantiate the hypothesis that data-driven RM mitigates project risks in Saudi Arabian government projects. The model, in explaining improvement in performance, explains 52.8% of the variance: $R^2 = 0.528$, and has a statistically significant regression, $F = 26.518$, $p < 0.001$ (Bahoria, 2021). That is, the impact of AI on promoting collaboration, $\beta = 0.623$, $p = 0.000$, is more significantly positive to project performance than that brought by

resource optimization, which equals $\beta = 0.244$ with $p = 0.005$. The result in this respect has indicated that AI-based tools for enhanced collaboration and resource optimization are what is necessary for risk reduction through data-driven approaches, thereby supporting the hypothesis that data-driven approaches will mitigate project failure (Roni & Djajadikerta, 2021).

4.3.9 Regression analysis for Hypothesis 5

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.617 ^a	.381	.368	1.209

a. Predictors: (Constant), 12. Our organization has the necessary resources to implement AI-based project management tools., 11. I am willing to adopt AI-based project management tools in our government projects.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.281	2	43.641	29.836	.000 ^b
	Residual	141.879	97	1.463		
	Total	229.160	99			

a. Dependent Variable: 18. Our organization should prioritize the adoption of AI-based project management and resource allocation tools in the next year.

b. Predictors: (Constant), 12. Our organization has the necessary resources to implement AI-based project management tools., 11. I am willing to adopt AI-based project management tools in our government projects.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.192	.398		2.991	.004
	11. I am willing to adopt AI-based project management tools in our government projects.	.792	.121	.662	6.561	.000
	12. Our organization has the necessary resources to implement AI-based project management tools.	-.107	.138	-.078	-.777	.439

a. Dependent Variable: 18. Our organization should prioritize the adoption of AI-based project management and resource allocation tools in the next year.

The output of the regression analysis therefore basically supported a hypothesis that some level of investment specificity combined with a legitimate framework can help support successful adoption of AI in the Saudi government at the level of project management (Hu, 2020). In this way, the developed model explains 38.1% of the variability in the criterion variable: priority of AI-based tools in the next year ($R^2 = 0.381$). That the AI-based tools are ready to be used within government projects scores $\beta = 0.662$, $p=0.000$ as a significant predictor of prioritization towards AI integration; organizational readiness—with individual support—may be the key to success in AI integrations. On the other hand, resource availability is insignificant at $\beta = -0.078$, $p = 0.439$, meaning that successful implementation cannot be guaranteed by resource allocation alone without other supportive measures. As per

Bahoria (2021), the involvement of investment in the process, while cultures of willingness and the development of frameworks that enhance uptake of AI are more important for success in management of government projects.

Topic	Codes	Themes
The increasing adoption of AI in government projects has opened up new opportunities for global applications. AI can be used to streamline processes, improve decision-making, and enhance transparency (Misuraca et al., 2020). For instance, AI-powered chatbots can be used to handle citizen inquiries, reducing the workload on human officials. This can lead to increased efficiency and cost savings. Additionally, AI can help government agencies analyze large datasets, identify patterns, and provide insights to policymakers (Neumann et al., 2022). Furthermore, AI can help automate routine tasks, freeing up resources for more strategic initiatives.	AI adoption in government projects enables global applications. (AI, government projects, global applications, process streamlining, decision-making, transparency)	Applications of AI in Government Projects

Saudi Arabia has been at the forefront of AI adoption in project management, leveraging its significant investments in digital infrastructure. AI can be used to predict project timelines, optimize resource allocation and improve collaboration among team members. For instance, AI-powered project management tools can help identify potential delays and suggest corrective actions. Moreover, AI can help identify potential risks and suggest mitigation strategies. This can lead to improved project outcomes and reduced risks. Furthermore, AI can help Saudi Arabia's project management industry develop new skills and competencies.	Saudi Arabia leads AI adoption in project management. (AI, project management, Saudi Arabia, collaboration, project outcomes, risk management)	AI based project management opportunities in Saudi Arabia
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Integrating AI into project management can be challenging due to various factors such as data quality issues, lack of skilled professionals, and cultural resistance. However, overcoming these challenges requires a strategic approach that involves identifying key integration points, developing implementation plans, and ensuring stakeholder buy-in. For instance, data quality issues can be addressed by developing robust data management systems. Similarly, cultural resistance can be overcome by developing a clear change management plan. This can lead to successful integration and realization of benefits from AI adoption.	Integrating AI into project management requires a strategic approach. (AI integration challenges, data quality issues, skills gap, cultural resistance, implementation plan)	Challenges of AI Integration in Project Management
The benefits of AI in project management include improved accuracy, reduced costs, and enhanced decision-making. AI can also help identify potential risks and suggest corrective actions. For instance, AI-powered predictive analytics can help identify potential delays and suggest corrective actions. Moreover, AI can help automate routine tasks, freeing up resources for more strategic initiatives. This can lead to improved project outcomes and reduced risks. Furthermore, AI can help improve	AI benefits include improved accuracy and reduced costs. (AI benefits, accuracy, costs, decision-making, predictive analytics)	Benefits of AI in Project Management

communication among team members and stakeholders.		
The increasing use of AI in government projects raises legal and ethical concerns such as privacy issues, data security risks, and job displacement. It is essential to address these concerns through proper governance and regulation. For instance, governments should develop clear data protection policies and ensure that citizens are aware of how their data is being used. Moreover, governments should invest in retraining programs for workers who may be displaced by automation. This can lead to a more responsible and sustainable use of AI in government projects.	AI adoption in government projects raises legal and ethical concerns. (AI legal implications, ethics, privacy issues, data security risks)	Legal and Ethical Implications of AI in Government Projects
Effective integration of AI into government project management requires a strategic approach that involves identifying key integration points, developing implementation plans, and ensuring stakeholder buy-in. For instance, governments should develop clear strategies for integrating AI into existing systems and processes. Moreover, governments should invest in training programs for officials to ensure they have the	Effective integration of AI requires a strategic approach. (AI integration strategy, key integration points, implementation plans)	AI Integration Strategies for Government Project Management

necessary skills to work with AI systems. This can lead to successful integration and realization of benefits from AI adoption.		
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Table 2: Topic and Themes associated with AI

Chapter Five

Results

5.1 Chapter Introduction

The discussion chapter involves analysis and exploration of the significance of the information presented in the study. In the discussion chapter, researchers analyze the results by evaluating and interpreting the findings of the overall study. There is an inclusion of the importance of artificial intelligence in existing government projects. That determines that Artificial intelligence is highly effective for automating several jobs, allowing for better data management (Tschang & Almirall, 2021). Further, there is a discussion of AI tools that the Saudi Arabian government can use to enhance their project management techniques. Additionally, there is an analysis of the benefits and challenges of AI. Lastly, an analysis of effective AI integration approaches for project management in Saudi Arabia is conducted.

5.2 Discussion of Primary Quantitative Data

5.2.1 Discussion of Statistical analysis

In the analysis of the involvement of AI in management of Government projects, the results show considerable evidence towards the positive impact that AI could bring in a more efficient and integrated project delivery. From the response to the questionnaire, participants seemed to have a fair knowledge about AI with a mean of 3.32. This familiarization in the respondent's opinion about AI's possible improvement on project management's efficiency can be supported by the left-skewed mean of 3.54. AI is capable of raising organizational

capacity, as highlighted by (Almquist et al., 2020). Also, the participants who had a mean of 4.05 for AI enhancing project performance has been greatly preferred signifying high level of agreement with the analysis of the results showing a density at the extreme left showing that more respondents had a positive perceptive on the impacts of AI in project efficiency. This reaffirms the arguments made by (Allal-Chérif et al., 2021) noting that AI in case of project management, results in efficient and cost-saving benefits.

In essence, while the study found positive feelings towards the task execution in projects related to AI implemented issues related to the integration of AI in the government sectors. In particular, examining the regression model associated with the AI's effect on the management of projects, it is possible to identify the $R^2 = 0.482$ suggested moderate predictability (Bahoria, 2021). The ANOVA F value is 22.023 with a corresponding significance with the p-value < 0.001 , shows that some of the variables – such as the application of AI for resources distribution – are highly significant for predicting the success of projects. This is consistent with the Key Point of Odeh (2023), stating that although there are apparent benefits for the usage of AI, the absence of technical support-framework and infrastructures hampers its successful implementation. As seen in the context of Saudi Arabian government projects, there is a requirement of the right manpower to implement these projects and a proper technological support system that is required for AI to be of optimum use in the field of project implementation; this indicates that AI in and of itself cannot guarantee success.

These challenges were further explored by means of a binary logistic regression analysis. The analysis showed that the most important factors included skills and infrastructure confirming that both of them are crucial in efficient use of AI tools. Such findings align with the existing literature by (Boal et al., 2023) who noted that infrastructural constraints and inadequate skilled human resource is among the biggest impediment to the use of artificial

intelligence in government projects. The prediction is smooth and accurate represented through Nagelkerke R-squared of 1. 000, indicate that the said challenges have to be overcome to the letter (Rights & Sterba, 2019). However, the overfitting problem was also discussed, meaning that more confirmation is required in order to ascertain that this model doesn't overemphasize the real-life efficacy. These outcomes are evidence for further discussion about the necessity of establishing comprehensive training and developing programs of the government agencies, for the purpose of filling the skills gap, to support the AI solution adoption more effectively in a longer perspective (Floridi et al., 2021).

Finally, correlation analysis extended the understanding about the ways AI affect the management of government projects, such as collaboration and performance (Chowdhury et al., 2022). The correlation test showed that there is a strong positive relationship between the subject's perception of the effectiveness of artificial intelligence in increasing performance and the support that AI offers to team cooperation ($r = 0. 641, p < 0. 001$). This emphasizes with Sravanthi et al., (2023), assertion that although useful, AI has to integrate with human manpower. The positive coefficient indicates that when effectively deployed, there is potential for AI to be utilized as an instrument for increasing efficiency of teamwork (Webber et al., 2019). However, if we look at the results of the questionnaire, the correlation between AI confidence and the performance of tasks ($r = 0. 442, p < 0. 001$) is moderate which proves that without proper supervision and judgement from the project managers, AI is not enough. Hence, project management when incorporated with AI has to be seen in terms of its synergistic relationship with human intellect to provide better results (Taboada et al., 2023). In addressing the ethical issues, the elimination of the likewise limits of AI adoption was initiated through chi-square analysis for the assessment of the study's constraints with sample results generally impacting algorithmic bias, data privacy, and legal issues (Turhan, 2020). Likewise, the chi-square values (102. 365 and 104. 260, $p < 0. 001$) showed that these

constraints are significantly associated with the challenges of AI implementation in the government projects. This assertion is similar to the study by Gupta (2023) that elaborated on different ethical issues affecting the use of AI of which the main one is fairness and transparency. There is a need that the policy makers should come up with laws that are aimed at preventing discrimination and misuse of data in the implementation of AI. According to Bogina et al., (2021), it is important to highlight that ethical approaches to AI should be promoted while government policies' discussions should include these concerns as the key prerequisite for AI success stories. These steps would aid in minimizing fear towards AI implementation whilst on the same note enhancing the confidence the public has towards these technologies.

Going into further discussion of the analysis of hypothesis five, which states that AI minimized the risks that may threaten the project, it was observed that AI has a role to promote collaboration in the project ($\beta = 0.623$, $p < 0.001$). This finding holds special importance while doing government projects in Saudi Arabia because most projects involve multiple teams and departments. The chance to make people collaborate more, given by AI through optimizing communication lines and automatizing some processes, contributes to effective risk management related to improper usage of resources and time (Sravanthi et al., 2023). Herein, Hassani et al., (2020) agree with this saying that through use of artificial intelligence tools, costs will be cut and there will be enhanced operations. Nevertheless, this also suggested that resource availability was not a related factor towards success, defined as resource availability ($\beta = -0.078$, $p = 0.439$) while only resource willingness could determine the success rate of implementation.

The findings, therefore, indicate that with AI comes great promise but also comes risk which depend on such issues to do with expert help, ethical norms, and infrastructure preparedness (Banja, 2020). The results of the study support prior research works, which creates a sense

of practical realism for the hypothesis of the study. Considering the results, it has demonstrated thus far with regards to efficiency and interplay, AI is still not an easy Endeavor to be implemented into governmental projects and initiatives, as it is a great deal about both human interactions and environments (Duan et al., 2019). All in all, this study fits into the current public administration literature on AI in project management, exhibiting the aspect's benefits and drawbacks. It proves that AI has the ability to produce positive change on government projects with pivotal advantages like efficiency improvement, collaboration enhancement and better decision making. But these benefits could only be achieved if adequate attention is paid to the enabling factors, technical know-how- how and the ethical considerations (Barmer et al., 2021). This is in line with what the literature is positing and has been observed in the analysis that an AI solution for government project management is not a panacea to the current deficits in managing such projects but part of a highly interlinked web that entails careful application and integration with human labor and visionary planning. Further work has to be done in order to identify the gaps concerning the skills, as well as infrastructure and ethical models required to unleash the opportunities of applying AI in the government's project management. On this basis, the governments can mobilize for embracing the opportunities that AI offers in the given area of application while at the same time countering the risks of its implementation.

5.3 Discussion of Qualitative Data

5.3.1 Theme 1: Application of Artificial intelligence in existing government projects

5.3.1.1 Overview of Artificial Intelligence in Project Management

AI in the present situation is a great asset to enhance the efficiency and outcome of overall projects including processing, data-driven decision-making and informed outcomes. The AI integration in project management requires more sound technical items with skilled employees to handle the development of the project through AI. Along with integrating AI

in the project management data processing power, language processing systems and machine learning are included. This implementation and integration can help the project managers to understand the analysis of any vast data with a shorter duration than the traditional method of analysis. Survey responses 6 and 8 indicate that many participants know the concept of AI and see AI implementation in their organizations. However, the risks related to the projects can also be mentioned by the AI system enhancing the decision-making power of the project managers with vast data analysis. AI can involve in all sorts of repetitive work for project handling like assigning tasks, and scheduling meetings and calls while enhancing the quality of the outcome of the projects. Implementing the AI can also help all the subordinate teams to have original data about the progress of the project with clear communication with the team members by chatbots. The reminders to the respective person can also be scheduled by AI systems increasing the productivity of the employees for the particular projects. However, on the other hand, corrective actions and other subordinate recommendations can be made by the AI while looking into the history of the past project data and trend analysis on the market (Abioye et al., 2021). The future risks can be mitigated before they appear as a problem in the project through the recommendations of AI on specific projects.

5.3.1.2 Applications of Artificial intelligence in government projects

Artificial intelligence has numerous applications in government projects that allow it to enhance project management. Some primary fields of government for implementing project management are **public administration, healthcare, security, transportation and environment**. AI is highly effective for automating several jobs, allowing for better data management. It is considered that the benefits of Artificial intelligence in government projects also include effective decision-making processes, automotive tasks and improved data management systems. Public administration can derive chatbots for responding to requests of citizens that require minimal effort from human employees. It also highlights that

automatic chat bots can respond in less time to improve public satisfaction from government organizations. As per survey response 9 maximum participants think AI based tools are essential for government project management. AI is also beneficial for helping the healthcare industry by early disease detection. It facilitates personalized therapy and effective resource management. Technologies derived from Artificial intelligence help to forecast patient admissions and maximize resource utilization (Al Owais et al., 2023). It also signifies that artificial intelligence helps to evaluate medical imaging for identifying diseases such as early stages of cancer. In the context of security management of government authorities, **predictive policing, and surveillance technologies** by artificial intelligence improve the safety of the public (Deloitte, 2021). It includes a face recognition system that is derived from AI technology AI and helps to identify criminals. Artificial intelligence also allows the integration of smart cities by influencing the transportation sector. The use of AI in the transportation sector is analyzed as automated cars, intelligent traffic control systems, and infrastructure maintenance. So, it signifies that artificial intelligence is an effective and needed technology for government projects.

5.3.1.3 Future Outlook of Artificial Intelligence in Government Projects

Artificial intelligence has the potential to grow and enhance government projects. The significant future need for Artificial intelligence is highlighted as it facilitates **evidence-based decision-making** for government projects (Giabbanelli & MacEwan, 2024). It is beneficial for improving the efficiency of government initiatives. Additionally, artificial intelligence allows the creation of customized public services. In the era of changing market environments, the public has different and unique needs from the government. So, artificial intelligence makes it possible for governments to offer their highly customized services to the public. It helps in fulfilling the **individual requirements** and preferences which derive trust in the public for their government. The term personalized social services by government

facilities in the healthcare and education sectors. It contributes to enhancing the outcomes and raising public satisfaction in the regions. Artificial intelligence also allows development in a country that supports government projects. It includes the development of smart cities by handling energy consumption, traffic and public safety. Natural disasters and crises are also analyzed by artificial intelligence that is utilized by the government for predicting future risks in their regions. So, it is essential to improve emergency response times and forecast the occurrence of such incidents. Furthermore, predictive analysis for the disaster helps to better allocate resources. It is analyzed that the benefits of artificial intelligence such as better decision-making, more efficiency, and improved public services increase its future outlook in government projects.

5.3.2 Theme 2: Artificial intelligence-based project management opportunities in Saudi Arabia

5.3.2.1 Areas to implement artificial intelligence

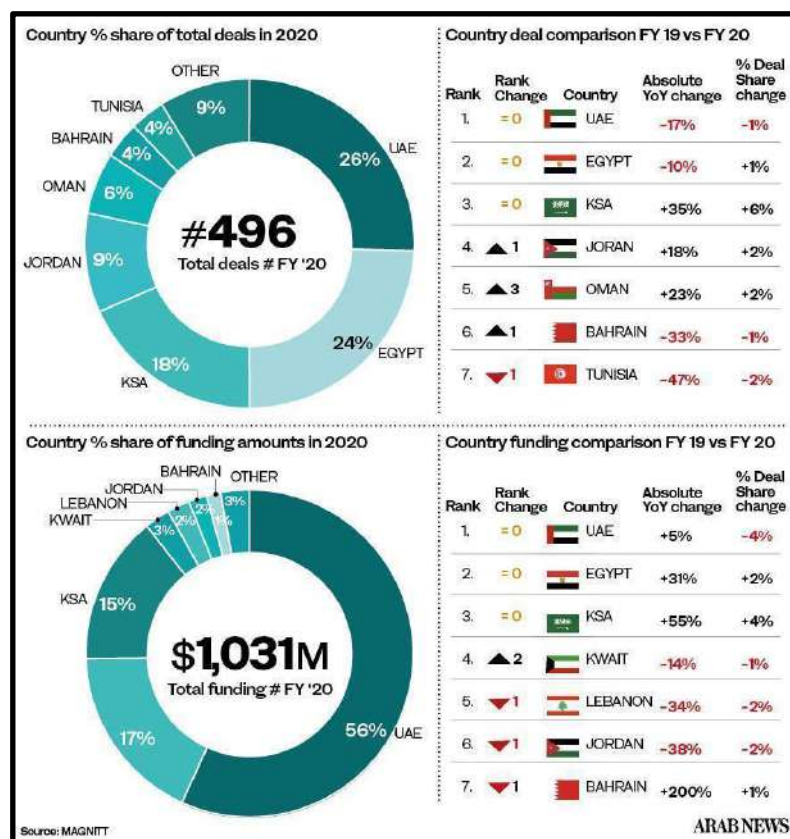


Figure 5.3.1: Budget allocation by Saudi Arabia for AI

Source: (Arab News, 2021)

Saudi Arabia uses 26% of its financial budget in optimizing its technology while investing 1031 million dollars which is around 56% of the annual budget (Arab News, 2021). The Saudi Arabian government faces pain points while implementing AI in its projects. The decision-making procedures and the natural language processing system do not meet the requirements of the government. The Saudi Arabian government should integrate the needs of government projects with AI for seamless project management. It is essential to overcome the pain point of AI integration in public projects such as the educational sector and healthcare. AI can help in the advancement of education procedures, but the pain points remain static while training the employees of the education sector (Elhajji, 2020). The initiative Vision 2030 is very relevant as the government wants to integrate AI into education purposes. The literature gap persists as the study does not show the limitations of integrating AI in higher education systems. Future research scope should focus on overcoming the pain points of integrating AI into the education system.

5.3.2.2 Development and Planning in Urban Infrastructure

The planning of the urban infrastructure in Saudi Arabia is in the initialization stage where the government seems concerned about green planning (Abubakar & Dano, 2020). Transport pollution control and hybrid land use are also taken into account. The implementation of AI can help the government allocate resources equally to develop a smooth workflow of public sector projects along with infrastructure planning. However, organizations should focus on practical insights of AI integration with urban planning to understand the pain point. The implementation of a smart transportation system in Saudi Arabia faced the challenges of inadequate resources and infrastructure blocking innovation (Almatar, 2024). As per survey response 4 maximum participants are managers from the transportation industry who have seen successful implementation of AI based tools in project management. The implementation of AI in the project management of Saudi Arabia can automate traffic signals

and contribute to equal resource allocation for smart transportation. The literature gap persists as the study does not provide enough data about the AI-integrated traffic management and mobility system. The future scope of research should understand the barriers to the integration of AI in mobility systems in the urban infrastructure and the ways to mitigate that.

5.3.2.3 Initiative for smart city and managing government services

The World Economic Forum stated that the use of GenAI for the city infrastructure has been initiated in a few cities like Seattle, and San Jose (World Economic Forum, 2024). Though it is in a very initial stage the inadequate resources and insufficient expertise make the implementation hard enough to sustain. The Saudi Arabian government can learn from these cities that are in the early stage of GenAI integration and formulate accordingly to Vision 2030. However, there must be consideration of using GenAI for urban infrastructure planning along with legal and constructive issues of using GenAI. Dubai is a country that depends on customized AI for city development and managing urban infrastructure planning. Saudi Arabia can have lessons from the AI integration of Dubai in urban infrastructure management and public services (The Economic Times, 2023). However, government entities should focus on the context of AI integration in Saudi Arabia learning from the developed model in the context of Dubai while addressing the local pain points.

5.3.2.4 Project Management in Healthcare

AI can change the shape of the healthcare system in Saudi Arabia through accurate treatment and customized medicine according to the requirements (Abdo, 2024). The Saudi Arabian government can streamline the treatment procedure along with the administrative data and proper resource allocation. The algorithms of AI can understand the customized needs of the patient and come up with customized medicines and other requirements. The AI can help the hospitals in predicting the rate of the patients which further helps the administration to

allocate the resources efficiently. The success rate of the project can increase efficiently while AI does managerial tasks like scheduling, helping in the reduction of managerial costs. AI also can help in understanding and recommending the pain points of any project in government healthcare letting healthcare organizations know about the correction plans and mechanisms (Alzaabi et al., 2023). The integration of AI can help healthcare organizations in large-scale events like vaccinations or provide insights to policymakers to create new policy guidelines. The government should also keep in mind the pain points and challenges of implementing AI like data privacy. The personal data of the patients and other personnel along with the private data of government healthcare laws and policy should be maintained with dignity. The AI can also help in withdrawing the repetitive tasks in healthcare by task automation procedures.

5.3.3 Theme 3: Included challenges AI integration in project management

5.3.3.1 Data Privacy and Security Concerns

While implementing AI in project management the government should take care of the data breaches. Large data set contains sensitive information which can be made public if any data breaches occur. The AI models which consist of machine learning capability also can be targeted by outsiders to break the AI security and take over all the sensitive information for the AI storage. The government should implement GDPR or CCPA as their protection policy. The cost of training AI to get customized with personalized and sensitive information is too much to incur. Cyber-attacks can mistreat the inputs given to the AI for evaluation which can lead to leakage of sensitive data. The training of the employees to understand and use AI for betterment has to be done to reduce the mistreatment of AI and its subordinate tools. Access control protocols should be maintained in the government organization to restrict people from misusing AI. A team of technicians and security engineers should be present to restrict and understand the unforeseen risks of AI implementation in project management and control

them accordingly. The input given to the employee should be given more carefully to avoid data biases which can lead to wrong evaluation and analysis of the given data. This can complicate the ethical use of AI from the project management perspective.

5.3.3.2 Compatibility Issues with Existing Systems and Skill Gaps Among Project Teams

While implementing AI in project management integration challenges can be faced. The traditional systems are not viable to work with the advanced AI technology which would further lead to disruption of work and dissatisfaction of the stakeholders. The AI workflow and format of data it works on can be complicated to understand by the employees leading to understandable issues. As per survey response 14 it is observed that implementation of AI based project management tools affects the workflow of the organizations. Therefore, effective planning is essential to implement this technology for project management. Downtime in the organization along with the risk of data loss can happen during the process of integration of AI in the system. The interoperability can stand as an issue as there can be hindrance while sharing the data among the existing systems. Inefficient sharing of the data across systems can negatively lead to poor results of data analysis and evaluation impacting negatively the implementation value of AI in project management. The scalability of AI with the increased demand for data in the project can be an issue as the integration of AI with the traditional system may not keep the fast pace with AI systems. The cost of scalability may hinder the AI service during an ongoing project leading negatively to the value integration of AI in public sector projects. AI can be customized and personalized according to the needs of the specific industry. However, customizing the AI needs skilled labor who understands and can customize AI according to the needs of the project. However, if the AI is rigid, it can be hard for the team to customize the AI according to the project needs, negatively impacting the value of AI implementation in the public sector project.

5.3.4 Theme 4: Benefits of Included AI integration in project management

5.3.4.1 Decision-making capability of AI in project management

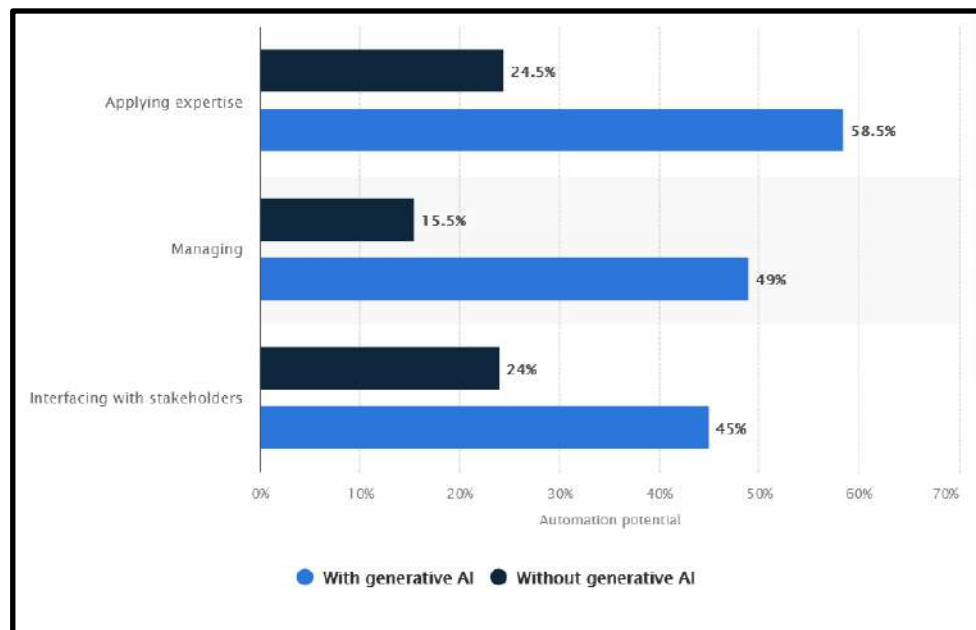


Figure 5.5.3: Application of AI in the decision-making process

Source: (Statista, 2023)

All types of decision-making approaches can be enhanced by the integration of AI into the management process. Without the application of AI, nearly all the fields can lack in the decision-making process. 24.5% is achieved in the application of expertise without AI integration which increased to 58.5% after the AI integration (Statista, 2023). Managing the project was 15.5% efficient by manual labor which increased to 49% after AI integration. The capability of AI in decision-making has increased day by day with the quality of analyzing vast data helping project managers to make more accurate decisions. The quality of data analysis through machine learning lets the AI find relations between the previous data which could have been missed by the project managers. The AI can let the managers know about the upcoming barriers by analyzing the trends of the market which could let them make proactive decisions (Stone et al. 2020). This AI integration is helpful specifically in large-scale projects which are complex enough to have different variables. The response 19 indicates that AI based project management tools are effective in enhancing the overall

organization performance. The evaluation and decision-making process of AI is more unbiased as it can evaluate the data without human bias leading to a more enhanced outcome of the project.

5.3.4.2 Improved Risk Management and Project Outcomes

Artificial intelligence reduces the work of project management which allows them to focus on higher levels of strategic management to mitigate future risk. AI gives data-driven insights into a project that helps managers identify potential challenges and develop strategies to keep the project on track (Niederman, 2021). So, the integration of AI enhances the overall decision-making capability of Saudi Arabian government project managers, and they can reduce the potential chances of risk in future. Artificial intelligence also provides advanced tools such as machine learning, cyber security threat detection, fraud detection, and market risk analysis software for improving risk management (Bécue et al., 2021). **Saudi Vision 2030** involves an algorithm of fraud detection that detects early warning signs of potential risks such as budgetary issues, delays in work, and quality concerns (Ghamri, 2024). On the other hand, this software also implements several project scenarios to analyze the significant influence of various risks and recommend effective mitigation approaches. AI in Project management performs more complex tasks, makes recommendations and identifies potential insights for reducing future risk in Saudi government programs. However, response 20 reflects that it can enhance the performance and effectiveness of government projects significantly. AI is helpful for project managers in optimizing the software of project management and eliminating repetitive operations from the Vision 2030 initiatives (Nagireddy, 2023). This results in a higher success rate of projects and managers can complete more government projects within budget, maintaining quality standards within the deadline.

5.3.4.3 Data solution and data accessibility through AI

Artificial intelligence has several benefits for government projects that mainly allow it to increase the efficiency of projects. It is analyzed that artificial intelligence can process vast amounts of complex data with ease. **Quick data solutions** with accuracy allows the government to improve the efficiency of their project. It also helps to automate the tasks including data entry and analysis to bring more flexibility to the activities of the project. Artificial intelligence improves decision-making by including advanced analytics for the project management of the government (Valle-Cruz et al., 2022). It is highly beneficial for analyzing historical data for predicting future trends to facilitate informed decision-making. Survey response 17 indicates that there are several benefits of AI observed by the participants in their organization. Resource allocation, policy development and responding to emergencies are some of the advantages of AI project management tools in project handling. Furthermore, artificial intelligence helps minimize repetitive tasks for the project which saves lots of cost for the government. In other ways, artificial Intelligence can analyze the issues of a project before it becomes critical, saving infrastructure repair costs for the government. Artificial intelligence is also beneficial for improving the **quality and accessibility** of public services. It is analyzed that government platforms and websites revenue by artificial intelligence are highly beneficial for meeting their needs. It provides potential outcomes to the public by analyzing their historical trends and previous performances.

5.3.5 Theme 5: Legal and Ethical Implications of AI in Government Projects in Saudi Arabia

5.3.5.1 Regulatory complexities

The depiction of legal and ethical considerations of applying AI in government projects in Saudi Arabia comprises a diverse set of factors that are influenced by the changes in the legal provisions and the compliance standards (Al-Baity, 2023). AI technologies are gradually

integrated into the government processes, which is why legal regulation needs to solve the problems connected with data protection, transparency of algorithms, and ethical usage.

Saudi Arabia has progressed in the formation of common rules on the utilization of AI mostly through SDAIA and the National Strategy for Data and AI. The National Strategy has the goal to promote AI development and its utilization as well as to maintain ethical guidelines and the protection of data (Alzahrani, 2024). The strategy also states that the AI systems have to be transparent and have to be fair to avoid biases and in equal environments, accountable for the results (Al-Baity, 2023). One of the regulations is Personal Data Protection Law (PDPL) with emphasis on data privacy and security (Alkhamsi & Alqahtani, 2024). That is why data use and collection are strictly regulated by the Saudi Data and Artificial Intelligence Authority (SDAIA) and covered by the PDPL. Personal data used by AI systems also needs to conform to all the regulations to prevent privacy infringements and legal consequences (Alzahrani, 2024).

Concerns on ethical issues are provided in the form of guidelines that speak to issues of fairness within the algorithms and the elimination of bias (Zhang & Zhang, 2023). This means that AI systems should not have a preconception that favors a certain group of people or discriminates against any other group of people. This is important because, the development of AI systems for public projects will have consequences on various groups of people and therefore to ensure that it is not compounding the problems of inequality, it must be subject to thorough scrutiny (Alshahrani et al., 2021).

5.3.5.2 Ethical Issues Regarding Data Protection

Apart from the benefits of Artificial intelligence, there are several challenges included in it. It is identified that Artificial intelligence collects personal data for analysis. So, it raises concern for security and privacy problems of critical public data. Governments are primarily responsible for ensuring **data protection** for the data of the public in their artificial

management systems (Saura et al., 2022). It is possible by integrating protection laws that help to minimize the illegal access of public data. As per survey response 16, most of the participants observed AI-based challenges in their organizations which are the foremost concern of the organization. Along with that, the decision-making process through artificial intelligence includes **complexity**. It highlights that the confidence of the public in government decisions may wane due to ineffective decision-making processes. Additionally, there are numerous ethical considerations such as **data confidentiality** included in the operations of artificial intelligence. It falls under the responsibility of the government to prioritize responsible and fair benefits of artificial intelligence. Government authorities must imply ethical consideration and standards for integrating technology into their projects. To facilitate this purpose, the government must ensure a specific team of experts. This step requires additional costs for the government where the team is dedicated to managing the artificial intelligence-based operations in the government projects.

5.3.6 Theme 6: Analysis of effective Artificial integration strategies for project management

5.3.6.1 Analyzing areas for AI integration in project management

The implementation of AI technology can happen in multiple stages of the project which will further help to increase the efficiency of the project with quality outcomes to the stakeholders. The AI can be implemented in project planning by informed data about the previous project which would let the AI find out the barriers to the completion of the project. AI can also help in scheduling tasks along with proper resource allocation which would fit with the resource availability required for the project completion (Fewings & Henjewe, 2019). It can also help in providing achievable timelines for the project along with suggesting bottlenecks which can be mitigated by the strategic planning of the project managers. Accordingly, survey response 10 indicates that the lack of AI-based tools affects the time of

project delivery. The analytical power of AI is efficient enough to understand the skill set of the employees and assign tasks accordingly enhancing regular productivity. In contrast, customized AI can also help in managing repetitive tasks like updating status and tracking the progress of the project leading to a reduction of manual efforts and human errors simultaneously (Darko et al. 2020). The decision-making perspective of AI is very useful for project managers as it can analyze large amounts of data. The project managers can have more informed decision-making while AI can provide them with relations in between past data which does not seem to validate through manual or human analysis.

5.3.6.2 Implementing Predictive Analytics and Automation for Routine Tasks

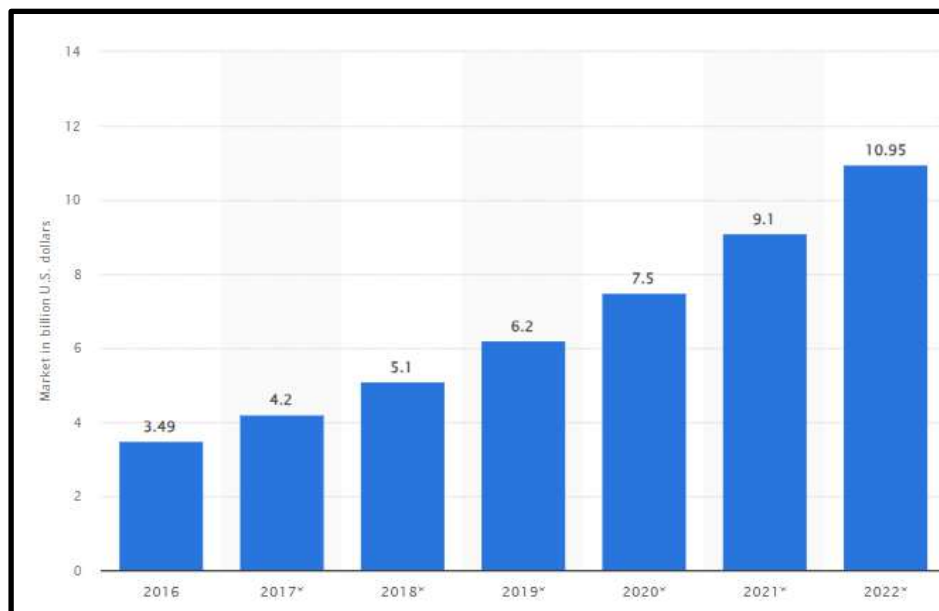


Figure 5.4.1: Predictive analytics market size

Source: (Statista, 2022)

The figure illustrates that the predictive analytics market will reach over 11 billion dollars by 2022 (Statista, 2022). Several large numbers of businesses make use of predictive analytics techniques for everything from project management to fraud detection. So, it is determined that predictive analytics use various statistical models within businesses to make predictions about a wide range of future outcomes. Predictive analysis is already one of the most widely adopted intelligent automation technologies in the world (Guo & Zhang, 2022). Artificial

intelligence helps project managers make effective and quick decisions by using predictive analytics tools. AI analyses past information of organizations and predicts future outcomes of the decision to mitigate challenges (Benbya et al., 2020). Additionally, the Saudi Arabia Vision 2030 programs use AI tools in their projects to forecast potential project outcomes and risks (Alshahrhan et al., 2022). Budgetary issues, deadlines of work, decision-making, and resource allocation are some key factors that are enhanced by AI. As per survey response 12 and 13 AI based project management tools are essential for effective resource allocation and resource optimization. This further increases the accuracy of project management and meets the deadline of government initiatives effectively. However, automation techniques of AI make the scheduling of repetitive tasks of project management and increase its efficiency (Taboada et al., 2023). Automation not only reduces the time but also helps in reducing human error risk and leads to more accurate project management. On the other hand, Machine Learning is a subdomain for AI that uses statistical models that software-based project management systems use to improve their performance on a specific work.

5.3.6.3 AI Integration Strategies for Saudi Arabia Government Project Management

Saudi Arabia's approach to the use of AI in government project management is pegged on the National Strategy for Data and AI as well as Vision 2030. It provides a broad direction towards leveraging AI to improve the efficiency of public services (Loulwa Fadel Alqublan, 2024). It should be noted that the chosen priorities can be regarded as the targets of the National Strategy to transform Saudi Arabia into a world leader in AI adoption. It is central to Vision 2030, which aims at one painting for economic diversification and the improvement of the performance of the public sector by incorporating technology (Madkhali & Sithole, 2023). The large-scale investments in the focus strategies consist of infrastructure investments in data centers and high-performance computing equipment. This infrastructure has enabled applications of AI in different Government projects, for instance in NEOM

which is a \$500bn Smart City project (Business Insider, 2024). NEOM applies artificial intelligence in city modelling, delivery, and functioning, which shows actual application of big data and ‘thinking’ in real life. The accomplishment signals the advancement in the strategy of utilizing artificial intelligence in NEOM in enhancing the efficiency and efficacy of the public sector.

Saudi Arabia’s AI including innovation and research are also named as a major section of focus. It has also ensured that AI is among its top funded projects and has encouraged alliances with international tech companies (Yusuf & Lytras, 2023). It is to advance technology and begin implementing artificial intelligence solutions and utilize them in huge scale activities like predicting the maintenance necessities of Saudi Aramco. These programs identify the ‘soft’ application of AI and are in accord with the key strategic focus of promoting innovation (aramcolife.com, 2021). Concerns of ethical governance are solved in the beginning by the National Strategy that includes the guidelines concerning data privacy, corporate transparency and bias (Alfordy & Othman, 2022). These guidelines are a good step in the direction of creating more covers towards preventing the misuse of artificial intelligence even though extensive regulations remain in the process of formulation.

5.3.6.4 Analyzing future scope of AI integration for project management

The application of AI in the application of project management in the areas of planning and execution. In future, AI will be more accurate in data-driven decision-making. The vast data analysis will be more accurate with more flexible AI systems to customize and personalize those according to the needs of the project. Another promising quality of AI implementation can be advanced data analysis for the future along with the integration of machine learning (Auth et al., 2019). In future, AI will analyze more complicated data which can be unstructured and taken from various sources of social media. This would help the project managers to make more informed decision making and let them understand more barriers

during the completion of the project. As per response 18 maximum people expect to adopt AI based project management tools in their organizations by upcoming years. It means there is a high scope for the utilization of this technology in different industries. However, in future, the automation quality of AI will lead the project managers to focus on making strategic decisions more accurately while it helps in doing project planning and execution. AI can also incorporate learning mechanisms from the progress of the project which would further lead to providing more accurate information and recommendations for project efficiency.

5.6 Chapter Summary

The chapter consists of four themes which include the usage of AI in existing government projects which consists of the application of AI in public sector projects. The benefits, challenges and the future scope of the usage are also discussed in this section. Possible areas to implement AI for the Saudi Arabian government are highlighted in this chapter along with the development and planning of urban city infrastructure. Smart city initiative and the implementation of AI in healthcare is also highlighted in this chapter. The analysis of the usage of existing AI in the public sector is discussed along with the strategic implementation. Concerns like data privacy and skill gaps among the employees along with induced technical issues are highlighted in the chapter.

6.1 Key learning outcomes

Learning Outcomes	Description
Participants are in managing position	The research survey obtained that the participants are in managing positions and experienced for a maximum of 4 years, which addresses research question 4.
Highly educated people, working in the Ministry of Transportation	The majority of the participants of the survey work in the Ministry of Transportation and are also highly educated. They are willing to implement AI in government project, which addresses research question 2.
Optimistic Perception of AI	The optimistic perception among the government employees can foster the success of AI implementation, which addresses the research question 6.
AI implementation in the governmental project management	The government projects are aimed to implement AI in their project management which is highlighted in research question 4.
Hinder without AI-based tools in project management	The people associated with project management hinder the delivery of the outcomes without AI while interpreting research question 3.
Necessity of AI-based tools in organization	The citizens agree with the necessity of AI tools and have an optimistic perception of it to implement the advanced resources in organization project management which addresses research question 2.
Changing current workflows	The changing workflow of the organization project management in Saudi is going towards AI-based tools as per research question 5.
Challenges and benefits in AI resource implementation	Major project management has faced several challenges in the implementation of AI. Also, they faced primary benefits due to implementing AI-driven tools in project management, as highlighted in research question 3.
The positive impact of AI implementation	The citizens of Saudi Arabia have a positive perception of the impact of AI implementation and AI tools in the organization, which addressed research question 1.

Table 3: Key learnings

6.2 Future research scopes

The integration of AI into project management within the government sector of Saudi Arabia indicates a significant advancement in technologies. The **Vision 2030** initiative aims to modernize the economy, reduce the dependency on oil and enhance public services (Amran

et al., 2020). The research provides a comprehensive understanding of the AI-driven transformation in government projects, leaving several areas for further investigation. The research can foster a more comprehensive understanding of AI and the impact of its advanced tools in project management.

6.2.1 Longitudinal impact analysis

Future studies can explore the long-term effects of AI implementation in government projects from the available information and data provided in this research (Zuiderwijk et al., 2021). Especially, the efficiency, cost reduction and project delivery timelines analysis can be conducted from the current research. A longitudinal analysis can help in assessing the benefits of AI in economy and project management.

6.2.2 Comparative studies across sectors

The research is focused on government projects broadly, future research can be operated on other sectors associated with the data and information provided in the research on Saudi Arabia. Especially in healthcare, education, infrastructure and tourism can be compared with certain project management based on AI.

6.2.3 Human-AI collaboration Dynamics

As AI becomes more integrated into project management the dynamics between human decision-making and AI systems will be combined. In future, the researcher can explore the interaction between government employees and project management and perceive AI tools. Also, the researchers investigate more issues related to AI implementation such as trust, reliance and potential of AI.

6.2.4 Ethical governance considerations

In this research, ethical consideration was promoted within the increasing usage of AI in government projects. Future research can focus on the governance frameworks required to ensure that AI is used to foster responsibility and transparency in government projects.

Alongside this, developing ethical guidelines and governance structures will be crucial to ensure that AI services provide productive outcomes.

6.2.5 AI infrastructure and resource allocation

Future studies can investigate the infrastructure requirements for AI implementation in government projects including the need for data centers, cloud computing capabilities and cybersecurity measures (Ahmad et al., 2021). Additionally, the research can explore how to build a sustainable AI infrastructure that supports long-term innovation in government projects.

6.2.6 Global comparisons and best practices

Future research can compare the AI integration of Saudi Arabia in government projects with other countries in the world that conduct AI in government projects (Al-Baity et al., 2023). In addition, the researchers can identify the best practices and lessons learned from international case studies that can be valuable insights for refining Saudi's AI strategies in ensuring the governmental sectors.

6.3 Key research implications

6.3.1 Data availability and quality

One of the major challenges faced by the researchers is the availability and quality of data while interpreting the research about the AI integration in Saudi's government project (Alkrajji et al., 2020). Also, government projects often involve vast amounts of data but accessing the data is difficult due the privacy concerns and restrictions. These factors impeded the ability of researchers to conduct accurate and reliable analyses.

6.3.2 Technical and infrastructure constraints

The integration of AI requires robust technical infrastructure including computing power, data storage capabilities and cybersecurity measures (Schmitt et al., 2023). The researchers faced limitations in terms of access to such infrastructures, especially in the AI adoption in

the government sector. These constraints can prevent the scope of research, hindering the ability to test and validate AI models at a range.

6.3.3 Ethical and legal considerations

In this research, ethical implications were a significant concern in AI research, especially in the context of government projects that are directly related to public welfare (Vesnic-Alujevic et al., 2020). Researchers experienced ethical issues such as ensuring data privacy, avoiding biases in AI algorithms and maintaining transparency in AI decision-making processes in government projects of Saudi Arabia.

6.3.4 Cultural and societal actors

Both the cultural and societal context of Saudi has challenges and opportunities for AI research (Alshahrani et al., 2022). The cultural norms, values and societal expectations can be cognizant by the researchers while designing and implementing AI systems in government projects. Also, understanding the factors is crucial to ensure that AI implementation is aligned with cultural norms, and societal values and to avoid the potential resistance to research.

6.3.5 Scalability and generalization of findings

Appropriate AI research in Saudi government projects requires collaboration across multiple disciplines including computer science, engineering, public policy and social sciences (Alotaibi & Alshehri, 2023). The collaboration was challenging to foster effective interdisciplinary because of different methodologies, research priorities and geographical distances. Researchers have also faced knowledge gaps in areas such as AI techniques, public administration or domain-specific expertise. Several gaps in the context of scalability were experienced by researchers while researching AI implementation research in Arab government projects.

6.3.6 Unavailability of the specific regional data

The unavailability of specific regional data encompasses significant challenges for researchers while studying AI implementation in Saudi Arabia's government projects (Alshuwaikhat et al., 2022). The lack of localized data causes many difficulties in tailoring AI models to lead to diversification in the economy. The invalid data leads to inaccurate data and creates a bias in AI-driven decisions.

6.4 Recommendations

Developing a clear AI strategy aligning with Vision 2030: To ensure that AI implementation is effective, it is essential to develop a clear and comprehensive AI strategy that aligns with the broader goals of Vision 2030. The strategy should outline the specific objective of AI integration in government projects such as improving project efficiency, reducing delays and enhancing resource allocation.

Investing in AI infrastructure and technology: Effective infrastructure is crucial for the successful implementation of AI in project management in Saudi (Savio & Ali, 2023). The government of Saudi should invest in advanced computing resources, data centers and cloud computing platforms for large-scale AI operations. Additionally, the development of secure and reliable data storage by building a strong technological foundation is important for government projects in Saudi.

Enhancing data collection and management capabilities: AI systems encompass high-quality, accurate and up-to-date data to function the project effectively (Haleem et al., 2022). In this context, the government should focus on improving data collection and management practices across all sectors. Moreover, the government have to implement IoT devices, satellite technology and other advanced technologies and tools. Also, by enhancing data capabilities the government can ensure that AI-driven insights are comprehensive and reliable information.

Promoting AI training and capacity building: The successful implementation of AI in government project management needs a knowledgeable and skilled workforce in AI technologies. The government should invest in training programs to upskill existing employees and prepare them to work effectively within AI systems. This includes offering courses on AI basics, data analytics, machine learning and ethical AI use.

Fostering collaboration and knowledge-sharing: Collaboration between government agencies, academic institutions and the private sector is essential for the successful implementation of AI in project management. The government of Saudi should create platforms for knowledge sharing and collaboration from which the stakeholders can enhance their knowledge and exchange ideas for the best practices in AI initiatives. Saudi Arabia can accomplish the adoption of AI more effectively through this strategy.

Implementing pilot projects and scaling gradually: The pilot projects can serve as testing grounds for AI technologies, allowing the government to assess their effectiveness and address the challenges related to AI systems. Also, it helps to forecast the risks by analyzing the historical data of the previous initiatives. Gradual scaling also allows for continuous learning and adaptation, enabling the government to refine its AI strategy.

Establishing an ethical and regulatory framework: The use of AI in governmental projects fosters important ethical and legal considerations. The government should develop clear ethical guidelines and regulatory frameworks for AI use in government project management. However, establishing an advanced mechanism to monitor AI implementations and ensure compliance with ethical standards is also crucial.

Monitoring and evaluating AI impact continuously: Continuous monitoring and evaluating the AI systems are essential to measure the implementation and achieve the desired outcomes. The government should establish processes for regularly assessing the

impact of AI in project management. The processes include measuring improvements in efficiency, cost savings and project delivery times.

-Recommendations

7.1 Implementing training programs

Several people are not aware of using AI in the organization. So, to integrate AI into the Saudi Arabian government project management proper training of the staff is required to enhance the use of the AI systems. The training programs should be well-equipped to make the Saudi Arabian government employees more efficient with the related tools and advanced AI technologies (Sayed Al Mnhrawi & Alreshidi, 2023). Several conferences, seminars and lesson plans should be prepared to make the training program effective. The training program should be equipped to provide foundation knowledge to the employees to manage AI-based projects. The training should be more focused on practical knowledge rather than theoretical knowledge to implement AI successfully in the organization. The training should focus on areas like analysis, prediction, management, automation of repetitive tasks and learning mechanisms from the previous data inputs. Previous case studies should be taken into account from the database to understand and mitigate the barriers faced previously during integration (Alrashedi & Abbod, 2021). Also, the training programs devised by the organization should be continuous to keep the employees trained about the new proposed technologies required for successful integration.

7.2 Initiating pilot project through AI implementation

Initiating a pilot project through artificial intelligence refers to the initial and small-scale implementation of AI within a specific area or process to inspect its feasibility, effectiveness and potentiality. It has a crucial role in assessing the work performance of AI because it **mitigates risk, proves concepts**, provides **data-driven insights** and improves **decision-making** (Williams, 2024). To improve the efficiency, transparency and overall success of

government projects in Saudi, initiating the pilot project through AI is highly recommended. AI has the potential to revolutionize project management by addressing common challenges such as delays, over-budget problems and resource misallocation, which prevent massive government projects. Also, AI can analyze **historical project data** to **forecast potential risks** and project timelines more accurately (Gruetzemacher et al., 2021). A pilot project approach is recommended for government initiatives because of its significance in strategically managing government projects through AI. This crucially provides the testing for the AI tools in a controlled environment with the insights gained for guiding the future.

7.3 Implementing Innovation in the Workplace

A culture of innovation has to be initiated in the workplace if the organization wants to integrate AI successfully. Government employees need to be open-minded and get enough freedom to test AI-based systems and understand their impact on project management. The organization should also allow the employees to understand the use of AI in data analytics with the consequences of failures (AlGosaibi et al., 2020). The more the employees can test the AI systems stand-alone, the more they can be acquainted with using the advanced AI system for their work. The more use of AI by the employees while testing the work makes the system reliable to the employees and makes it preferable to use for government project management. However, the employees do not only stick to technicalities for understanding but also test new things to understand the efficiency. Therefore, diverse teams are required in project management who can effectively test the AI efficiency in project management and understand the analysis direction. Through this innovation mindset, the challenges of the employees to use AI can also be identified along with the strategies to mitigate them.

7.4 Engaging stakeholders

Engaging the stakeholders to improve project management through AI is significant to gaining success. Stakeholders included in the AI project such as management, employees,

end-users and customers play a pivotal role in this whole work procedure (Miller, 2022). The Arabian government should include the stakeholders in the projects to ensure the AI technologies are effectively integrated and aligned with the nation's strategic objectives. Employee or stakeholder engagement helps to **build trust** and **regular communication** among the stakeholders assists in creating innovative decision-making about the goals and benefits and prevents potential challenges. Also, **collaborative planning** through workshops, focus groups and consultations can be used to gather input which can tailor the AI solutions more effectively (Farzadmehr et al., 2023). Moreover, it is important to invest in training and capacity building about AI efficiency in stakeholders to fully embrace it. The necessary skills and knowledge to work with AI tools can ensure a seamless transition and empower managers to leverage AI effectively. The Saudi Arabian government can maximize the benefits of AI in project management by prioritizing the engagement of the stakeholders, which ensures the potentiality of the technologies.

7.4 Raising funds for project management

Raising funds is vital for project management, especially in implementing advanced technologies like AI (Jejenywa et al., 2024). Adequate funding ensures access to the necessary approaches such as **training** and **support** enabling successful project execution and maximizing the returns and investments. Securing sufficient funding is essential to implement AI in the project management of Saudi Arabian government projects. Adequate or sufficient financial resources enable the acquisition of advanced AI technologies, training of personnel and the integration of AI systems into the existing project management processes. The funding can ensure the Saudi government leverages AI's full potential enhancement, transparency and project success. **Transformative technologies** of AI require a large-scale investment to conduct its functioning (Aldoseri et al., 2024). Also, to secure the government's funding, it's important to demonstrate the value of AI that can bring potential

cost savings, efficiency gains and improvement in project outcomes as well. Alongside, to raise the necessary funds, the government should explore various funding sources such as setting the government-allocation, public-private partnerships and international grants that focus on innovative technologies.

7.5 Taking data protection measures

Implementation of AI requires more data to be fed into the system to get better results for the project output. As the AI requires all types of data to be fed Saudi Arabian should comply with international data privacy laws like General Data Protection Regulations (GDPR). Along with this, the AI implementation should also go by the Regional Data Protection Act and guidelines like Saudi Arabia data and Artificial Intelligence Authority (Alzahrani, 2024). The data given to the AI should be protected with proper encryption as another level of security to prevent unnecessary access to the data which can lead to data misuse. Access cards should be given to the specific employees handling data for the AI and there has to be continuous monitoring of the data used by AI. The encryption codes have to be changed to maintain the secrecy of the code. A technical team can be set up for regular checking and understanding of any point of data breach or any problems in the systems that can tend to be a huge risk with data security in future. The risk mitigation team and the continuous upgrade of the security system of AI has to be maintained to have reduced risk of data management and privacy.

7.6 Spreading awareness among people

Raising public awareness about AI's role is crucial to building up **trust, support** and **understanding** of the importance of AI in conducting government projects (Aoki, 2021). It can be spread through providing education, transparency and open communication about the potentiality of AI to improve work efficiency. As the Saudi government moves towards integrating AI in project management, it can be spread among the public automatically. This

awareness ensures the people of the nation understand the functions of AI and improve their work performance and efficiency with the help of AI. Also, public awareness is vital to foster the acceptance of AI implementation in government initiatives. Additionally, by educating the benefits of AI such as improved **project outcomes, cost reduction, and enhanced service delivery**, the government can build trust and reduce fear or misconception (Duberry, 2022). Also, the government should implement a multi-faced communication strategy to spread awareness about the benefits of AI implementation. The governmental integration, transparency and implementation of AI ultimately lead to greater public trust and support. The government of Saudi can build supportive AI-driven project management by spreading awareness among the citizens.

7.7 Considering Ethical Principles

The ethical principles of AI are essential components that guide the responsibility and fairness of artificial intelligence. The principle aims to address the potential risks and challenges associated with AI technologies and promote their beneficial usage in society. The key principles of AI include fairness and **unbiased** features, **transparency, accountability, privacy and data protection, autonomy** and lastly **sustainability** (Carneiro & Veloso, 2022). As the Saudi government explores the integration of AI, it is essential to consider the key principles of AI usage, because it provides the ultimate public trust in the governmental project and initiatives in several aspects. The use of AI as per its principles ensures that decision-making is made unbiased and equitable. Alongside, to ensure ethical AI use, the government of Saudi Arabia should establish clear and strict guidelines and frameworks to address issues such as data privacy, autonomy, algorithmic transparency and accountability.

7.8 Implementing a performance-tracking tool

Performance tracking tools are for monitoring performance and issues while conducting the AI systems. It shows the efficiency and effectiveness of AI systems by evaluating metrics such as **accuracy rate**, **response time** and **user satisfaction** (KATRAGADDA, 2023). It provides insights into AI performance, identifies the areas to be improved and ensures the procedure meets the objectives. To enhance the efficiency and success rate of AI-driven project management in Saudi, performance tracking tools are essential. These tools are essential for evaluating the effectiveness of AI systems and ensuring that the project meets the **desired aims** and **tangible benefits**. The implementation of AI performance tracking tools helps to inspect the accuracy, speed, service response time, and effectiveness of AI systems. Consistent monitoring of these metrics ensures the government that the AI solutions are functioning optimally and delivering the expected outcomes. Also, the tracking tools enable the measurement of various key performance indicators such as the accuracy of AI prediction, efficiency of automated processes and user satisfaction. However, the effective implementation of the AI tracking tools can ensure the government of Saudi that the system is accurate, transparent, continuously improving and leading to more successful and impactful public projects.

7.9 Building a project management team for identifying government needs

Any advanced technology implementation requires expertise and professionals to cooperate with the system effectively. Similarly, the Saudi Arabian government should build a specialized project management team to effectively leverage AI to improve the outcomes of the projects. The expert team will be responsible for identifying the specific AI needs of government projects. They can also assist in AI solutions that are tailored to address the needs and **deliver the optimal results** of government projects. The government should build an effective team to assemble individuals with diverse expertise. The different departments or

expertise of AI project include the project managers, AI specialists, data scientists and domain experts. This **multidisciplinary team** ensures a comprehensive approach to identifying the gaps and improvement areas of the project (Rane, 2023). Also, the multidisciplinary team should define clear objectives and needs of the AI integration as per the assessment of the project. However, the team building of project management and AI implementation can facilitate the government to reach the success and objectives of the projects.

7.10 Identifying Current Government Initiatives

It is crucial to identify the current government initiatives to advance AI integration in project management and improve the outcomes (Birkstedt et al., 2023). This approach ensures that the AI applications are effectively aligned with the existing systems and strategic goals that maximize the project outcomes. The government should conduct a comprehensive review of running government AI initiatives. They assist in evaluating the current AI projects such as the **National Artificial Intelligence Strategy** and **Vision 2023** (Ahmad et al., 2023). By inspecting the currently running projects, the government can identify successful strategies, potential areas and the areas that AI can address. Also, it should be aligned with the broader strategic goals, such as Vision 2030, so that the capability of AI applications and systems can be measured. AI integration requires coordination among the various governmental departments and agencies. Despite this, the continuous monitoring and evaluation of AI initiatives are essential for measuring their effectiveness and impact. The study recommended that the **Saudi Arabian** government identify and assess current AI initiatives to robust the implementation of AI in government projects effectively.

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Appendices

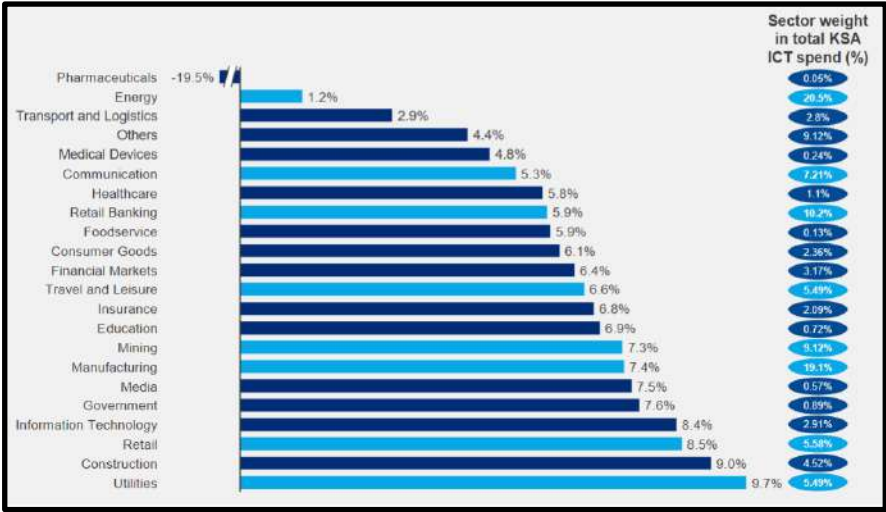


Figure 1.3.1: Information and Communication Technology Growth in Different Sectors of Saudi Arabia

Source: (MCIT, 2023)

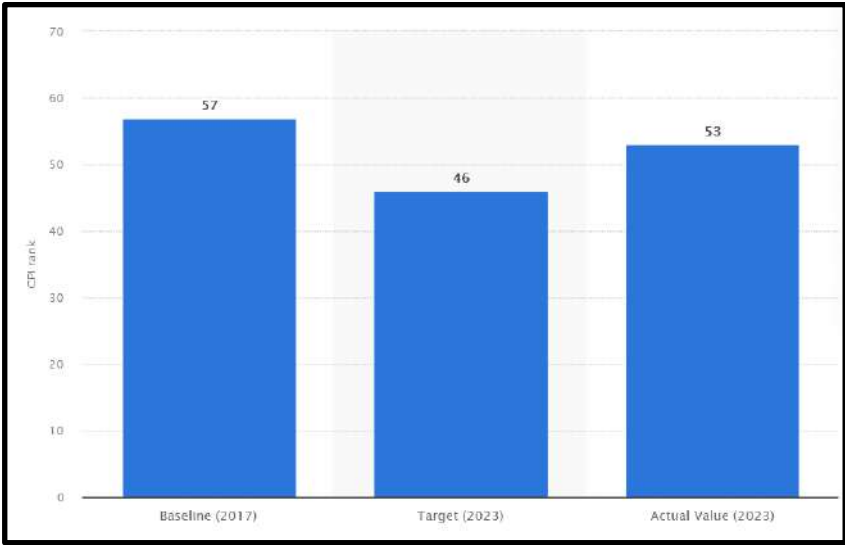


Figure 1.3.2: Corruption Perception Index of Saudi Arabia

Source: (Statista, 2024)

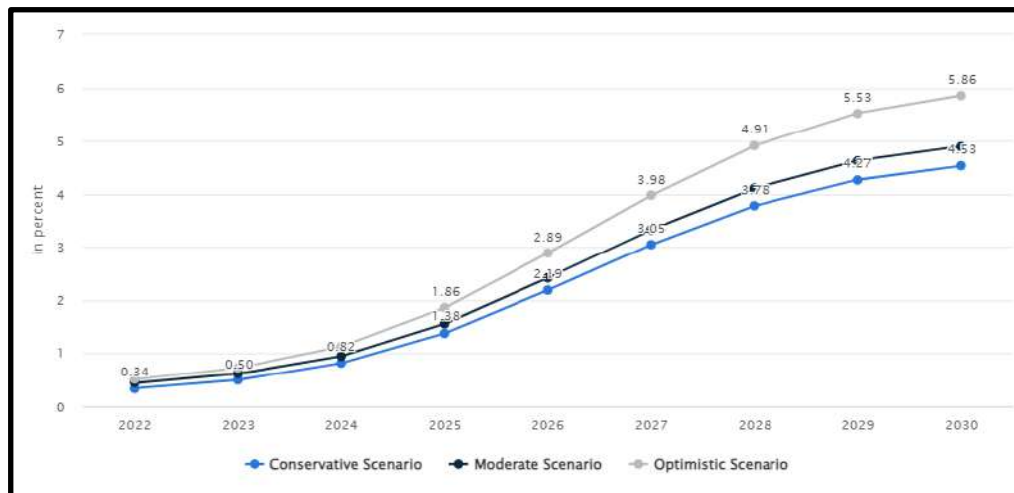


Figure 1.6.1: Impact of AI on Saudi Arabia's GDP

Source: (Statista, 2024)

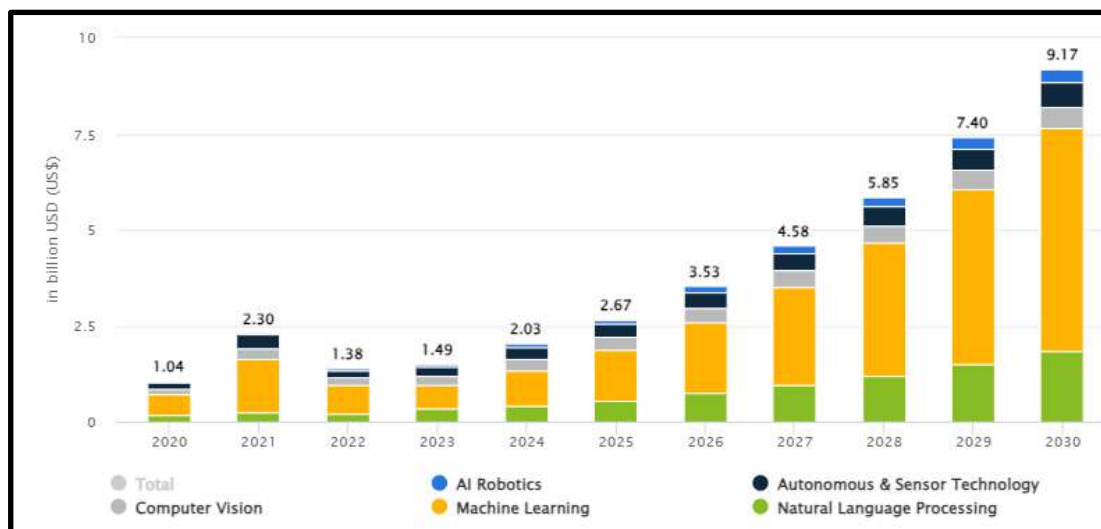


Figure 1.8.1: AI market size in Saudi Arabia

Source: (Statista, 2024)

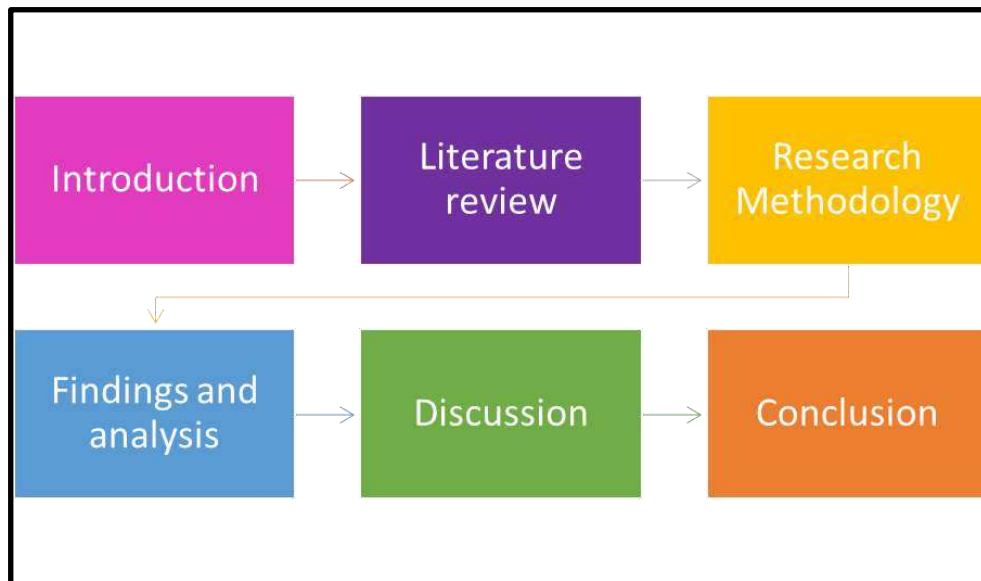


Figure 1.11: Structure of research

Source: (Self-designed)



Figure 2.7.1: Waterfall Model

Source: (Self-created)

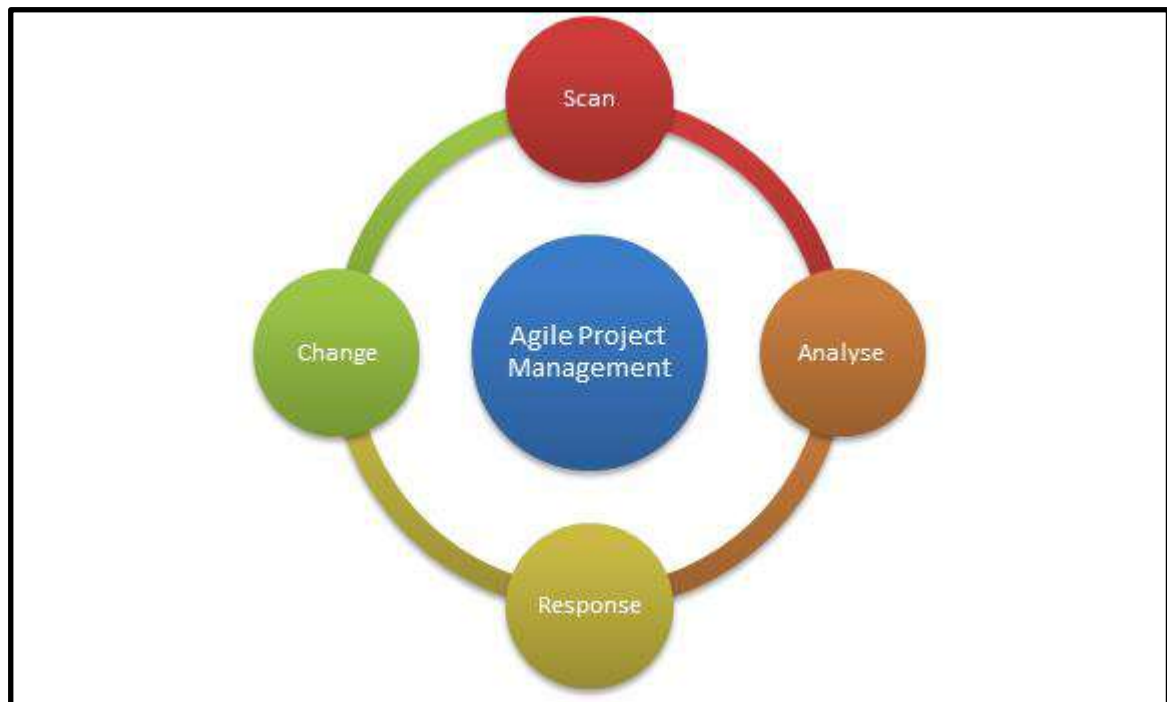


Figure 2.7.2: Agile Project Management

Source: (Self-created)

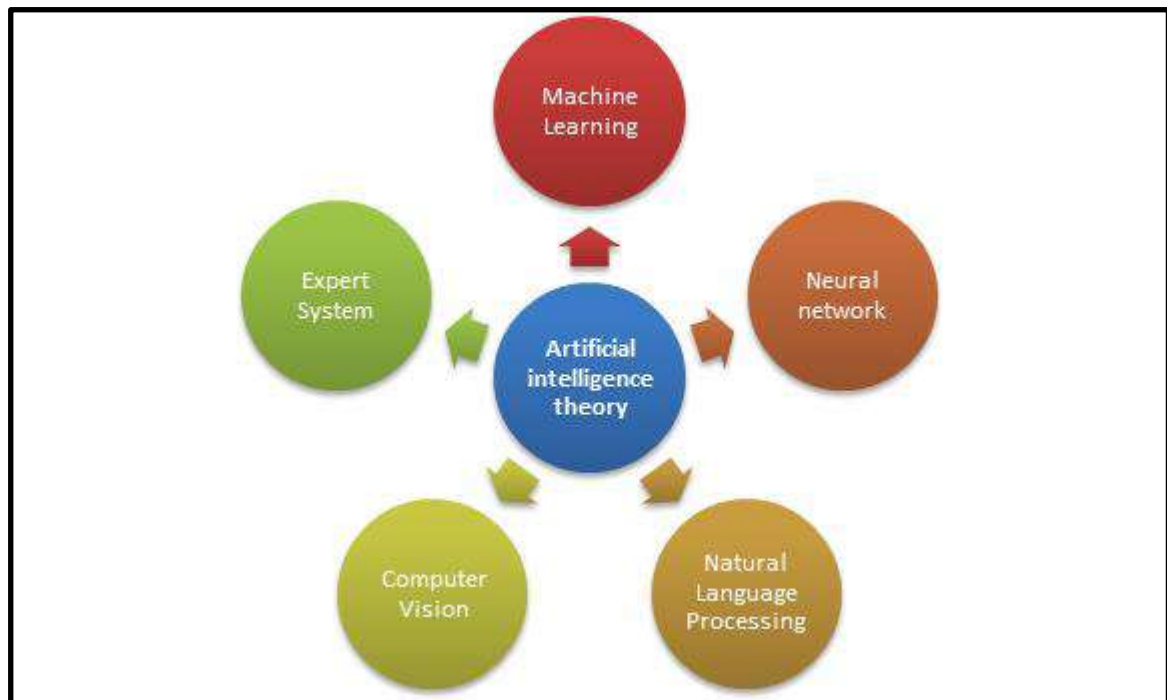


Figure 2.7.3: Artificial intelligence theory

Source: (Self-created)

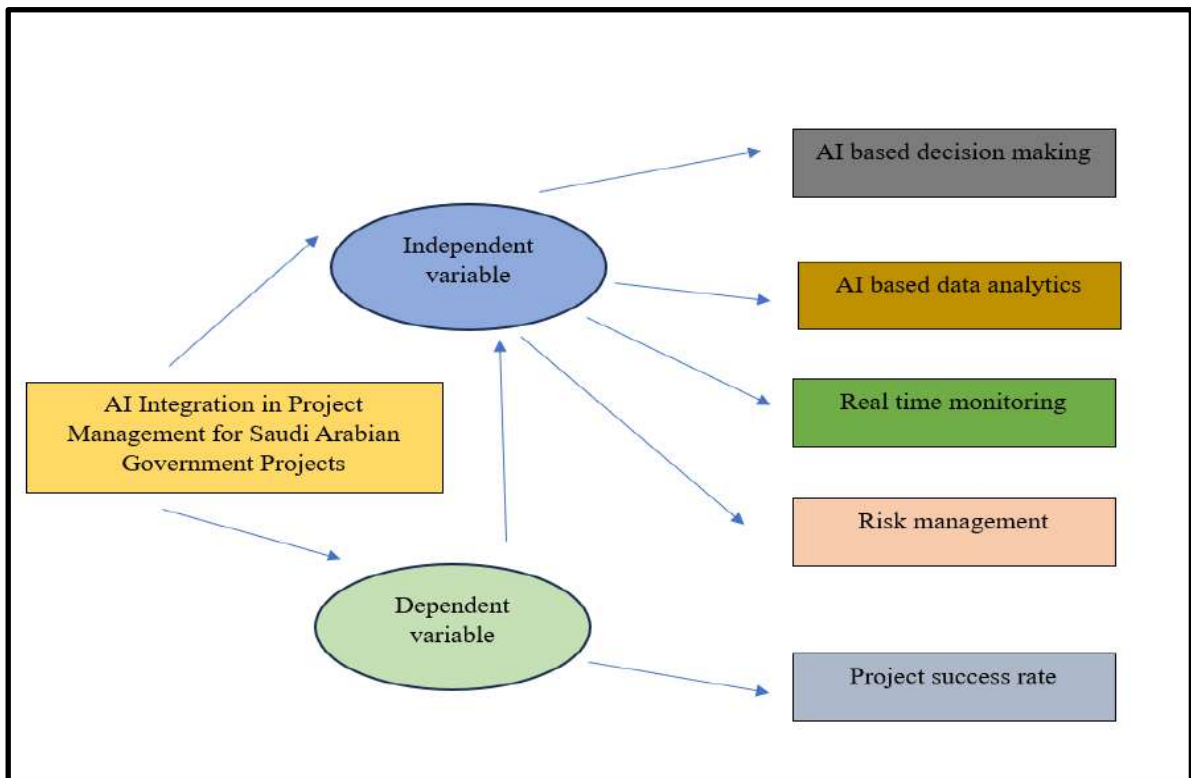


Figure 2.10.1: Conceptual framework

Source: (Self-designed)

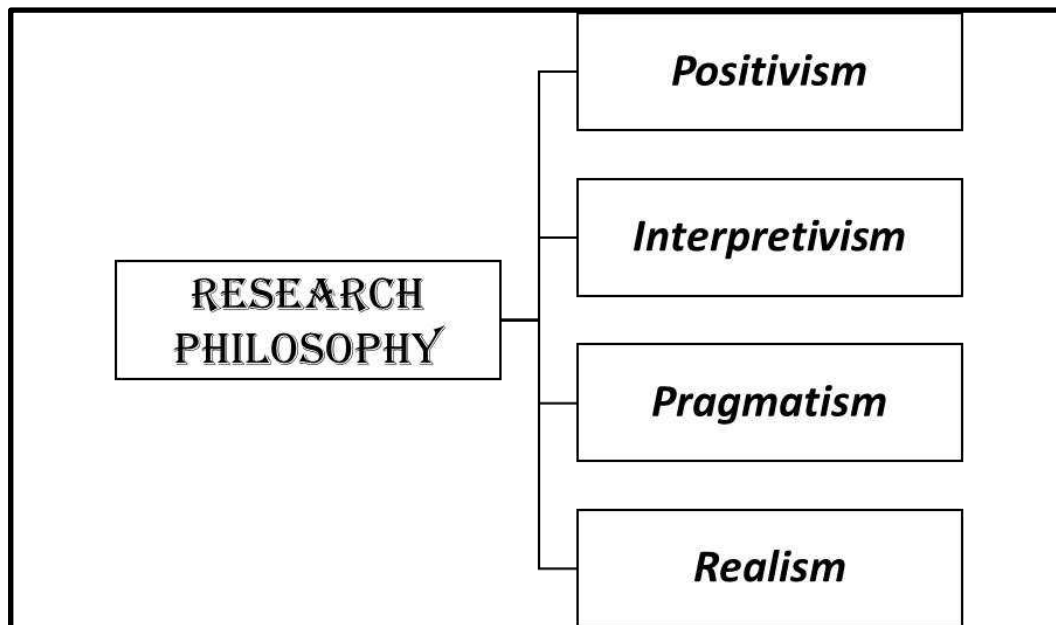


Figure 3.3.1: Types of Research Philosophy

Source: (Self-designed)

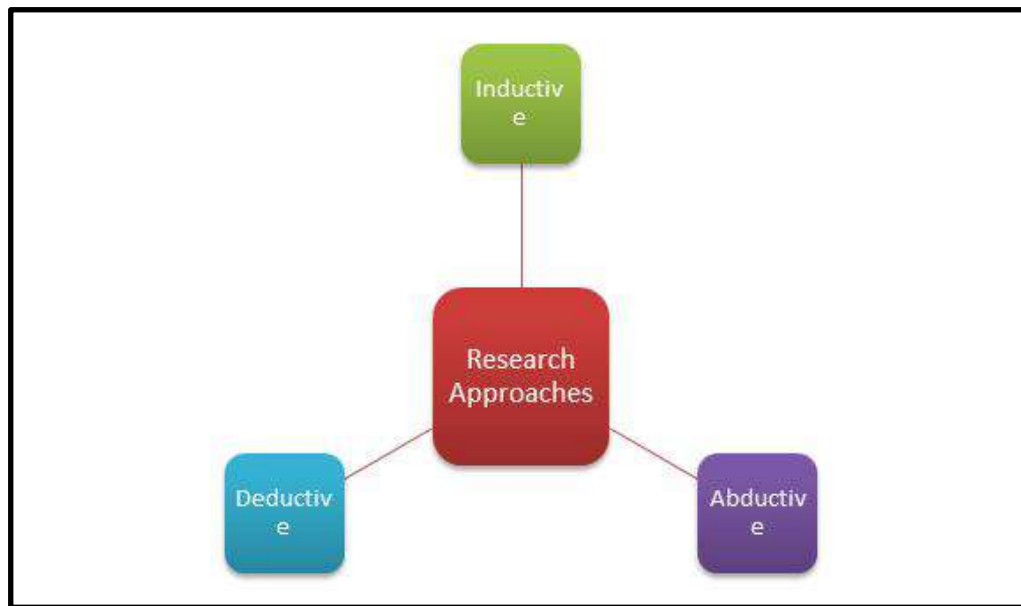


Figure 3.4.1: Types of Research Approach

Source: (Self-created)

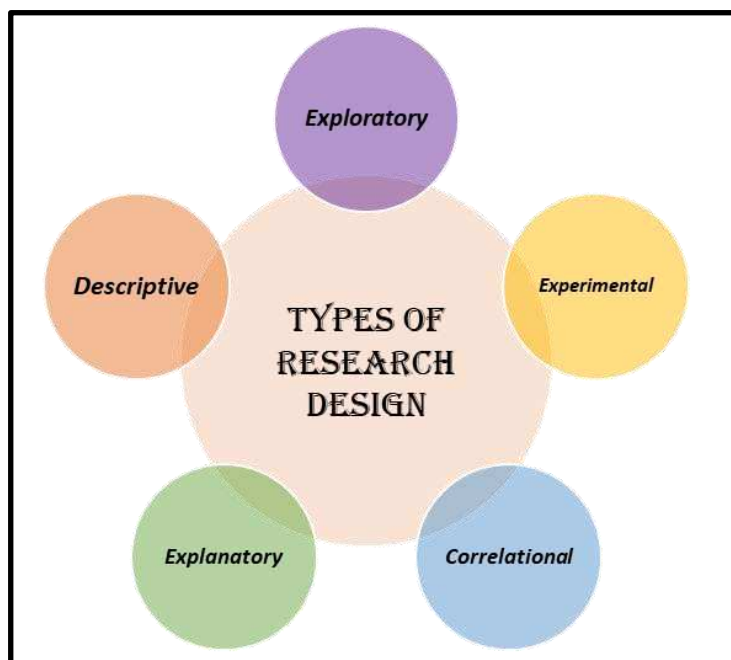


Figure 3.5.1: Various types of research design

Source: (Self-designed)

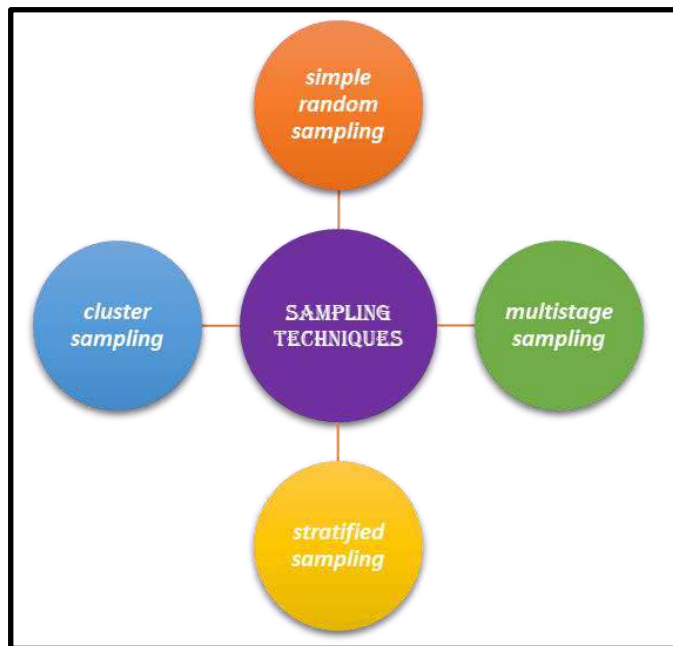


Figure 3.6.1: Types of sampling techniques

Source: (Self-designed)

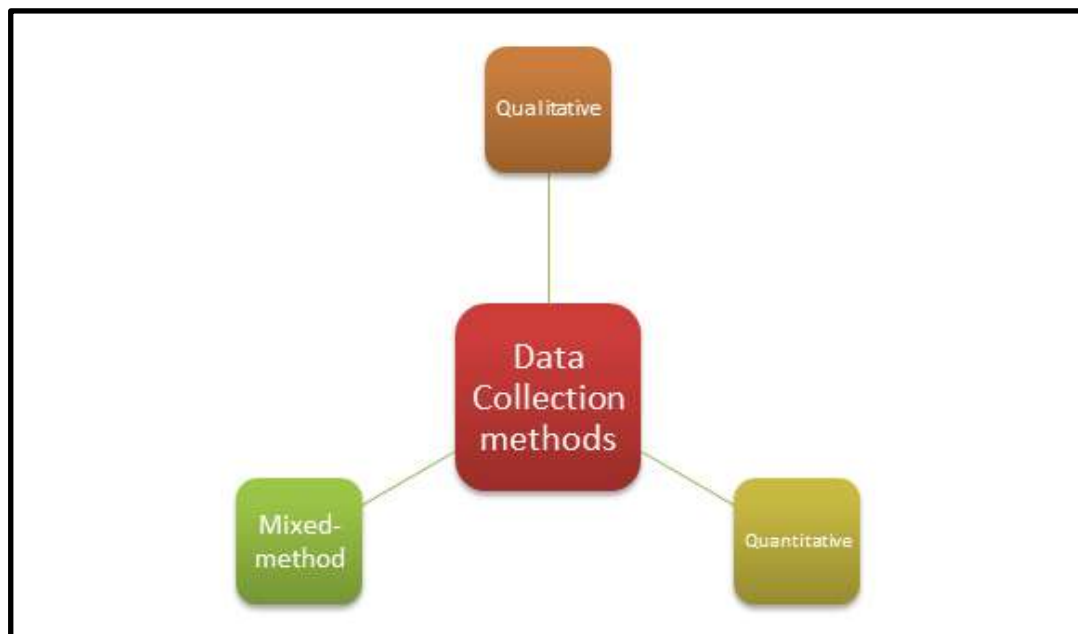


Figure 3.7.1: Data collection methods

Source: (Self-created)

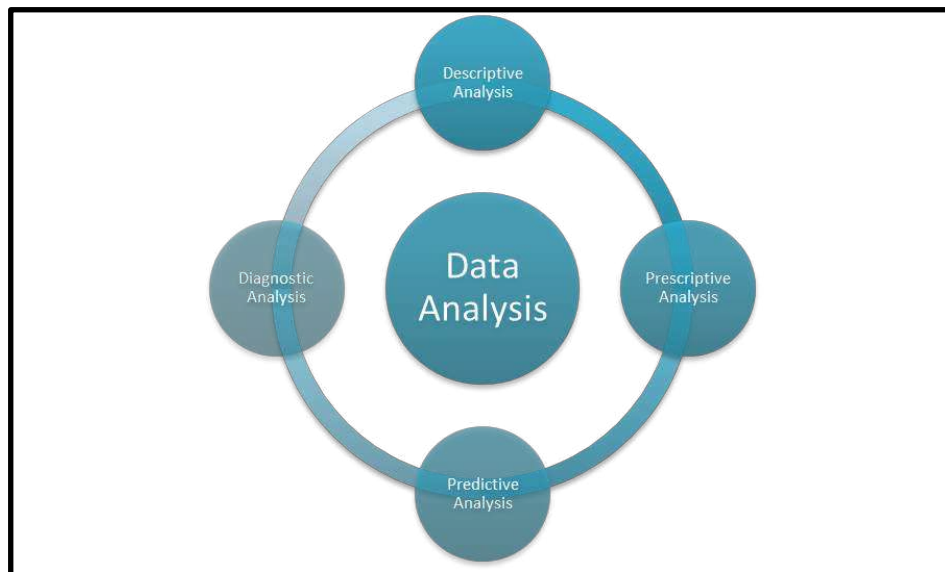


Figure 3.8.1: Types of Data Analysis

Source: (Self-created)

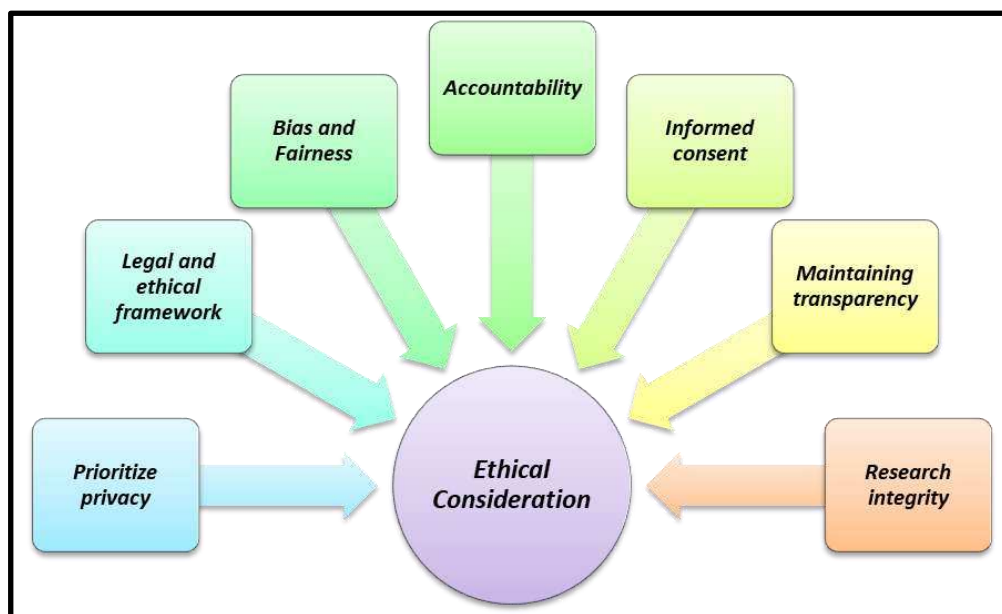


Figure 3.11: Ethical Consideration

Source: (Self-created)

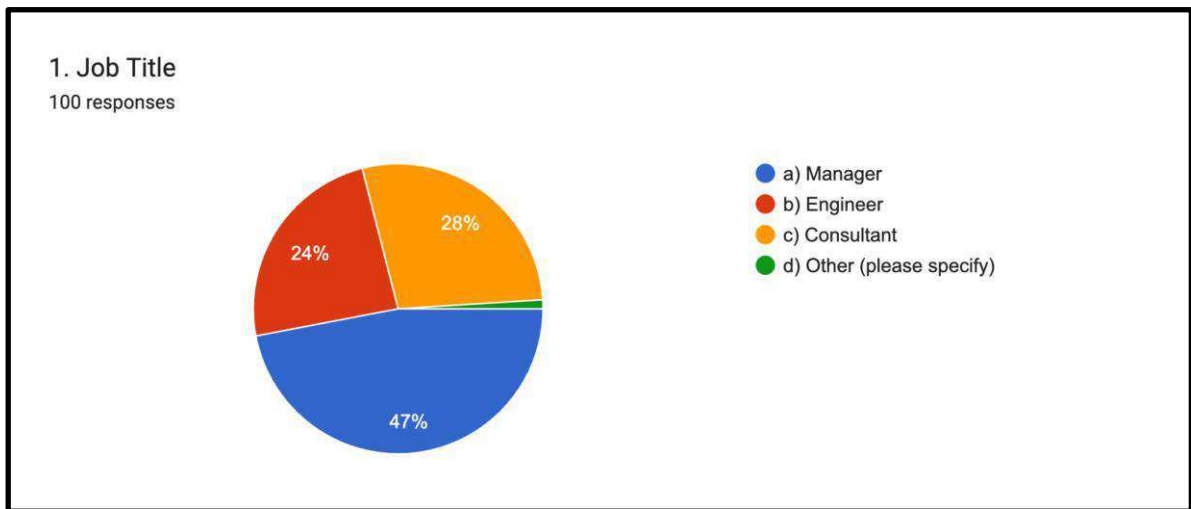


Figure 4.2.1: Job role of participants

n = 100

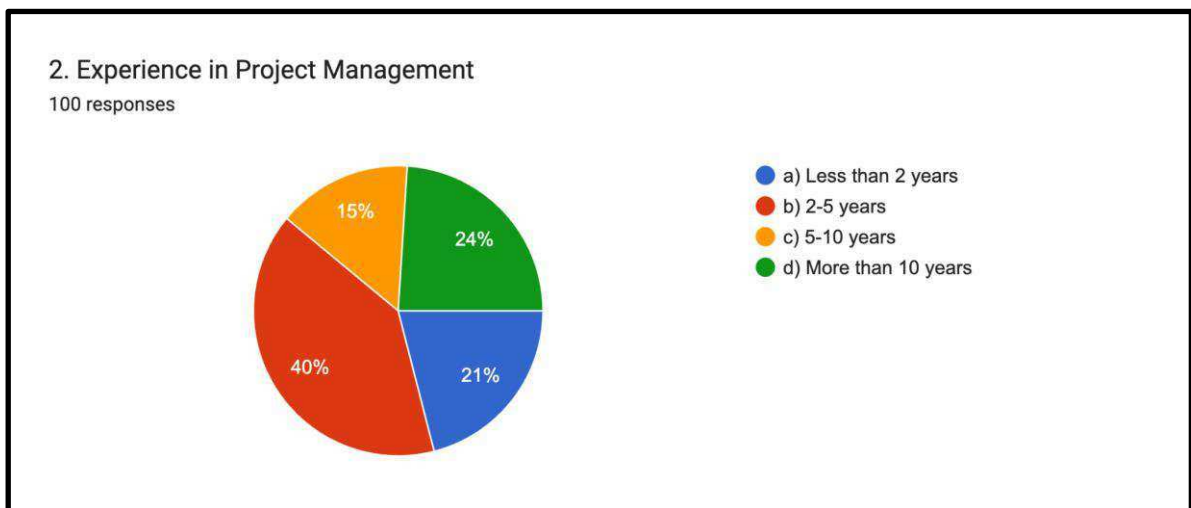


Figure 4.2.2: Experience of participants

n = 100

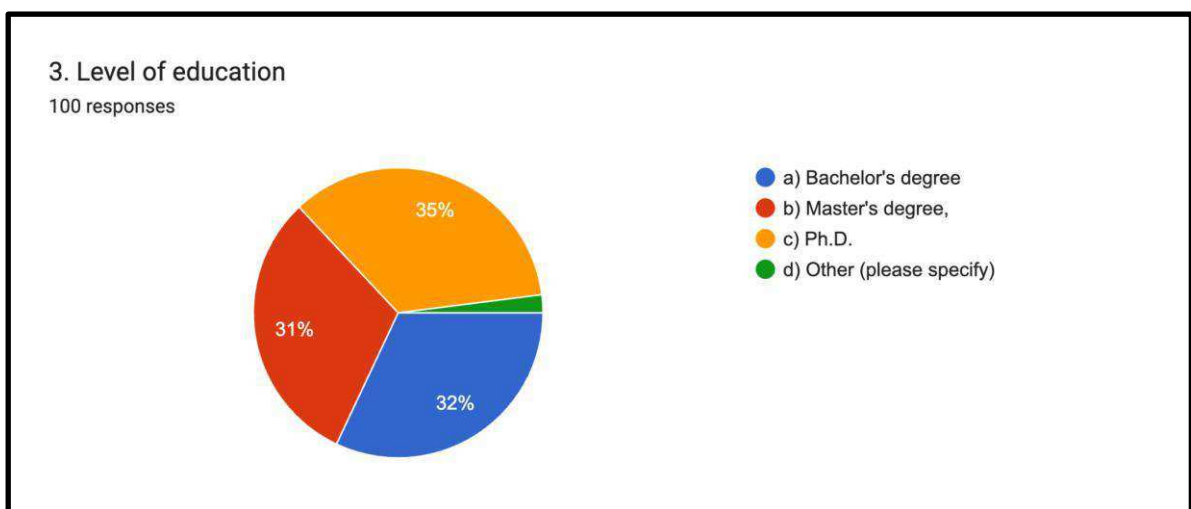


Figure 4.2.3: Completed education of participants

n = 100

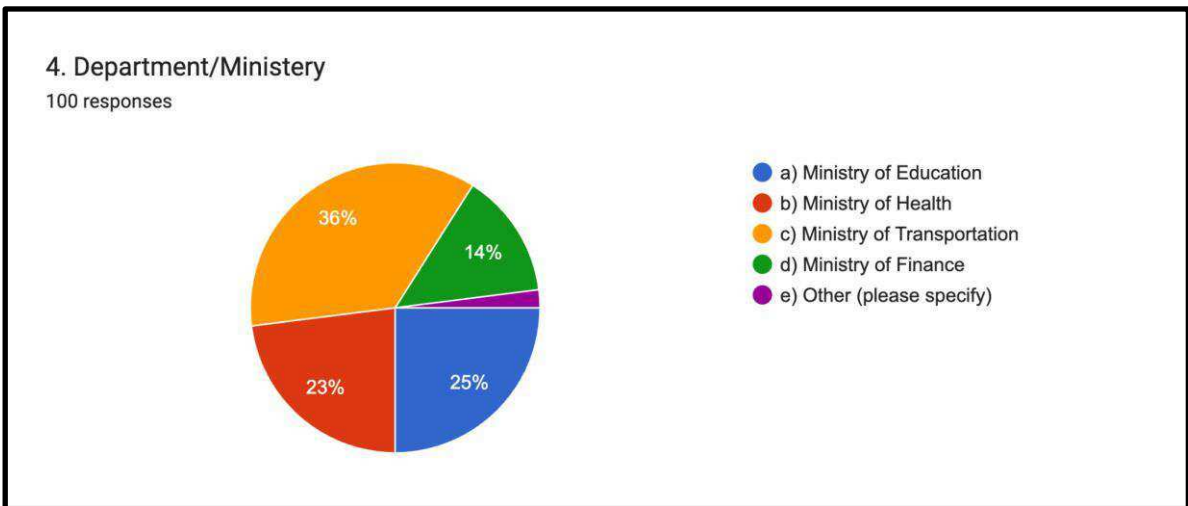


Figure 4.2.4.: Working department or ministry of participants.

n = 100

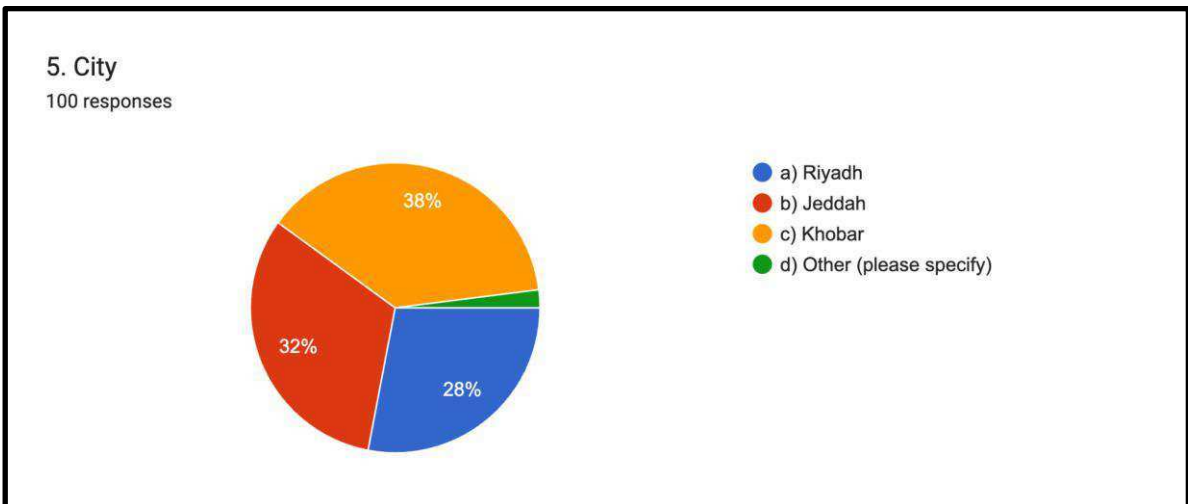


Figure 4.2.5: Belonging of participants

n = 100

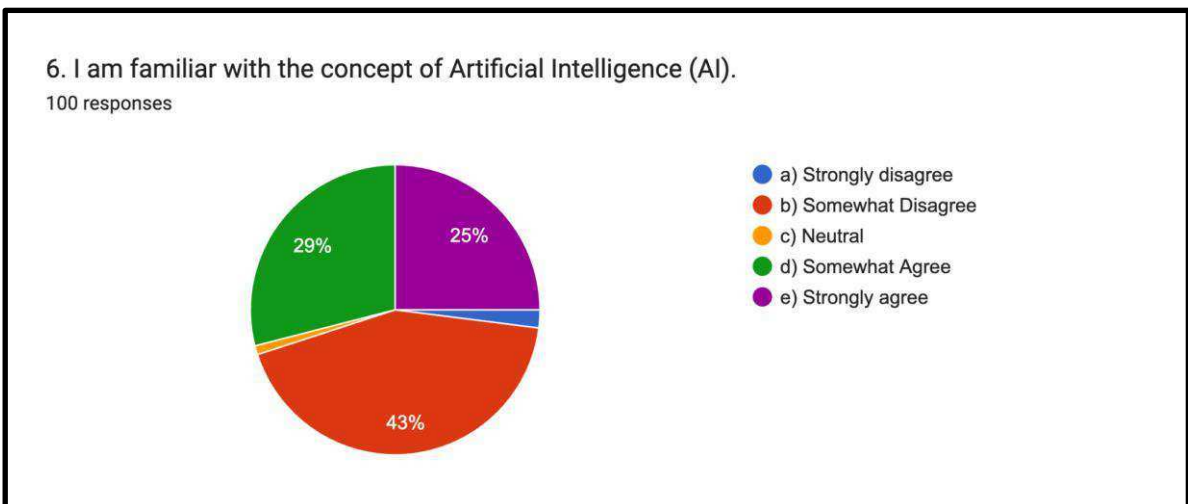


Figure 4.2.6: Participants response on their familiarity with artificial intelligence

n = 100

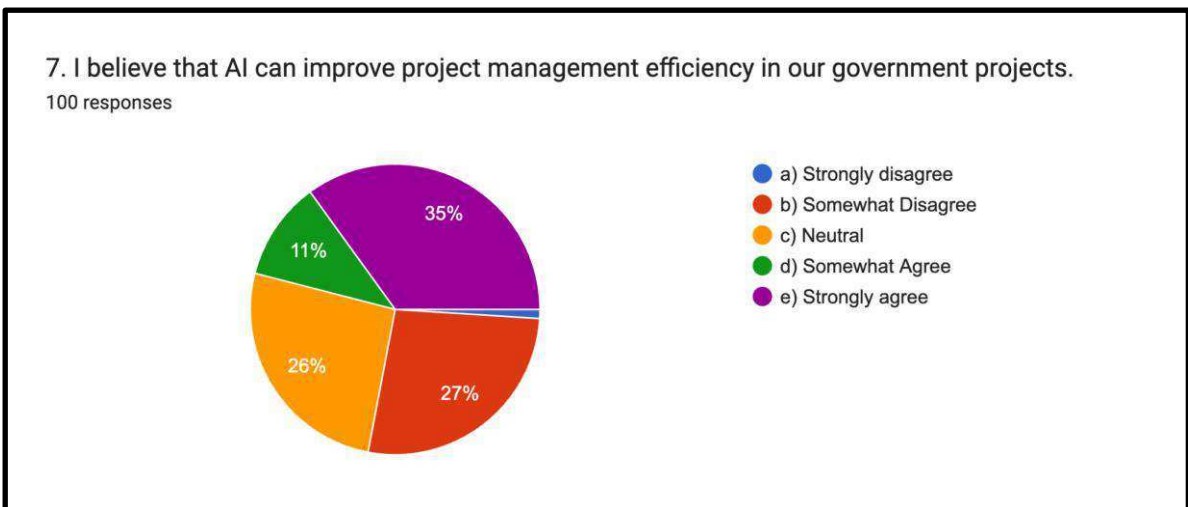


Figure 4.2.7: Improvement in project management efficiency with AI

n = 100

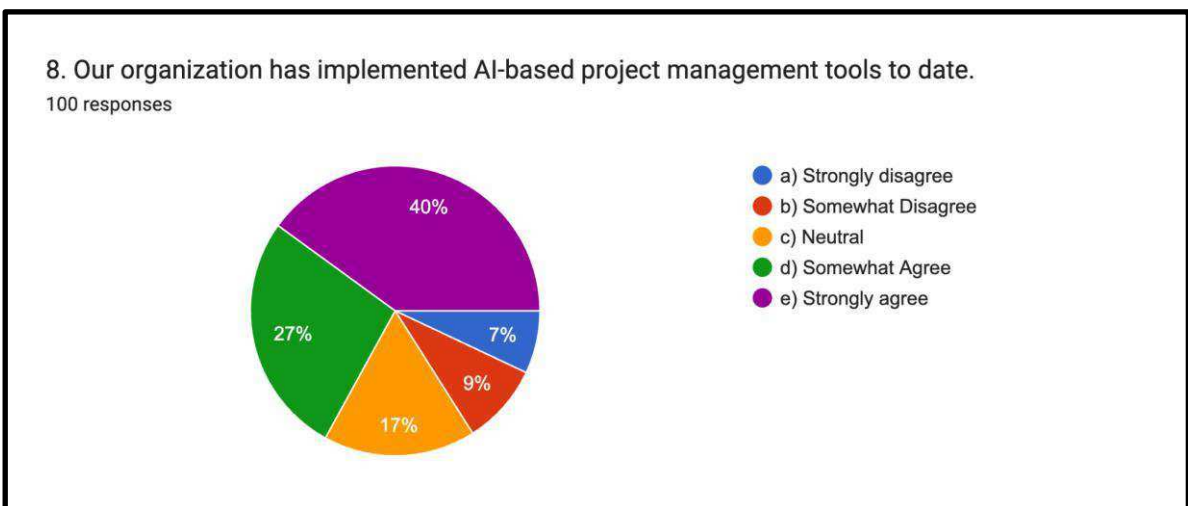


Figure 4.2.8: Implementation of AI-based project management tools in the organization of selected participants

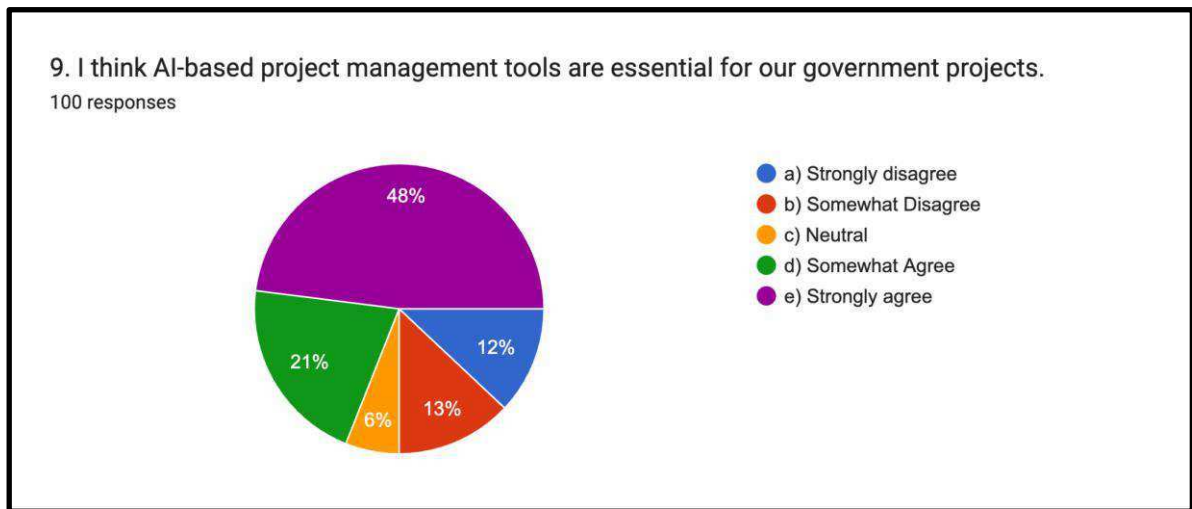


Figure 4.2.9: Perspective of participants for essentials of AI-based project management tool in their government projects

n = 100

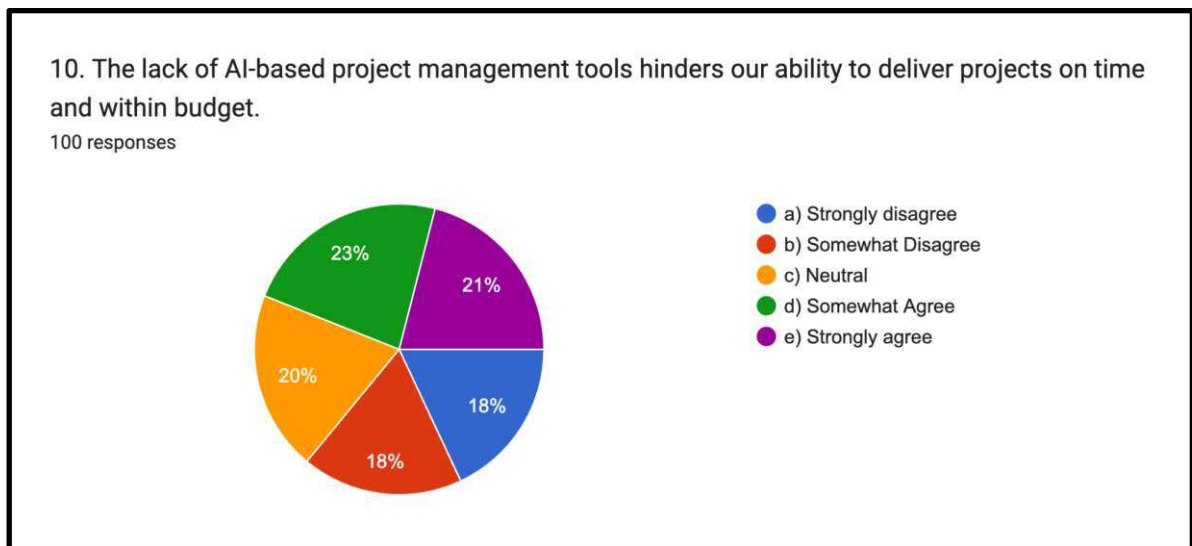


Figure 4.2.10: Hinders bring by AI-based project management tools to deliver projects on time and within budget due to lack of knowledge.

n = 100

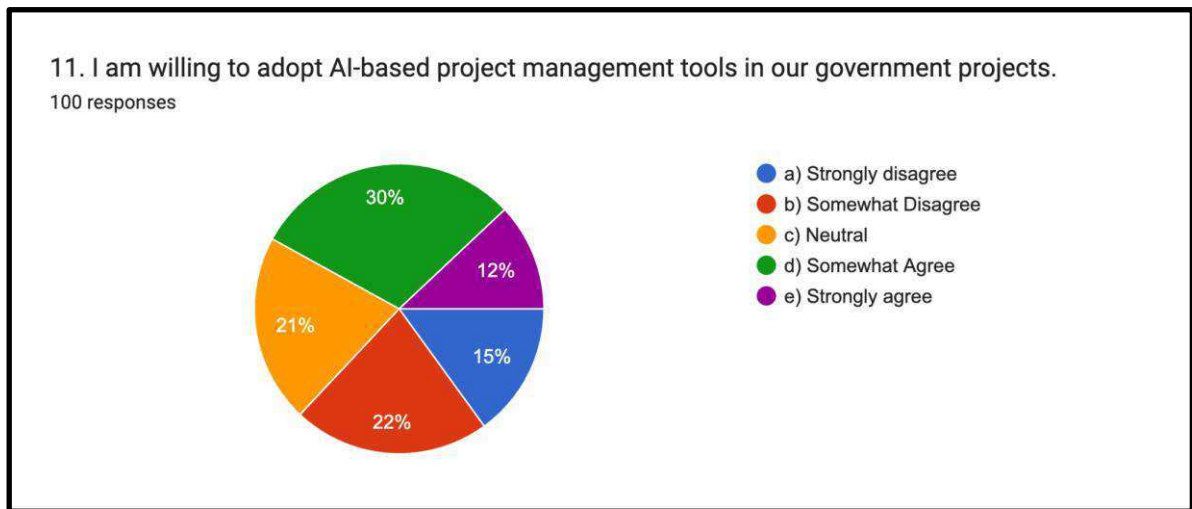


Figure 4.2.11: Willingness of participants to adopt AI-based project management tools in their government projects

n = 100

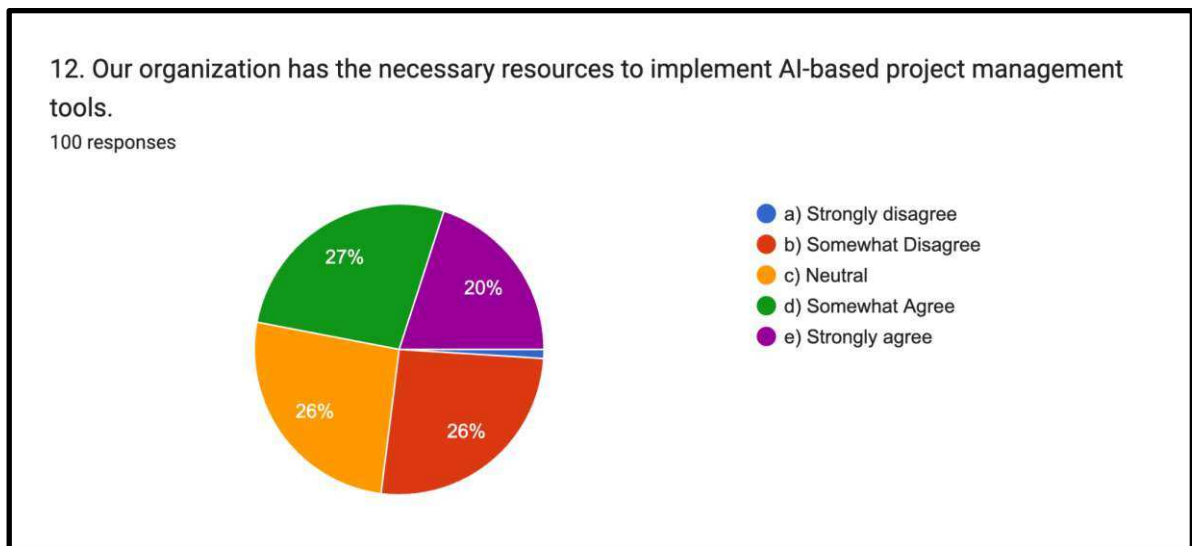


Figure 4.2.12: Resources in organization for implementing AI-based project management tools.

n = 100

13. I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.

100 responses

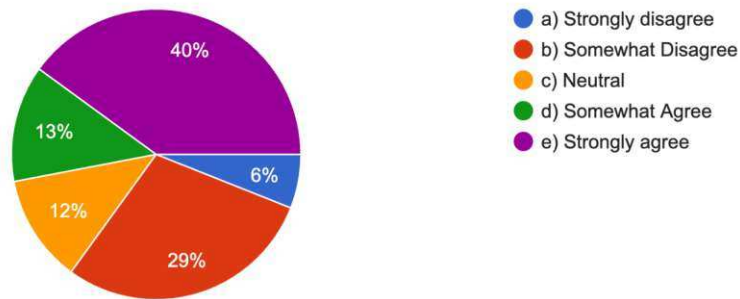


Figure 4.2.13: Help by AI-based project management tools for optimized use of resources in the government projects of participants.

n = 100

14. The implementation of AI-based resource allocation tools would require significant changes to our current workflows and processes.

100 responses

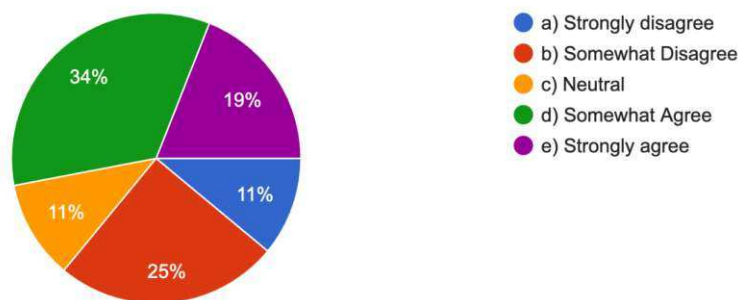


Figure 4.2.14: Requirement for changing current workflows and processes in the organization for implementing AI-based resource allocation tools.

n = 100

15. I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.

100 responses

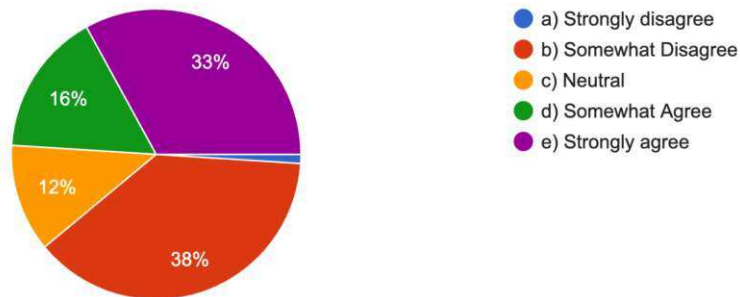


Figure 4.2.15: Help by AI-based project management tools for optimized use of resources in the government projects of participants.

n = 10

16. Our organization has experienced challenges in implementing AI-based project management and resource allocation tools in the past.

100 responses

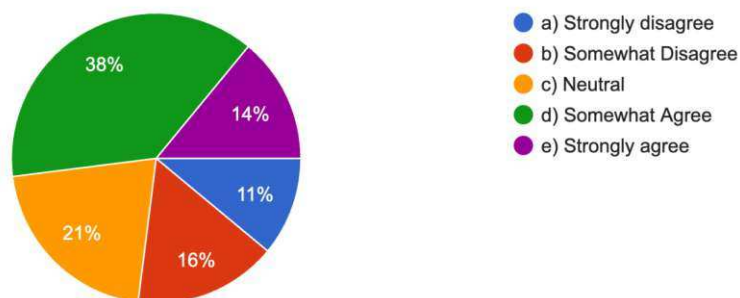


Figure 4.2.16: Challenges faced by organizations for implementing AI-based project management and resource allocation tools.

n = 100

17. I think the benefits of AI-based project management and resource allocation tools outweigh the costs and challenges associated with their implementation.

100 responses

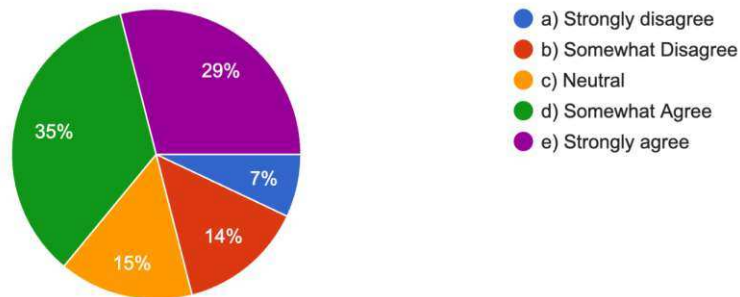


Figure 4.2.17: Primary benefits of implementing AI-based project management tools for reducing costs and challenges]

n = 100

18. Our organization should prioritize the adoption of AI-based project management and resource allocation tools in the next year.

100 responses

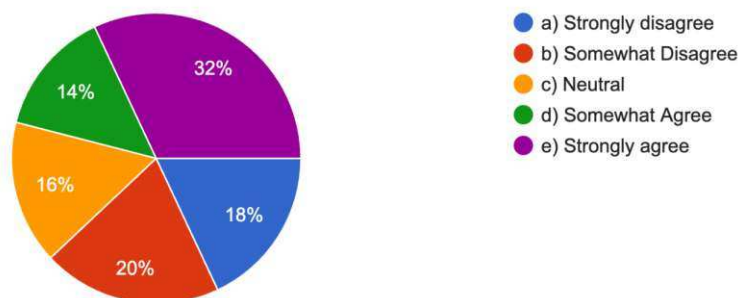


Figure 4.2.18: Adoption of project management and resource allocation tools for organizations by next year

n = 100

19. I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.

100 responses

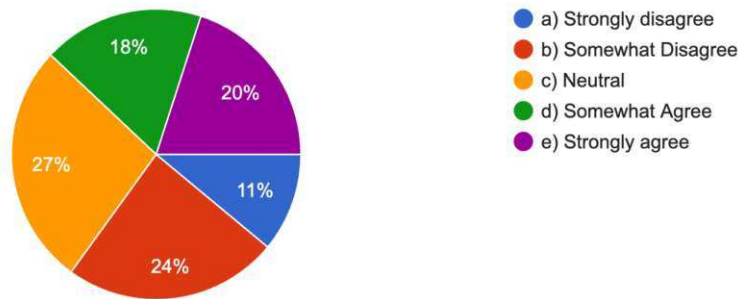


Figure 4.2.19: Confidence of participants in AI-based project management tools for improving the overall performance of their government projects

n = 100

20. The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.

100 responses

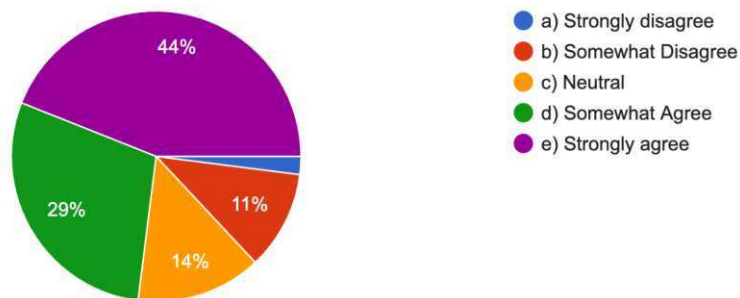


Figure 4.2.20: Adoption of AI-based project management and resource allocation tools for increasing efficiency and effectiveness

n = 100

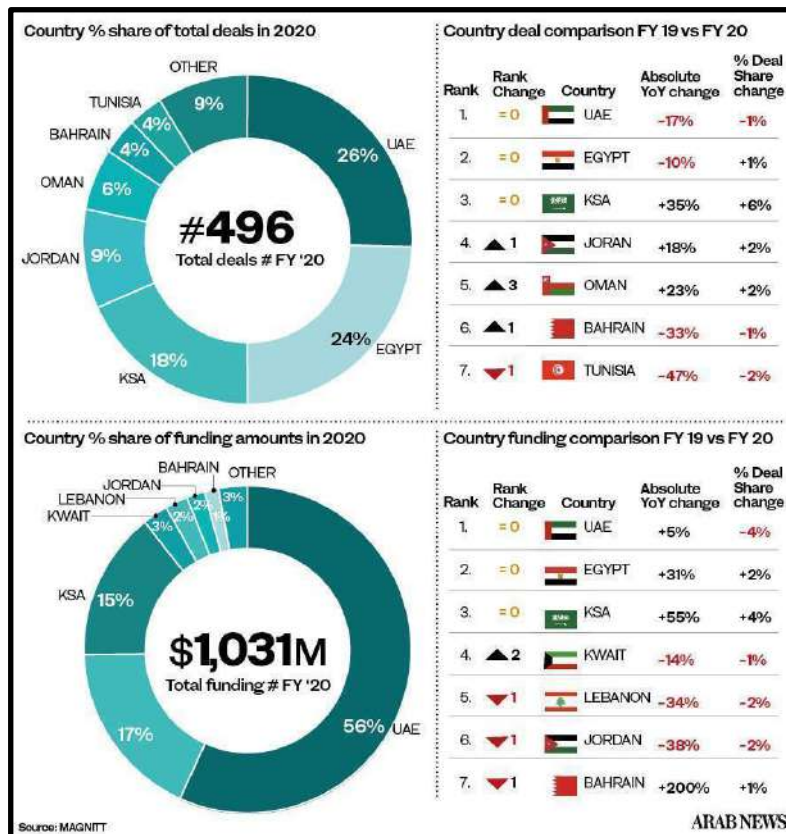


Figure 5.3.1: Budget allocation by Saudi Arabia for AI

Source: (Arab News, 2021)

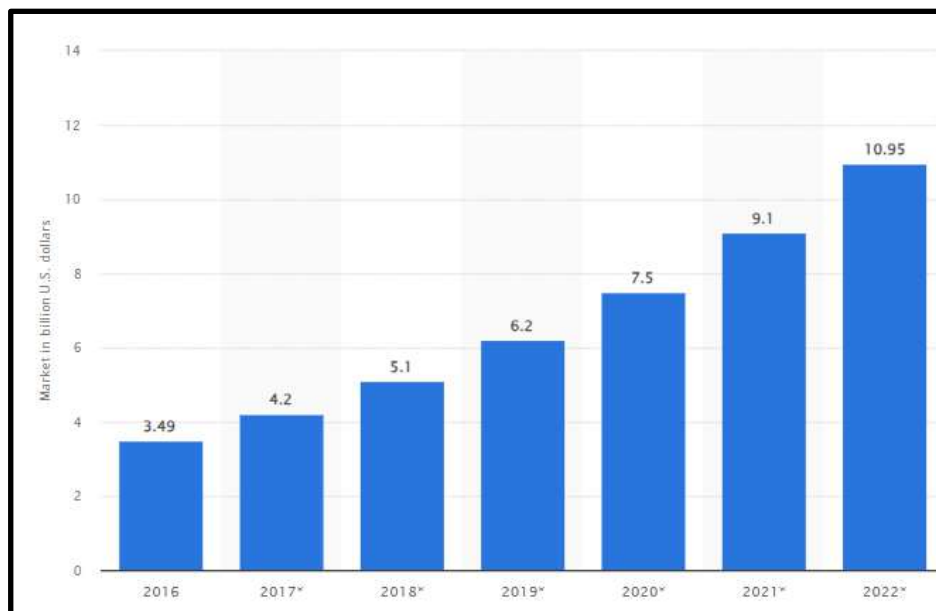


Figure 5.4.1: Predictive analytics market size

Source: (Statista, 2022)

-The questionnaire

Question #	Question	Response Options
1	Job Title	a) Manager, b) Engineer, c) Consultant, d) Other (please specify)
2	Experience in Project Management	a) Less than 2 years, b) 2-5 years, c) 5-10 years, d) More than 10 years
3	Level of Education	a) Bachelor's degree, b) Master's degree, c) Ph.D., d) Other (please specify)
4	Department/Ministry	a) Ministry of Education, b) Ministry of Health, c) Ministry of Transportation, d) Ministry of Finance, e) Other (please specify)
5	City	a) Riyadh, b) Jeddah, c) Khobar, d) Other (please specify)

Likert Scale Questions

Question #	Question	Scale
6	I am familiar with the concept of Artificial Intelligence (AI).	1= Strongly Disagree, 2= Somewhat Disagree, 3= Neutral, 4= Somewhat Agree, 5= Strongly Agree
7	I believe that AI can improve project management efficiency in our government projects.	1-5
8	Our organization has implemented AI-based project management tools to date.	1= Strongly Disagree, 2= Somewhat Disagree, 3= Neutral, 4= Somewhat Agree, 5= Strongly Agree
9	I think AI-based project management tools are essential for our government projects.	1-5

Question #	Question	Scale
10	The lack of AI-based project management tools hinders our ability to deliver projects on time and within budget.	1-5
11	I am willing to adopt AI-based project management tools in our government projects.	1-5
12	Our organization has the necessary resources to implement AI-based project management tools.	1= Strongly Disagree, 2= Somewhat Disagree, 3= Neutral, 4= Somewhat Agree, 5= Strongly Agree
13	I think AI-based resource allocation tools can help us optimize resource utilization in our government projects.	1-5
14	The implementation of AI-based resource allocation tools would require significant changes to our current workflows and processes.	1-5
15	I believe that AI-based project management and resource allocation tools can improve collaboration among team members in our government projects.	1-5
16	Our organization has experienced challenges in implementing AI-based project management and resource allocation tools in the past.	1= Strongly Disagree, 2= Somewhat Disagree, 3= Neutral, 4= Somewhat Agree, 5= Strongly Agree
17	I think the benefits of AI-based project management and resource allocation tools outweigh the costs and challenges associated with their implementation.	1-5
18	Our organization should prioritize the adoption of AI-based project management and resource allocation tools in the next year.	1-5

Question #	Question	Scale
19	I am confident that AI-based project management and resource allocation tools can improve the overall performance of our government projects.	1-5
20	The adoption of AI-based project management and resource allocation tools will lead to increased efficiency and effectiveness in our government projects.	1-5

Note: The scale ranges from "Strongly Disagree" (1) to "Strongly Agree" (5), with "Neutral" (3) being the middle point.