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Organizational factors, project features and individual features associated with the use of emerging technologies by project managers in Kenya.

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ORGANIZATIONAL FACTORS, PROJECT FEATURES AND INDIVIDUAL FEATURES ASSOCIATED WITH THE USE OF EMERGING TECHNOLOGIES BY PROJECT MANAGERS IN KENYA

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DECLARATION

I declare that no prior submission or approval for the award of a degree by this or any other university exists for this thesis. Except for instances where appropriate reference is provided within the dissertation, to the best of my knowledge and belief, no previously published or written work has been included in the dissertation.

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Signature……..... ..... Date.....18th May 2025.....

Approval

This dissertation of Florence Ilovi is approved for examination by the Supervisor.

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Signature……..... Date.... 18th May 2025.....

DEDICATION

This research dissertation is dedicated to my father, Eng. P.P. Ilovi, who has always been my biggest support and source of inspiration. I could not have come this far without your love and support. Thank you, Dad.

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ABSTRACT

A project is a collection of tasks that have a set deadline and must be finished to achieve a certain set of objectives. Project Management is applying knowledge, skills, tools, and techniques to project activities to meet project objectives. The main objective of project management is to ensure projects are delivered on time, at the lowest possible cost and at the highest possible quality. To aid in achieving project management deliverables of time, cost and quality, most projects require effective project management and project management software. Aside from these software, project management has also benefited from the emergence of new technologies such as Blockchain (BC), Machine Learning (ML), Artificial Intelligence (AI) and Robotic Process Automation (RPA). Empirical literature has focused on the use of these technologies in project management but has not evaluated the extent to which the technologies have been adopted by organizations for project management. This adoption is important for organizations and project managers to achieve better project outcomes. This study, anchored on resource-based view and diffusion of innovation theories, aimed to establish organizational features, project features and individual features that influence the use of new technologies by project managers in Kenya. The main population was the 630 members of the Kenya Association of Project Managers (KAPM). Data was collected using an online administered questionnaire. Both descriptive and multivariate analysis was used to analyze data, with the binary logistic regression model. Only 74 respondents participated in the study. The key findings were that artificial intelligence is the popular technology adopted, followed by machine learning, and then blockchain technology across the organizations, project level and individual levels. Robotic process automation has not been adopted. The study found a positive and significant association between firm size and sector in the adoption of Machine Learning and Artificial Intelligence technologies. The rest of the organizational factors are insignificant. The study also found a positive and significant association between project size, project cost and project function in the adoption of Machine Learning and Artificial, while project complexity is negatively associated with the adoption of new technologies, though this is not significant. A project manager's qualification will likely influence the adoption of machine learning and artificial intelligence. Furthermore, knowledge of artificial intelligence contributes largely to individuals adopting both machine learning and artificial intelligence, but no significant relationship with work experience and project management experience. The results and findings are important as they contribute to empirical and have implication for academia and practice. Further studies can focus on barriers to adopting the emerging technologies such as block chain and robotic process automation.

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DEFINITIONS OF TERMS

Project	A collection of tasks to be completed within a specified time in order to achieve a set of objectives
Project Management	The application of knowledge, skills, tools, and techniques to project activities to meet project requirements
Project Initiation	Identifying the objectives, scope, budget, and timetable.
Project Planning,	Developing a thorough action plan
Project Execution	Carrying out the actions indicated in the project plan
Project monitoring	The process of tracking, reviewing, and regulating the progress and performance of a project to ensure it stays aligned with the project plan
Project Controlling,	The processes and activities used to monitor, measure, and guide the performance of a project to ensure it stays on track
Project Closure	closure includes completing duties, gaining project approval, and preserving records
Project Integration Management	A broad function that oversees the work of all other knowledge functions. It has an impact on and is influenced by all other knowledge areas.
Project Scope Management	Entails working with all relevant stakeholders to define, obtain written agreement for, and manage all of the work required to effectively finish the project.
Project Schedule management	Calculating how long it will take to complete the job, designing an acceptable project schedule based on the most cost-effective use of available resources, and assuring project completion on time.
Project Cost management	Prepare and manage the project's budget.
Project Quality management	Ensure that the project meets the stated or implicit requirements for which it is undertaken.
Project Resource management	Making the best use of the people and physical resources available for the project.
Project Communications management	Creating, gathering, transmitting, and preserving project information.
Project Risk management	Identifying, evaluating, and reacting to risks associated with projects, is the eighth.
Project Procurement management	Obtaining supplies and services for a project from vendors outside the organization.
Project Stakeholder management	Locating them, getting to know their needs and expectations, and keeping them informed and involved throughout the project.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
BC	Blockchain
DOI	Diffusion of Innovation
KAPM	Kenya Association of Professional Managers
ML	Machine Learning
NACOSTI	National Commission for Science, Technology, and Innovation
PM	Project Management
PMI	Project Management Institute
RBV	Resource Based View
RPA	Robotic Process Automation
SERSRC	Strathmore Institutional Ethics and Scientific Review Committee

CHAPTER ONE: INTRODUCTION

1.1. Background of study

The profession of project management, which was initially a management function, has been around for more than a century (Seymour & Hussein, 2014). Chiu (2011) explains that project management was necessitated by the fact that countries and organizations were having challenges in managing, specifically large projects, with the majority being also complex.

Project management is an area that has therefore been given attention by not only countries and organizations but also individuals in practice and academia. Whereas organizations and practitioners have focused on improving project management (Pollack, 2007), academia has seen vast empirical research addressing various aspects of project management (Morris, 2009). This study seeks to contribute to the available empirical research, and aims to establish organizational, project and individual factors that influence the use of new technologies by project managers in Kenya.

Section 1.1 of this chapter begins with an overview of project management, emerging technologies applicable in project management, a highlight of the research gaps on use of technologies in project management. Section 1.2 provides the research problem, Section 1.3 highlights the research objectives and questions, Section 1.4 has the justification of the study and section 1.5 concludes with the scope of the study.

1.1.1 Overview of Project Management

The Project Management Institute (PMI) defines project management as "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements" (PMI, 2017). "A project is a collection of tasks to be completed within a specified time in order to achieve a set of objectives. A team of individuals known as the project team, under the direction of a project manager, handles the planning, scheduling, monitoring, and effective completion of projects" (Slevin, & Pinto, 2007).

Both individuals and organizations carry out projects with different objectives and goals. These range from construction of buildings, planning and executing an event, tasks completion. Additionally, projects can be used in a variety of organizational functional areas, including marketing, operations, production, finance, human resources, and information technology. (Fokina et al., 2022).

The project management triangle is used by project managers to help their teams meet project deliverables being —time, cost and quality (Apaolaza et al., 2020). Cost includes payment for resources such as inventories, tools, facilities, equipment, and raw materials are included in the cost of a project. The time component of the triangle includes the number of hours that team members devote to the project, the time required to complete each milestone, and the time required for planning and strategy. Quality is the extent to which a project's intrinsic features satisfy the expected requirements. Determining the clients and their needs is critical for the projects' success.

To complete projects and achieve the three deliverables of time, cost and quality, the project management profession has suggested the project management lifecycle (PMI, 2021). The project life cycle represents the five different stages/phases that a project begins and ends. These are: initiation, planning, execution, monitoring and controlling, and closure. Initiation includes identifying the objectives, scope, budget, and timetable. Planning follows, with a focus on developing a thorough action plan. Project execution refers to carrying out the actions indicated in the project plan. Once the project has begun, it must be monitored and supervised to ensure that no deviations from the plan occur. Finally, closure includes completing duties, gaining project approval, and preserving records. According to Cabecas (2022), the objective is to have a structured approach to achieve deliverables, while managing the resources well and also timelines as the project progress from one phase to the next.

The project management profession expects project management professionals to know various aspects of project management (PMI, 2021). These are called project knowledge areas. They are summarized into ten areas and are considered essential for successful completion of projects. First, project integration management is a broad function that oversees the work of all other knowledge functions. It has an impact on and is influenced by all other knowledge areas. Second, project

scope management entails working with all relevant stakeholders to define, obtain written agreement for, and manage all of the work required to effectively finish the project. Third is project schedule management, which includes calculating how long it will take to complete the job, designing an acceptable project schedule based on the most cost-effective use of available resources, and assuring project completion on time. The fourth is project cost management that aims to prepare and manage the project's budget. Fifth, project quality management that guarantees that the project meets the stated or implicit requirements for which it is undertaken. Sixth, project resource management is concerned with making the best use of the people and physical resources available for the project. Seventh, project communications management entails creating, gathering, transmitting, and preserving project information. Project risk management, which includes identifying, evaluating, and reacting to risks associated with projects, is the eighth. Project procurement management is the ninth, and it involves obtaining supplies and services for a project from vendors outside the organization. To sum up, managing project stakeholders comprises locating them, getting to know their needs and expectations, and keeping them informed and involved throughout the project.

1.1.2 Software and Emerging Technologies in Project Management

To aid in achieving project management deliverables of time, cost and quality, almost all projects require effective project management and project management software. Project management software is a computer application that allows project managers to lead projects and achieve project-related goals (Gupta, 2022). Project Management Software aims to automate and combine project management tools such as Gantt Charts, Work Breakdown Structure, Project Network Diagrams, Kanban Boards, Time Sheets, Project Evaluation and Review Techniques, Project Dashboards, and Reports (Mishra & Mishra, 2013).

Project Management Software serves four main purposes. First, if an organization has several teams actioning the same project, project management software will coordinate the teams and guarantee timely achievement of the deliverables. For example, accessing with the aid of a cloud-based project management platform, members from various departments can monitor the progress of the project with minimal communications such as emails and therefore, time is saved to focus on important tasks (Apaolaza, 2020). Second, when managing a project, it's critical to keep track

of the individual duties assigned to each team member. However, a member of the team will likely prefer a personalized approach to monitor the progress of the project. The project management software aims to reduce the preference to silo, and therefore provides one location for task assignment, in addition to operating other tools that the project members will note the tasks completed (Nienaber & Cloete, 2003). Third, being able to access real-time data through dashboards, with automated reporting, makes project management software a vital component of project management. Having project reports easily available and accessible, the project leaders stay informed about the projects milestones, tasks and eventually how the project is delivered on time and minimum (Martínez-Rojas et al., 2016). The last feature of project management software is automated time tracking, which is especially important if you wish to bill your clients correctly. With the help of billable and non-billable hour tracking software, you can keep track of the hours spent on each task and merge them with client and project information to create comprehensive reports that help you decide on prices (Nienaber & Cloete, 2003).

Project management software have several benefits. The first benefit is to elevate project planning. Companies must understand the current state of projects as well as how the workload will match each team's capability in the long run. Smart software is used to create timelines, set milestones, and prioritize work instead of organizing projects in endless spreadsheet tabs. (Raith et al.,2017). Second, there is seamless communication. It would be challenging to manage everything within the project team without a tracking system. With the help of project management software, a project manager can monitor client history, stay on top of tasks, and communicate with clients via notes and messages all on the same platform (Nakayama & Chen 2016). Quicker project completion is the third benefit. Effective project execution is characterized by speed and agility, and this is an area in which project management software shines. One can quickly adapt when necessary thanks to features like task management, communication, and reporting (Ciric et al., 2018). Finally, budgets are well optimized. If projects are well-organized and time is kept track of, it is straightforward to estimate how much they will cost.

In addition to Microsoft Office Project Management Software, we have many other types of software that rely on different project management tools, such as Wrike, the finest for cross-functional communication. Asana is the greatest for appealing images. Monday.com is the greatest

for use case templates. Adobe Workfront is the finest for Adobe integration. Smartsheet is the greatest for spreadsheet-like capabilities, whereas ClickUp is the best for mind mapping. Airtable is the best for data-driven teams; Jira is the finest for development teams. Trello is the best for simple tasks, while Notion is the best for document storage, among others (Stanimirovic et al., 2023).

Aside from these software, project management has also benefited from new technologies such as Blockchain (BC), Machine Learning (ML), Artificial Intelligence (AI) and Robotic Process Automation (RPA). For the purpose of this study, emerging technologies are also new technologies. Empirical studies in project management have evaluated the application of blockchain in project management (Hegeman, 2019; Nanayakkara, 2019 and Khatib et al. 2021), the use of machine learning (Pasupuleti, 2018; Wei & Rana, 2019 and Kanakaris et al., 2020), the use of artificial intelligence (Butt, 2018; Davahli, 2020; Shoushtari, Daghighi, & Ghafourian, 2024) and the use of Robotic Process Automation (Leeuwen, 2022).

1.1.3 A brief highlight of the research gap and motivation for the Study

As briefly highlighted in the introduction, project management has been given a lot of attention by both practitioners and academicians. There is vast empirical literature, of which it is impossible to summarize in the current study. For some highlights of several decades of research see Hall (2012) Padalkar and Gopinath (2016).

Some empirical studies in project management have evaluated the relevance of project knowledge (Fong, 2003 and Gasik, 2011), factors affecting project performance (Ogunlana, 2010; Meng, 2012), Frameworks for managing large complex projects (Jaafari, 2003 and Sanderson, 2012), various strategies to manage and complete projects (Leybourne, 2009; Lipke et al., 2009), the value of project management for the organization (Crawford, 2006; Thomas & Mullaly, 2007), managing risks in projects (Petit, 2012; Sanderson, 2012; Thamhain, 2013). Finally, other studies have considered the critical success factors for projects (Ika et al., 2010; Muller & Jugdev, 2012).

In terms of software and new technologies, beside the empirical studies highlighted under section 1.1.2, practitioners have also aimed to identify not only the use of software and new technologies

in project management but also their benefits and challenges of using the technologies. See Lu et al. (2022) form block chain technology, Kanakaris et al. (2020) for machine learning, Taboada et al. (2023) for artificial intelligence and Garg et al. (2022).

Despite the numerous studies on project management and technologies, there is room for some aspects to be considered. For example, based on available literature, it is not clear the type of technologies that the organization will adopt in project management. Secondly, empirical studies are also not available to the type of projects that will likely use the emerging technology. Still within the scope of emerging technologies, there is no evidence regarding the preference for certain technologies in project management by project managers and the organizational, project and individual project managers features that will likely influence the choice. This study was therefore motivated, within the context of Kenya, more specifically, the Kenya Association of Project Managers, to provide empirical evidence on the use of new technologies in project management.

1.2. **Problem Statement**

Section 1.1. has provided the background to the study, discussing the importance of project management and the software and new technologies that support project management, with a brief highlight of the research gap and eventually the motivation for the study. Project management aims to ensure that projects are completed within the expected time, at the lowest possible cost, and at the highest possible quality (Apaolaza, 2020). According to Baniko et al. (2022), it would be a challenge to achieve these objectives without the aid of a software. As organizations grow, projects become more complex, technology has also improved.

According to Gil et al. (2021), artificial intelligence is used throughout a project's lifecycle, from commercial development to construction and commissioning, and even in operation and maintenance tasks. The authors showed how, by using real-time project data analysis and artificial intelligence in decision-making, the project manager could be informed about potential risks and opportunities. Project managers, organizations, and projects all stand to benefit from the use of emerging technologies in project management.

Despite the benefits, it is also possible that organizations, projects and project managers may also face challenges in adopting and implementing the emerging technologies in project management. For example, small organizations may have a challenge with the resources required to utilize emerging technologies. In addition, some projects may also be very complex and may not have the appropriate technologies available. Meanwhile, project managers may not have the prerequisite knowledge to utilize the emerging technologies.

This study, therefore, aimed to provide answers to these pertinent issues, from the extent to which organizations are using new technologies in project management with the various organizational factors that influence their choice, the types of projects that will likely use the emerging technologies, and the individual characteristics that also influence the use of emerging technologies by project managers.

1.3. Research Objectives and Research Questions

1.3.1 Research Objectives

The general objective of this study was to establish the factors that influence the use of emerging technologies in project management in Kenya.

The specific objectives were:

1. To establish organizational features that influence the use of emerging technologies by project managers.
2. To establish project features that influence the use of emerging technologies by project managers
3. To establish individual features that influence the adoption of emerging technologies by project managers.

1.3.2 Research Questions

The study had the following research questions.

1. What are the organizational features that influence the use of emerging technologies by project managers?
2. What are the project features that influence the use of emerging technologies by project managers?

3. What are the individual features that influence the adoption of emerging technologies by project managers?

1.4. Scope of the Study

The study used an online questionnaire to collect data from the members of the Kenya Association of Project Managers (KAPM). As at the time of authoring, the institute had slightly more than 630 members, as per the association's website. Due to the potential for a smaller response rate, the questionnaire was sent to all the members to increase the chances of a higher response rate. The questionnaire was made available from 5th of April 2025.

1.5. Significance of the Study

1.5.1 Regulators and Policy Makers

Project management is regulated by a number of organizations, including the Kenya Association of Project Managers and other government policy makers. The results of this study provide regulators with information about the degree of use and applicability of new technologies in project management, enabling them to support and create policy guidelines that encourage the use of technology among other things as a strategy for improving project outcomes.

1.5.2 Companies/Organizations

Organizations seek to launch new projects as part of their strategy. Organizations depend on technology to meet the project deliverables of cost, schedule, and quality. The results of this study educate organizations about project management trends, applicable technologies, and the advantages and drawbacks of implementing new technologies.

1.5.3 Project Managers

Project managers stand to benefit directly in applying new technologies in project management. The findings from the study provide shared experiences on the perspectives of new technologies in project management. Project managers will learn from one another about organizational factors and project factors that influence the application of new technologies in project management.

Project managers with expansive experience provided information about new technologies in different projects and even stages of the project.

1.5.4 Researchers and Academicians

The results and findings of this study add to the empirical literature on project management and new technologies. The results and findings contribute to the knowledge gaps and population context and based on findings, provide industry applications and suggestions for knowledge extension through additional areas for research.

1.6 Chapter Summary

Chapter One has provided the background to the study, with an overview of project management, the use of emerging technologies in project management and a highlight of research gaps and motivation. The chapter has also provided the problem statement, research objectives and questions, a justification of the study and the scope. Chapter Two provides the empirical review, chapter three the methodology, chapter four presents the results and findings and chapter five provides the discussions and conclusions.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

The main purpose of Chapter Two is to provide the theoretical foundation of the study and the empirical studies that the study supports and aims to extend. Section 2.2 of the chapter begins with a highlight of the theoretical framework for the study. This is followed by Section 2.3 with the empirical studies, Section 2.4 is a summary of knowledge gaps arising from the study, Section 2.4 concludes with the conceptual framework and then section 2.6 concludes with operationalization of the variables.

2.2. Theoretical Framework

According to Hanisch and Wald (2011), research on project management should borrow extensively from management theories, given that project management was (and possibly still is) a management function. The common theories will likely include organization theory, contingency theory, systems theory and resource-based view theory among others. Almarri and Gardiner (2014) found that resource-based view (RBV) theory is popular in project management research and has been used in various themes such as project management knowledge, project management tools and methodologies, project complexity and transforming organizations through project management. Meanwhile, Diffusion of Innovation Theory (DOI) is relevant when evaluating the use/application of new technologies (García-Avilés, 2020).

2.2.1 Resource-Based View Theory (RBV)

Utilizing resources rather than industry or economic conditions, the resource-based theory explains performance differences amongst firms. The theory's founding works are found in the 19th-century writings of David Ricardo (William et al., 2010). However, Habbershon and Williams (1999) believe that the RBV theory began with the contributions by Selznick (1957), Penrose (1959), Pfeffer and Salancik (1978).

The Resource-based View (RBV) theory is widely used in project management and is rooted in strategic management ideas. It looks into the potential for resource-based competitive advantage.

The ability to generate greater value than rivals and earn a higher return on investment is known as a competitive advantage. Long-term gains through attributes that are challenging to replicate are necessary for a sustainable competitive advantage (Killen et al., 2012). The RBV theory is based on the idea that an organization's resources and capabilities are not heterogeneous over time, and it can be used to explain why different organizations have different success rates.

According to the RBV theory, organizations can gain a competitive edge and perform better when they differ from one another in terms of their tangible and intangible resource bundles (Habbershon & Williams, 1999). The theory looks at how a company's internal characteristics and procedures relate to how well it performs.

"The resource-based view provides an explanation of competitive heterogeneity based on the premise that close competitors differ in their resources and capabilities in important and durable ways" (Helfat & Peteraf, 2003). This means that any firm within an industry has distinct strategic resources, and these diverse features have the ability to provide a competitive edge. A firm can maintain its competitive advantage for extended periods of time because its resources are distinct from those of other firms and cannot be perfectly replicated by them (Habbershon & Williams, 1999; Pablo et al., 2007).

In project management research, the RBV theory is applied to determine which PM resources and capabilities shape the firm's competitive advantage (Crawford et al., 2006; Besner & Hobbs, 2012); in the case of project risk management (Govan & Damnjanovic, 2016). Previous studies have shown that strategy theories such as the Resource-Based View (RBV) can provide valuable insights to improve research findings in project management (PM) studies and provide practitioners with examples of PM resources that are advantageous to the organization from the RBV perspective (Killen et al., 2012).

The resource-based view theory (RBV theory) has gained prominence as one of the most significant strategic theories in management; however, opponents continue to raise questions about research gaps, the quality of the definitions behind the RBV theory, and the generalizability of the theory. (Barney, 2011; Truijens, 2008; Levitas & Ndofor, 2006). The non-homogeneous use of

terms like competencies, assets, resources, and capabilities is noted by Truijens (2003). Barney et al. (2011) contend that the effectiveness of future research is limited by the discrepancy between RBV theory and the measurement of intangible resources, raising serious concerns about the validity of the empirical test used to support the use of RBV strategy.

2.2.2 Diffusion of Innovation Theory (DOI)

According to Rogers (1962), the Diffusion of Innovation (DOI) theory aims to explain how, why, and how quickly novel concepts and technologies proliferate within a social system. The process by which technology spreads throughout organizations is known as diffusion, according to Fichman (2000).

Four categories—innovations, communication systems, time, and social systems—make up the DOI theory (Sahin, 2006). According to Rogers (1983), innovations are concepts, behaviors, or items that a person or other adoption unit perceives as novel. Users can exchange information with one another via the communication system (Rogers, 2003). The time component of the innovation diffusion process is typically used to track the adoption rate and adopter classification. An innovation tracks time from the moment it is created until it ceases to be one. A social system is made up of interconnected entities that cooperate to solve issues and accomplish a common goal (Rogers, 2003). Before a social system recognizes an innovation, it is useless. Innovations disappear from society if they are not accepted. Only when an innovation is acknowledged as such by a social system and information about it is disseminated both within and between systems can innovation begin to diffuse.

According to Kaasinen (2005), DOI has classified innovators into five categories. Bold risk-takers who serve as gatekeepers for those who follow are known as innovators. Opinion leaders who are among the first in their group to embrace new technology and who are prepared to defend their position by assessing it for others are known as early adopters. Users who are more watchful and open to embracing innovations make up the early majority. When using a new invention or technology, they usually rely on the information supplied by early adopters. The Late Majority and Laggards are socially more conventional, frequently lower-class, and need social pressure to be encouraged to adopt. The main characteristics of the Late Majority category, which adopts after

the mean (average) portion of the population, are caution and skepticism (Gouws & George, 2011). Traditionalists who adopt new ideas slowly are known as laggards. Laggards are separated from the other adopter groups by nearly nonexistent opinion leadership. They are obsessed with the past, and decisions must take the past into account.

DOI theory is used to guide research on adoption of new technologies in various organizations and sectors (Al-Jabri & Sohil, 2012). Meanwhile it has been used in various project management studies (Zoubi, et al., 2023; Crespin-Mazet et al.,2021; Aizstrauta et al., 2015; Dube & Gumbo,2017; Min et al.,2021)

Despite its popularity, the theory of DOI has been criticized of being too mechanistic, while the technology sector is more dynamic and may not follow a rigid pattern in innovation. Not only is the adoption pattern of technology varied, with the rate of adoption being different, but also, often adopters developed negative attitudes about cutting-edge innovations (MacVaugh & Schiavone, 2010).

Both RBV and DOI are relevant are therefore relevant for this study in various ways. The RBV theory informs the various resources and capabilities in the organization that will influence the types of projects and the application of new technologies. For example, it is expected that large organizations with sufficient resources will likely use some cutting-edge technologies such as blockchain, artificial intelligence and robotic process. Likewise on diffusion of innovation, the selection and use of different technologies will also inform the potential for organizations and project managers to apply the new technologies.

2.3. **Empirical Studies**

As highlighted in Chapter One, despite many empirical studies in project management, there is little if any, of empirical studies evaluating factors influencing the adoption of new technologies in project management. The empirical studies discussed herein borrow from similar studies within project management and technology. Even though there would likely to be many factors that may influence the adoption of new technologies in project management, the study aims to be focused

while at the same time robust by grouping the factors into organizational related, project related factors and also individual related factors.

2.3.1. Empirical studies on organizational features influencing the use of new technologies by Project Managers

Empirical evidence is scarce on the factors that influence the application of new technology for project related issues and project management. However, there are various studies that evaluate the adoption and use of emerging technologies in the organization, as opposed to using new technologies on specific projects.

An earlier study of (Liberatore & Bruce Pollack-Johnson, 2003) that focused only on the project management software use by project managers, the study found that large organizations will likely adopt the use of project management software as compared to small ones. Furthermore, the use of project management software was evident for organizations having many, complex projects.

Organizational characteristics that are important to the adoption of blockchain technology include innovation and the organization's learning capability, according to Kulkarni and Patil (2020) and Newby et al.,2014). Nevertheless, the studies discovered that sector and size (as determined by total assets/resources) had no association with the uptake of blockchain technology. Lack of support from the top management (the board and the existence of an ICT committee) will affect the adoption of BC, according to research by Orji et al. (2020) and Clohessy and Acton (2019). This is because the top leadership has the power to authorize and allot resources for strategic decisions like the adoption of new technology. Nevertheless, Wong et al. (2019) discovered a negligible effect of senior management backing on the adoption of BCT.

With regards to the adoption of machine learning and artificial intelligence, Nguyen et al. (2022) found that the following factors significantly influence the uptake of AI applications: vendor cooperation, government participation, market ambiguity, technical compatibility, relative advantage, technical complexity, technical capability, managerial skill, and organizational readiness.

In terms of Robotic Process Automation, Sharma et al. (2022) found that organizational factors such as compatibility with other softwares and processes, top management support, Centers of Excellence and industry partner pressure to be positively and significantly associated with RPA adoption. However, the impact of scalability reported a negative association with RPA adoption.

These empirical studies are important because they provide useful information about important organizational factors that will likely influence the adoption of new technologies. As pointed out, these studies have not considered the adoption of new technologies for project management. Therefore, the important gap to be filled by this study is the same factors being considered in the context of project management. In addition, guided by the Resource-based view theory, the study aims to consider the organization factors into management support and presence of an ICT Committee, Firm Size (to represent the various available resources and processes, profitability representing organizational performance, Age (representing presence of various process and management capability built over time and Sector (which represents the scope of the organization in terms of products and industry partnerships). In addition to filling this gap the studies will also determine some of the benefits that organizations will gain from utilizing these technologies in project management, while also determining barriers to their adoption.

2.3.2. Empirical studies on the project features that influence the application of new technologies by project managers

Aside from these software, project management has also benefited from the emergence of new technologies such as Blockchain (BC), Machine Learning (ML), Artificial Intelligence (AI) and Robotic Process Automation (RPA).

Khatib et al. (2021) made use of six case studies centered on the application of blockchain technology in four government agencies in Dubai, one from Georgia, and one from Malta. The findings showed that collaboration between blockchain and project management can improve project execution efficiency. It offers a method for data transfer and recording that is transparent, auditable, and safe. Smart contracts have the potential to greatly improve communication with stakeholders, optimize manual processes, and give project managers a transparent record at various

stages of complex projects. These findings were similar to those of Hegeman (2019) and Nanayakkara (2019) for construction and other projects.

Meanwhile Pasupuleti (2018) evaluated the application of various studies and usefulness of machine learning technology to project management. The author noted that machine learning technology is biased towards algorithms that favor certain aspects of project management such as project initiation and progress, and less on project risk management. This anomaly arises due to project complexity and therefore, there is need for software developers to begin focusing on the complex aspects to write algorithms that address all aspect of project management. Wei and Rana (2019) also evaluated the application of machine learning to the aspect of project management scheduling and noted that most organizations that use Machine Learning for this aspect are small and medium sized entities, that have less complex projects. Kanakaris, et al. (2020) carried out similar studies on project management for construction projects in Greece and found that machine learning was useful in resource assignment problems, task(s) duration estimation and task accomplishment prediction for large projects. In addition, optimization and big data manipulation, are handled with equal attention in order to reach the desired outcome in PM tasks.

Butt (2018) interview around 56 project managers in Sweden on the relevance of artificial intelligence in project management. The majority reported that artificial intelligence will be useful in process management, from project planning to change management. However, the respondents reported that artificial intelligence will be more useful for large and complex projects. Meanwhile Shoushtari et al. (2024) reported that using AI for project management in project resource allocation tool resulted in a 20% reduction in project completion time and that AI used in a risk prediction model helped identify and mitigate potential risks, leading to a 15% decrease in project costs.

Lastly, El Khatib et al. (2023) discuss Robotic Process Automation (RPA). RPA has a lot to offer in terms of project automation, particularly when combined with AI and other technologies like OCR. Furthermore, with the help of different project management tools, RPA can be utilized for advanced analytics to help project managers make decisions.

In line with the above studies, it is evident that there is room for more studies that focus on the extent to which the different technologies have been adopted and the project features that will likely influence the adoption of the new technologies in project management. The studies highlight project features such as size, functional area and project complexity as key determinants. Additional features will also be highlighted by the respondents. The study will also provide more insights into other benefits that the projects will benefit from utilizing the new technologies, while also identifying the challenges to adopting the technologies.

2.3.3. **Empirical studies on individual characteristics influencing the use of new technologies by project managers**

Empirical studies on individual characteristics influencing the use of new technologies in project management are not available. This provides an opportunity to contribute to knowledge here.

The Study of Liberatore and Bruce Pollack-Johnson (2003) on the project management software use by project managers, highlighted additional aspects that influence the use of project management software by project managers based on individual characteristics. In addition to the firm size, the study found that years of experience in an organization and in the role of the project manager will likely influence the type of software used in project management.

Due to scarcity of empirical studies this study will borrow additional individual features influencing the use of new technologies by individuals in the study of Talukder (2012). The study was conducted in Australia and used an online questionnaire to obtain feedback from 2,270 full-time and part time academic and administrative (professional) staff of the

University of South Australia. The study found that prior experience and level of ICT knowledge, perceived usefulness, peers, age, tenure/role, academic qualifications were the important features that influenced the adoption of new technologies by people/employees. Even though the study evaluated other factors such as enjoyment and personal initiatives, these were not important.

Therefore, in order to contribute to knowledge, this study will extend the findings to individual features applicable to project managers and the use of new technologies. In addition, the study will

also highlight the benefits to individual project managers on the use of new technologies and the challenges they face. Guided by the theory of diffusion of innovation and these empirical studies, the applicable features include age, experience, title or level academic qualifications and the level of ICT knowledge as the important features.

2.4. Summary of Empirical studies and Research Gaps

Based on the discussions provided in the motivation of the study and a review of the empirical studies, this study aims to fill knowledge and contextual gaps.

For objective one, most empirical studies have focused on organizational features influencing the use of new technologies. (Hegeman, 2019; Nanayakkara, 2019 and Khatib et al. 2021; Pasupuleti, 2018; Wei & Rana, 2019 and Kanakaris, et al., 2020),

As at the time of authoring, to the best of the authors information from various publishing sources, there is no study on the extent of adoption and use of new technologies in project management. There is therefore room for more studies that focus on the extent to which the different technologies have been adopted and the project features that will likely influence the adoption of the new technologies in project management. The studies highlight project features such as size, functional area and project complexity as key determinants.

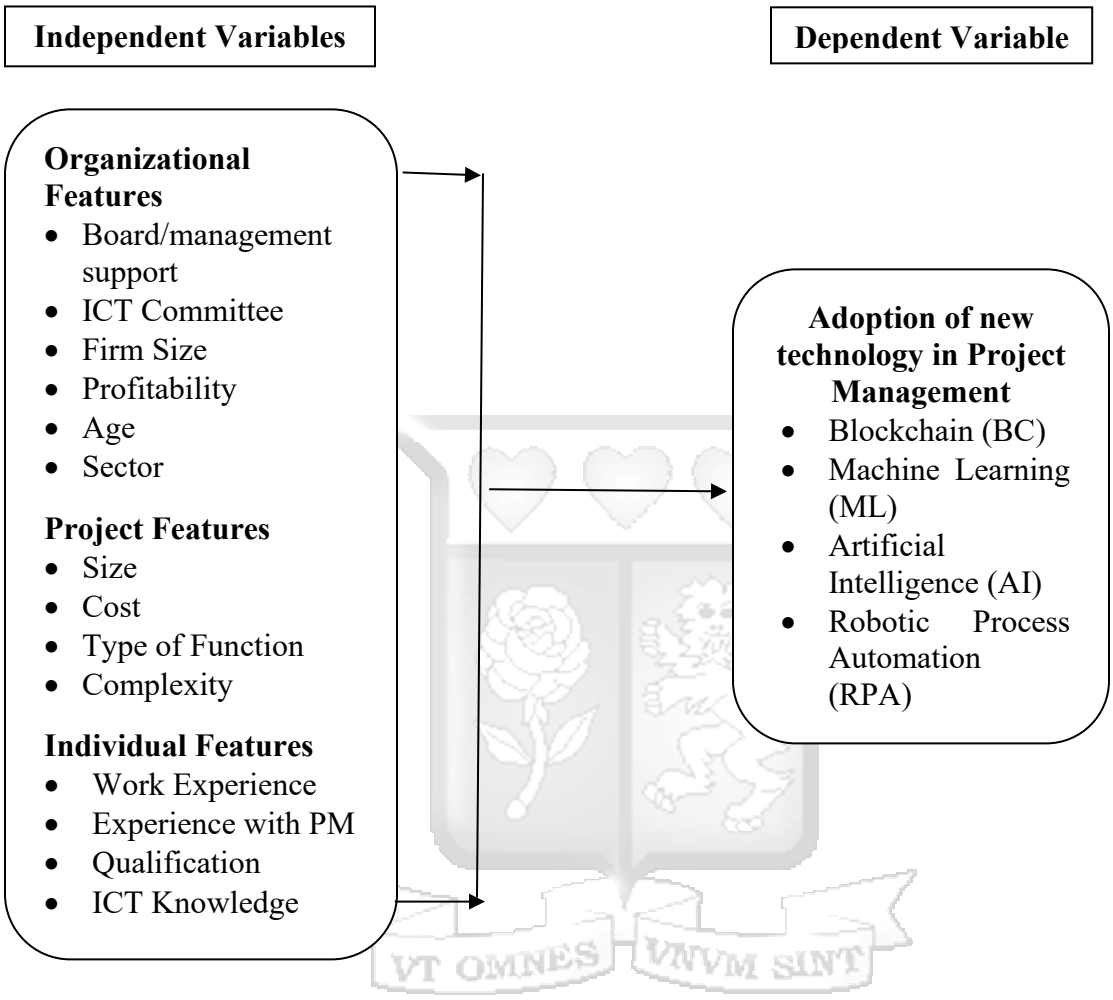
For objective two, the empirical studies have focused on the adoption and role of new technologies in project management (Butt, 2018; Davahli, 2020; Shoushtari et al., 2024; Leeuwen, 2022). This study therefore focuses on the extent to which the different technologies have been adopted and the project features that will likely influence the adoption of the new technologies in project management. The studies highlight project features such as size, functional area and project complexity as key determinants. Additional features will also be highlighted by the respondents.

For objective three, there is scarce empirical literature on individual features that will likely influence the use of new technologies by project managers. Therefore, this study extends the findings to individual features applicable to project managers and the use of new technologies. In addition, the study also highlights the benefits to individual project managers on the use of new technologies and the challenges they face.

2.5. **Conceptual Framework**

The conceptual framework is summarized in the next page. The figure shows the independent variables and dependent variables that the study focuses on.

Figure 2.1 The Conceptual Framework



2.6 Operationalisation of the Variables

Table 2.1 indicates the criteria for the operationalization of the independent, control and dependent variables of the study. The measurements, supporting studies, study-based theories and the test of variables are highlighted.

Table 2.1 Table of Operationalization of Variables

Variable	Measurement of Variable	Supporting Past Studies	Supporting Theories	Data Source	Analysis
Dependent Variables					
Nature of New technology	Adopted (1) Not Adopted (0) -BC -ML -AI -RPA		DOI	Questionnaire	Descriptive and Multivariate
Independent Variables					
Board/Management Support	• Liker Scale (5)	Kulkarni and Patil (2020) and Newby, at al.(2014).	RBV	Questionnaire	Regression Analysis
ICT Committee	• Likert Scale (5)	Kulkarni and Patil (2020) and Newby, at al. (2014).	RBV	Questionnaire	Regression Analysis
Profitability	• Likert Scale (5)	Kulkarni and Patil (2020) and Newby, et al. (2014).	RBV	Questionnaire	Regression Analysis
Firm Age	• Likert Scale (5)	Kulkarni and Patil (2020) and Newby, et al. (2014).	RBV	Questionnaire	Regression Analysis
Sector	• Likert Scale	Kulkarni and Patil (2020) and Newby, et al. (2014).	RBV	Questionnaire	Regression Analysis
Project Size	• Total Liquid Assets to Total Short-term Liabilities	Kanakaris, et al. (2020)	RBV	Questionnaire	Regression Analysis

Project Cost	• Likert Scale	Kanakaris, et al. (2020)	RBV	Questionnaire	Regression Analysis
Project function	• Likert Scale	Nanayakkara (2019)	RBV	Questionnaire	Regression Analysis
Project Complexity	Likert Scale (5)	Wei and Rana (2019)	RBV	Questionnaire	Regression analysis
Work Experience	• Years of work	Talukder (2012).	DOI	Questionnaire	Regression Analysis
PM experience	• Years of Work in PM	Talukder (2012).	DOI	Questionnaire	Regression Analysis
PM Qualifications	• PM and Bachelors (1) • PM and graduate (2) • PM and Postgraduate (3)	Talukder (2012).	DOI	Questionnaire	Regression Analysis
ICT Knowledge (Project Management Software and new technology Software)	• Likert Scale (5)	Talukder (2012).	DOI	Questionnaire	Regression Analysis

RBV – Resource based View

DOI – Diffusion of Innovation

2.7 Summary of the Chapter

Chapter Two presented the theoretical foundation of the study, being the Resource based view (RBV) and Diffusion on Innovation (DOI) theories. Meanwhile, the study has also presented empirical studies relevant to the study, with the conceptual framework and how the variables are operationalized. Next is chapter three that discusses the methodology.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Chapter Three highlights the research philosophy, research design, target population and sampling, data collection and analysis, validity and reliability, and concludes with ethical considerations. Chapter Three comprise of the following sections; 3.2 Research Philosophy, 3.3 Research Design, 3.4 Population and Sampling, 3.5 Data Collection and Tools, 3.6 Data Analysis, 3.7 Research Quality and 3.8 Ethical Issues.

3.2 Research Philosophy

Research philosophy defines the principles and beliefs that underlie scientific inquiry. It serves as the foundation of knowledge for a study's underlying predispositions (Patten, 2016). It explains the development of knowledge and nature of knowledge (Creswell, 2009). The major research philosophies are positivism and post positivism.

According to Henning et al. (2004), positivism aims to discover the truth and communicate it through objective methods. Validity of results, measurement, objectivity, neutrality, and actual facts form the basis of positivistic philosophy. (Saunders et al., 2009). Its core beliefs are that true knowledge stems from sensory experience and may be discovered by experimentation and observation, and that reason and observation are valuable in understanding human behavior. Positivists believe in realism, which claims that knowledge is both objective and quantitative, and that reality is presented as given and measured using properties that are independent of the researcher and the research methods. Post-positivism philosophy holds that people have subjective experiences with the outside world. They believe that reality is a social construct. According to Myers (2019), postpositivist scholars begin with the belief that social constructs such as common meanings, languages, and consciousness are the only means of accessing reality. The subjective paradigm's observation and interpretation processes entail acquiring facts about events and interpreting that data using typically subjective assumptions.

This study is anchored on post positivism philosophical approach (for the three objectives) and minimally, on positivism. The reason for post positivism is because the design of the study is based

on obtaining the views of the project managers in Kenya of which will likely subjective. However, positivism is also applied to the extent that even though some data collected is qualitative, it will be analyzed quantitatively to minimize bias.

3.3 Research Design

Research design promotes the collection and analysis of data with the goal of doing the research efficiently (Patten, 2016). Research design addresses sampling strategies, data collection tools, and data gathering protocols. For this study, a mixed method research design was used, combining quantitative and qualitative approaches. The mixed approach focuses on research problems that necessitate the analysis of several levels of perspective, cultural influences, and contextual understanding from everyday life.

Creswell and Tashakkori (2007), emphasize that mixed methods research deliberately use rigorous qualitative research to investigate the meaning and comprehension of constructs, as well as rigorous quantitative research to analyze the amount and frequency of constructs. The goal is to create a comprehensive interpretative framework that can lead to new insights into the problem or prospective solutions by combining the advantages of both types of data collection methods. As a result, this study employed both quantitative and qualitative methods.

The study used concurrent mixed methods as both the qualitative and quantitative data was collected and analyzed concurrently (Creswell & Tashakkori, 2007). This is because both aspects of qualitative and quantitative data were collected from the questionnaire.

3.4 Population and Sampling

A population is a complete set of individuals or items who share a common observable characteristic that a researcher is interested in (Sekaran & Bougie, 2016). The study targets all the members of the Kenya Association of Project Managers (KAPM). According to the information provided in the organization's website (Accessed in November 2024), the Kenya Association of Project Managers was founded on October 14, 2011, as a professional group responsible for monitoring and evaluating the conduct of Project Managers and Project Management Firms in

Kenya. The association's primary purpose is to provide leadership and policy guidance in the project management sector. The association now has 630 full members. The study targeted all members; there was no sampling because not all members were expected to participate. The organization committed to offer members with a link to fill out the online questionnaire, but the secretariat did not follow up with members who did complete the questionnaire.

3.5 **Data Collection and Tools**

The study collected data from primary sources via a semi-structured questionnaire containing information about the organization and other variables. The questionnaire was structured, with questions ranging from yes/no to different degrees of the Likert Scale, structured and unstructured, as well as open-ended questions. In developing the questionnaire, attention was paid to the objectives as well as prior empirical studies. The questionnaire had three sections for organizational, project and individual factors associated with the use of new technologies. The questionnaire was administered online. See Appendix II for the questionnaire.

3.6 Data Analysis

In achieving all the objectives, the research used descriptive analysis to determine the results from different variables and provide summaries on the use of different technologies, organizational features, project features and individual features. Multivariate analysis was also used for all objectives to determine the significant factors influencing the use of different technologies in project management. As per Chapter Two, the variables were grouped into organizational factors, project factors and individual factors.

Given that the adoption of new technology takes a binary status based on scale, a binomial logistic regression model was used for this study as it applies when the dependent variable can take a discrete status (Binary number), and the independent variables are a combination of continuous and dichotomous variables (Hair, 2009). The Binary Logistic Model provided is as follows:

$$\text{Log } (P/1\text{-}P) = \alpha_i + ß_1X_1 + ß_2X_2 + ß3X_3$$

Where Log (P/1-p) is the dependent variable, adjusted and measures as log likelihood in the binary logistic regression, ß is the coefficient while X is the independent variables. There will be three models for each category so that it is also possible to know which of the categories are most influential in the use of new technologies in project management. Table 3.1 provides a summary of the independent variables (X).

Table 3.1: Summary of Independent Variables in the regression model

Organizational Features – X_1	**Project Features – X_2**	**Individual Features – X_3**
• Board/management support • ICT Committee • Firm Size • Profitability • Age • Sector	• Size • Cost • Type of Function • Complexity	• Age • Experience • Title • Qualification • ICT Knowledge

The relevant software for descriptive SPSS version 29 and for the multivariate Statistics STATA Version 18 was used. For the binary regression model, detailed diagnostics is discussed at analysis level in Chapter Four. However, according to Gujarati (2011), the model diagnostics for binomial logistic regression can be carried out at various stages. To begin with, the average dependent variable is an outcome arising from a stochastic event having a density function cumulatively from 0 to 1. A cut off point of e.g., 0.5 is used to establish the outcome that is predicted by the model.

Next is the Pseudo – R squared which is the Cox and Snell's R-Square that copies multiple R-Square based on 'likelihood', although its maximum is less than 1.0 leading to challenges in interpretation. In addition, the likelihood ratio chi-square evaluates how good the logistic model is, with no predictors i.e. a null model. The model fits better than a null model if the p-value < 0.001.

The last check is the Akaike Information Criterion (AIC). This is a mathematical approach for checking if the binary logistic model fits the data well. Under multivariate statistics, AIC compares

different possible models to identify the best model for a given set of data. The best-fit model according to AIC is the one that explains the greatest amount of variation using the fewest possible independent variables. The smaller the AIC value compared with Bayesian critical, the better the model fit.

3.7 Research Quality

Research quality aims to enhance the credibility of the study. Quality is measured by the validity and reliability of the data collected. Validity is the extent to which the research measures what it aims to measure (Creswell, 2014). On the other hand, reliability ensures the consistency of the results over time and with different researchers (Mohajan, 2017).

First, to establish the validity of the questionnaire, content validation was done to verify that the questions asked answered the questions and met the study's objectives. (Taherdoost, 2016). To achieve reliability of the questionnaire, the questionnaire was pilot tested to assess its reliability using Cronbach's Alpha before being finally administered. Cronbach's alpha is a measure used to assess the reliability, or internal consistency, of a set of scale or test items (Taber, 2018). In other words, the degree to which a measurement is consistent with itself is referred to as its reliability. Cronbach's alpha, which is a number between 0 and 1, can be used to gauge the degree of consistency in a measurement. The higher the Cronbach's Alpha, the more reliable the questionnaire is, which is usually 0.7. Cronbach's alpha was tested on 15 responses obtained under the pilot test in relation to the organizational factors and a summary of the results is given as follows in Table 3.2:

Table 3.2: Cronbach' s Alpha Test result on organizational Features

Item	**Obs**	**alpha**
Board/Management Support	15	0.7046
ICT Committee	15	0.7206
Firm Size	15	0.7322
Profitability	15	0.7225
Age	15	0.7242

Sector	15	0.7746
Test scale		0.6992

Overall, the Cronbach's alpha is 0.6992, which is near 0.7.

3.8 Ethical Considerations

Ethical considerations are critical to ensuring the validity of research while respecting the rights of the many respondents. During primary data collecting from respondents, strong levels of anonymity was maintained to guarantee that the results accurately reflect the data analyzed. Respondents were offered the choice of participating willingly, with anonymity maintained and, to the greatest extent practicable, anonymously.

The proposal was presented to the Strathmore Institutional Ethics and Scientific Review Committee (SERSRC) for ethical approval, as well as the local regulator, the National Commission for Science, Technology, and Innovation (NACOSTI). See Appendix III. To avoid plagiarism, all researchers whose work was used in the study were mentioned and referenced, and permission was obtained from Strathmore University to conduct the research study.

3.9 Chapter Summary

This chapter has presented the research philosophy (having more of post positivism and less of post positivism), the research design (mixed concurrent mixed), the population (630 members of Kenya Association of Project Managers), the data collection sources and tools (online administered questionnaire) and the data analysis (Both descriptive and multivariate aided by the binomial regression model). The chapter concluded with the research quality of reliability and validity and ethical aspects.

CHAPTER FOUR: RESULTS AND FINDINGS

4.1 Introduction

Chapter Four presents the results and findings of the study. Chapter One introduced the study, then Chapter Two summarized the theoretical and empirical review and Chapter Three discussed the methodology. Chapter Four begins with a section 4.2 having the response rate and details of the respondents, then section 4.3 with organizational factors, Section 4.4 Project features and Section 4.5 With individual features influencing the adoption of new technologies in project management.

4.2 Response Rate

As explained in Chapter Three, the study used an online questionnaire, where the link was sent to the Kenya Association of Project Managers, to be shared with the members. At the time of concluding data collection, with time constraints, only 74 members responded to the request. This was about 11% of the total membership. The summary of the respondents by Title is given in Table 4.1. The responses were received between 5th and 12th April.

Table 4.1 Summary of the research respondents based on Job Titles

Title	No	Propon	Title	No	Propon
Accounts Assistant	1	1.35%	Marketing Officer	1	1.35%
Advocacy Officer	1	1.35%	Medical Officer	1	1.35%
Audit Manager	1	1.35%	Operations Assistant	1	1.35%
Auditor	1	1.35%	Operations Manager	4	5.41%
Branch Manager	1	1.35%	Procurement Manager	1	1.35%
Chief Executive officer	2	2.70%	Production Director	1	1.35%
Chief Risk Officer	2	2.70%	Production Engineer	1	1.35%
Commercial Services Manger	2	2.70%	Production Manager	2	2.70%
Construction Manager	1	1.35%	Project Associate	1	1.35%
Consultant Engineer	2	2.70%	Project Assistant	1	1.35%
Contractor	1	1.35%	Project Consultant	1	1.35%

Credit Manager	1	1.35%	Project Engineer	11	14.86%
Credit Officer	2	2.70%	Project Lead	1	1.35%
Customer Relations	2	2.70%	Project Manager	5	6.76%
Engineer	3	4.05%	Project Officer	2	2.70%
Finance Assistant	1	1.35%	Project Support officer	2	2.70%
Grants Officer	1	1.35%	Projects Manager	1	1.35%
Head of Staff	1	1.35%	Road Contractor	1	1.35%
ICT Manager	2	2.70%	Sustainability Manager	1	1.35%
Loans Officer	2	2.70%	Training Manager	1	1.35%
Managing Partner	1	1.35%	Training Officer	1	1.35%

According to Table 4.1, most of the respondents were project engineers, though the proportion was small at only 15%. However, if we include other respondents who handle projects directly, the proportion increases to nearly 33% i.e. 25 out of 74. Additional information regarding the members is provided in section 4.5.

4.3 Organizational Features influencing the use of new technologies in project management

4.3.1 Organizations that have adopted new technologies in project management

Based on the responses received, Artificial intelligence is the top new technology that has been adopted by organizations in project management, with 89% having adopted the technology, followed by machine learning at 59% and then blockchain at 15% and no organization had adopted robotic process automation. This information is summarized in Table 4.2 and Figure 4.1.

Table 4.2 Summary of Organizations adopting new technologies

	Blockchain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Yes	11	44	66	0
No	63	30	8	74
	74	74	74	74

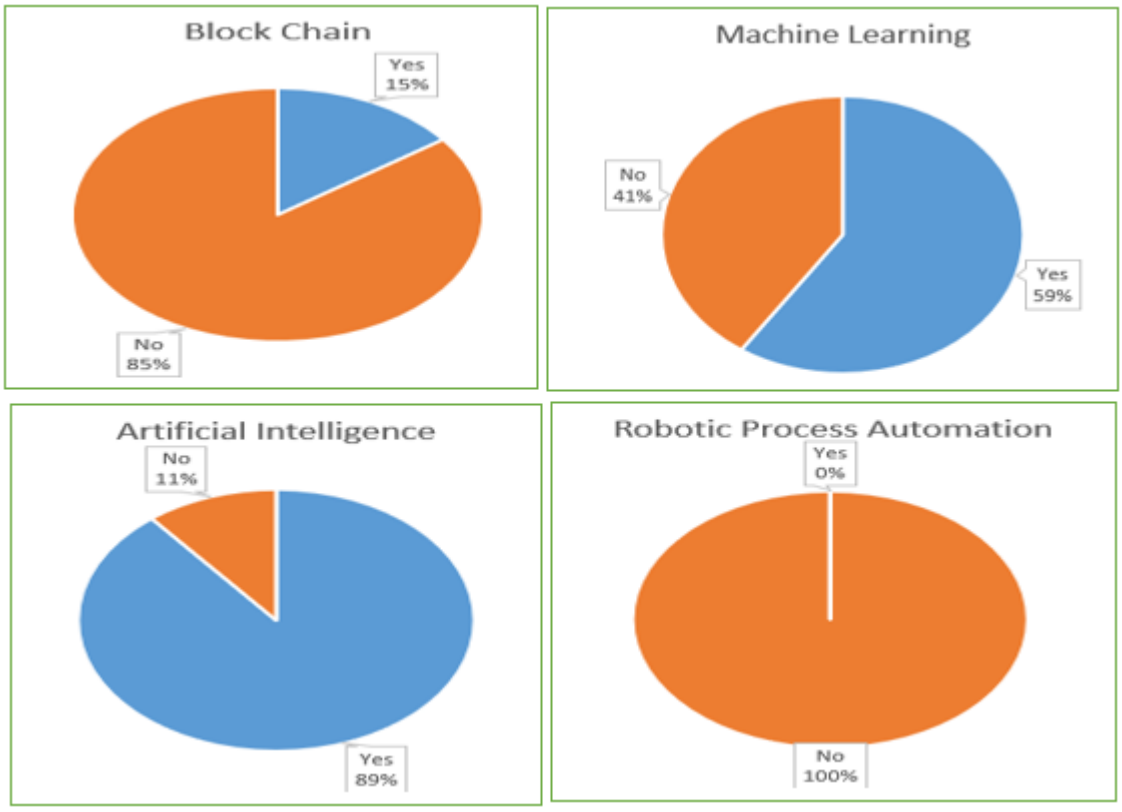


Figure 4.1 Summary of Organizations adopting new technologies in Project Management

4.3.2 Descriptive Statistics on Organizational Factors influencing adoption of new technologies

Question two of the questionnaire requested the participants to indicate which aspect of the organization they thought would likely influence the adoption of the new technologies in the organization.

The responses are summarized in Table 4.3 and figures 4.2 to 4.4.

Table 4.3 Summary of organizational factors influencing the adoption of blockchain technology in project management

	Board/management support	ICT Committee	Firm Size	Profitability	Age	Sector
Not Influential	0	0	0	0	0	0
Least Influential	0	0	0	2	0	0
Fairly Influential	3	4	1	1	4	0
Influential	8	3	7	7	7	7
Very Influential	0	4	3	1	0	4
Total	11	11	11	11	11	11
Average	3.73	4.00	4.18	3.64	3.64	4.36

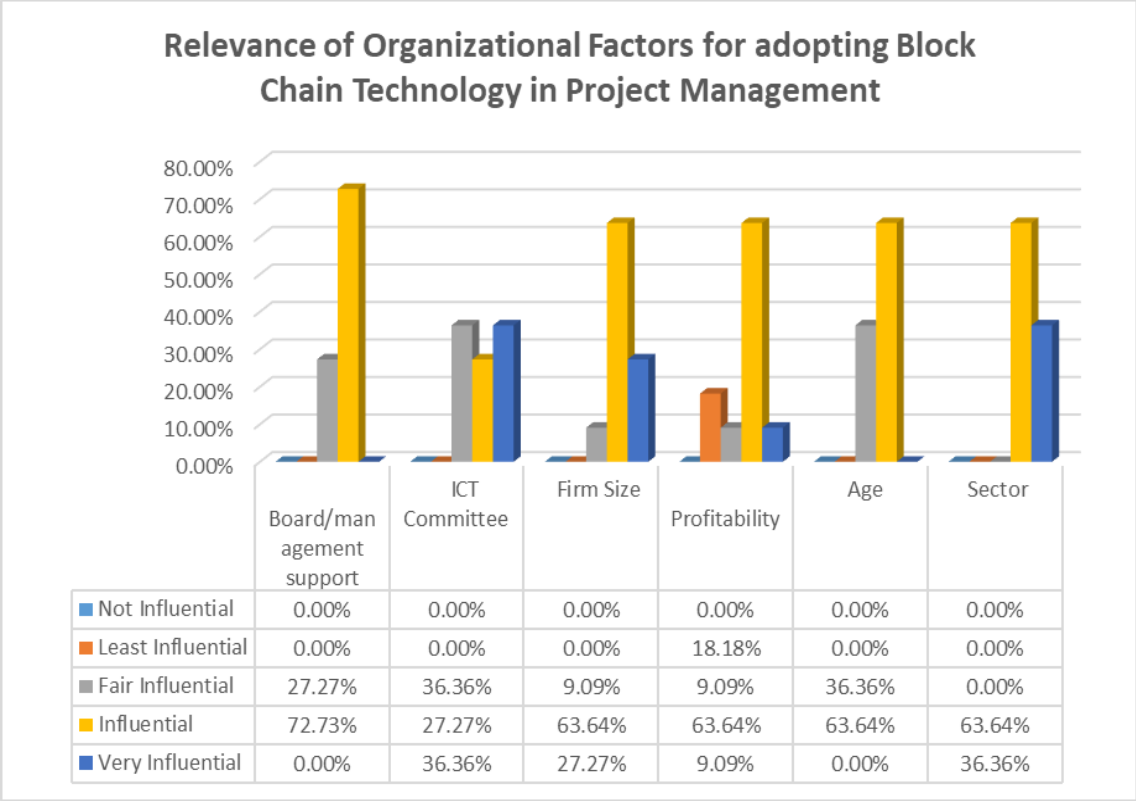


Figure 4.2 Organizational factors influencing the adoption of blockchain in Project Management

According to the respondents, Board/Management support is the most influential organizational factor for adopting blockchain.

Table 4.4 Summary of organizational factors influencing the adoption of Machine Learning technology in project management

	Board/management support	ICT Committee	Firm Size	Profitability	Age	Sector
Not Influential	1	0	0	0	0	0
Least Influential	12	5	0	3	0	0
Fair Influential	14	23	2	9	2	3
Influential	10	11	24	20	23	19
Very Influential	7	5	18	12	19	22
Total	44	44	44	44	44	44
Average	3.23	3.36	4.36	3.93	4.39	4.43

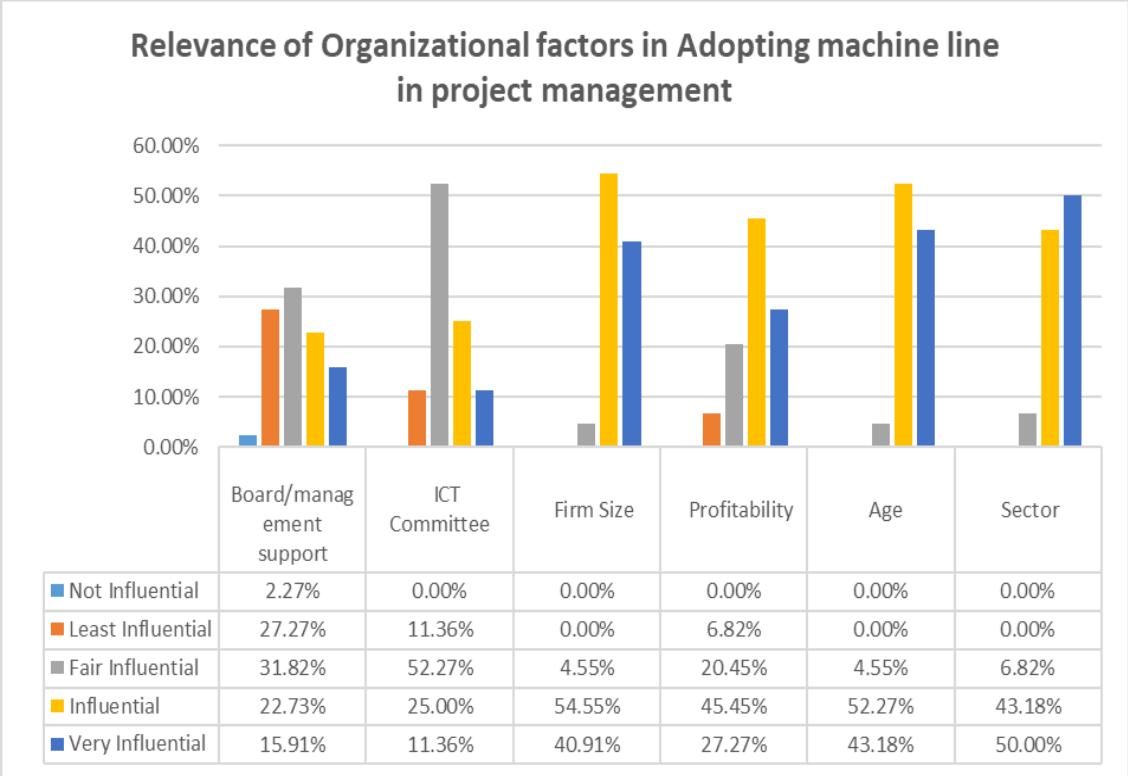
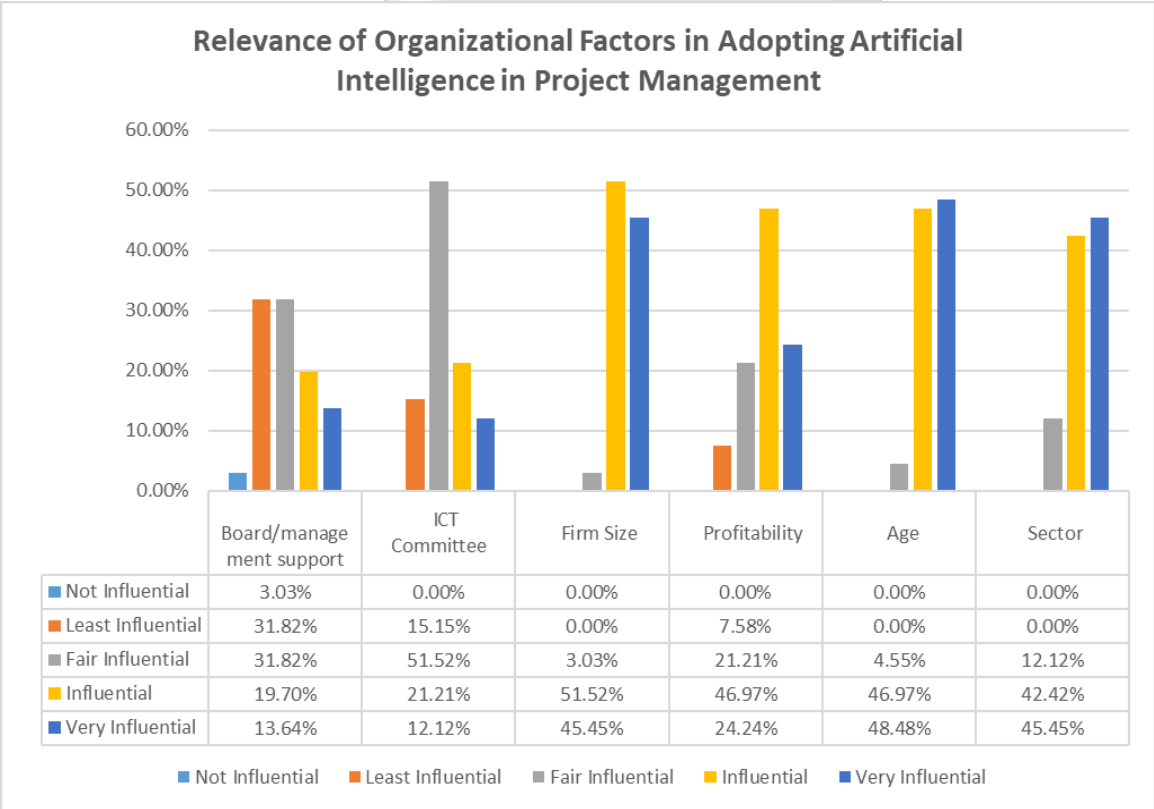


Figure 4.3 Organizational factors influencing the adoption of machine learning in Project Management

According to Table 4.4 and Figure 4.3, the respondents, nearly all organizational factors influence the adoption of machine learning technology, but with firm size topping them.

Table 4.5 Summary of organizational factors influencing the adoption of Artificial Intelligence technology in project management

	Board/management support	ICT Committee	Firm Size	Profitability	Age	Sector
Not Influential	2	0	0	0	0	0
Least Influential	21	10	0	5	0	0
Fair Influential	21	34	2	14	3	8
Influential	13	14	34	31	31	28
Very Influential	9	8	30	16	32	30
Total	66	66	66	66	66	66
Average	3.09	3.30	4.42	3.88	4.44	4.33



	Board/management support	ICT Committee	Firm Size	Profitability	Age	Sector
Not Influential	3.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Influential	31.82%	15.15%	0.00%	7.58%	0.00%	0.00%
Fair Influential	31.82%	51.52%	3.03%	21.21%	4.55%	12.12%
Influential	19.70%	21.21%	51.52%	46.97%	46.97%	42.42%
Very Influential	13.64%	12.12%	45.45%	24.24%	48.48%	45.45%

Figure 4.4 Organizational factors influencing the adoption of artificial intelligence in Project Management

According to Table 4.5 and Figure 4.4, the respondents, firm size, profitability and age are the main organizational factors that influence the adoption of artificial intelligence, but with firm size topping them.

4.3.3 Correlation analysis on organizational factors influencing the adoption of new technologies in project management

Table 4.6 provides a summary of the correlation of the organizational factors that influence new technologies in project management.

Table 4.6 Correlation of organizational factors influencing the adoption of new technologies in project management

	ML Adopt	AI Adopt	ML-Board/Mgt Support	ML-ICT Committee	ML-Firm Size	ML-Profitability	ML-Firm Age	ML-Sector	AI-Board/Mgt Support	AI-ICT Committee	AI-Firm Size	AI-Profitability	AI-Firm Age	AI-Sector
ML Adopt	1													
AI Adopt	0.333	1												
ML-Board/Mgt Support	0.8844*	0.3243	1											
ML-ICT Committee	0.9327*	0.2704	0.8094*	1										
ML-Firm Size	0.9798*	0.3136	0.8643*	0.9179*	1									
ML-Profitability	0.9454*	0.3134	0.8977*	0.9045*	0.9204*	1								
ML-Firm Age	0.9796*	0.3141	0.8428*	0.9200*	0.9621*	0.9115*	1							
ML-Sector	0.9769*	0.3142	0.8663*	0.9320*	0.9518*	0.9303*	0.9588*	1						
AI-Board/Mgt Support	0.4062	0.6221	0.6374	0.3591	0.3952	0.4627	0.3678	0.3998	1					
AI-ICT Committee	0.3849	0.6149	0.3196	0.5343	0.3827	0.3946	0.3856	0.4042	0.5134	1				
AI-Firm Size	0.3442	0.7868*	0.3012	0.3272	0.3969	0.3168	0.3407	0.3284	0.6295	0.7613*	1			
AI-Profitability	0.3935	0.7088*	0.4346	0.399	0.3774	0.5213	0.365	0.394	0.7241*	0.7133*	0.7644*	1		
AI-Firm Age	0.3485	0.7825*	0.2733	0.3344	0.3448	0.3078	0.4012	0.3431	0.5537	0.7406*	0.8668*	0.7417*	1	
AI-Sector	0.4603	0.7562*	0.4106	0.4605	0.4431	0.4453	0.4536	0.518	0.6366	0.8098*	0.8290*	0.7889*	0.8402*	1

*5% significant level

According to the table, board and management support, ICT committee, firm size and profitability have a high positive correlation with the adoption of Machine Learning and Artificial Intelligence.

4.3.4 Multivariate Analysis on organizational factors influencing the adoption of new technologies in project management

Table 4.7 provides a summary of the output from the binomial regression model. The dependent variables are the adoption of Machine Learning and Artificial Intelligence. The multivariate analysis of blockchain and robotic process automation were omitted because adoption levels were very low, and no organization adopted robotic processing.

Table 4.7 Summary Multivariate Analysis on organizational factors influencing the adoption of new technologies in project management

Variable		Machine Learning	Artificial Intelligence
Model Diagnostics	LR chi2	27.857	24.068
	Prob > chi2	0.0421	0.0495
	Pseudo R2	0.2014	0.395
Constant	Coeff.	-2.42419	2.820367
	Std Err	3.371908	6.583237
	z	-0.72	0.43
	p	0.472	0.668
Board/Management Support	Coeff.	0.2556	0.0120308
	Std Err	0.25649	0.3641
	z	1.04	0.03
	p	0.3	0.974
ICT Committee	Coeff.	-0.31641	-0.1838
	Std Err	0.31815	0.4574
	z	-0.99	-0.4
	p	0.32	0.688

Table 4.7 continued

Variable		Machine Learning	Artificial Intelligence
Firm Size	Coeff.	0.60706	0.5278
	Std Err	0.3963	0.4177
	z	0.77	0.85
	p	0.0638***	0.093***
Profitability	Coeff.	-0.0787	-0.5292
	Std Err	0.34105	0.5478
	z	-0.23	-0.97
	p	0.817	0.334
Firm Age	Coeff.	0.03785	-0.2853
	Std Err	0.4551	0.8696
	z	0.08	-0.33
	p	0.934	0.743
Sector	Coeff.	0.4352	0.2353
	Std Err	0.3008	0.51305
	z	1.45	0.46
	p	0.048*	0.046*

*Significance at 5% level and ***10 % Level.

According to Table 4.7, there is a positive and significant association between firm size and sector in the adoption of Machine Learning and Artificial Intelligence at 10% and 5% significant levels respectively. The logistic regression model is also significant as shown by the LR Chi2 (27.85) and (24.06) respectively being the Odds ratio and the probability (0.0421) and (0.0495) which is less than 0.05. Pseudo R squared values is used to compare multiple models fit to the same dataset. STATA uses the McFadden's Pseudo R, in this case a level between 0.2 to 0.4 shows the model is a good fit, though minimally falling off the brackets.

The rest of the organizational factors are not significant, even though we have positive association with the adoption of new technologies (Board Support) and negative association (ICT committee and profitability).

4.4 Project Features influencing the use of new technologies in project management

4.4.1 Adoption of New Technologies in Project Management

According to Table 4.8 and Figure 4.4, the respondents indicated that artificial intelligence (nearly 90%), followed by Machine Learning (59%), then blockchain technology (30%) are the technologies used specifically in projects. No respondent indicated the use of robotic process automation.

Table 4.8 Summary of new technologies adopted in project management

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Yes	22	44	66	0
No	52	30	8	74
Total	74	74	74	74

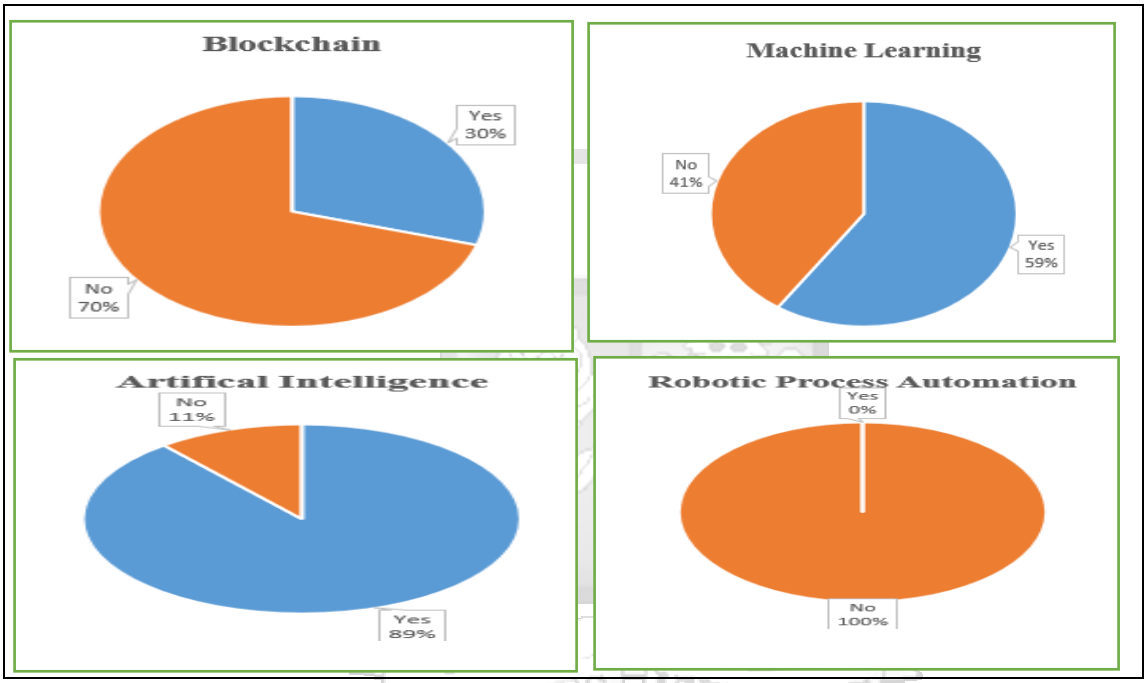


Figure 4.4 Adoption of new technologies in Project Management

4.4.2 Project Factors influencing the adoption of New Technologies

Tables 4.9 to 4.11 and figures 4.5 to 4.7 provide a summary of the project features that influence the adoption of new technologies.

Table 4.9 Project factors influencing the adoption of blockchain technology in project management

	Size	Cost	Function	Complexity
Not Influential	0	0	0	0
Least Influential	0	0	0	0
Fair Influential	3	2	3	8
Influential	14	14	13	13
Very Influential	5	6	6	1
Total	22	22	22	22
Average	4.09	4.18	4.14	3.68

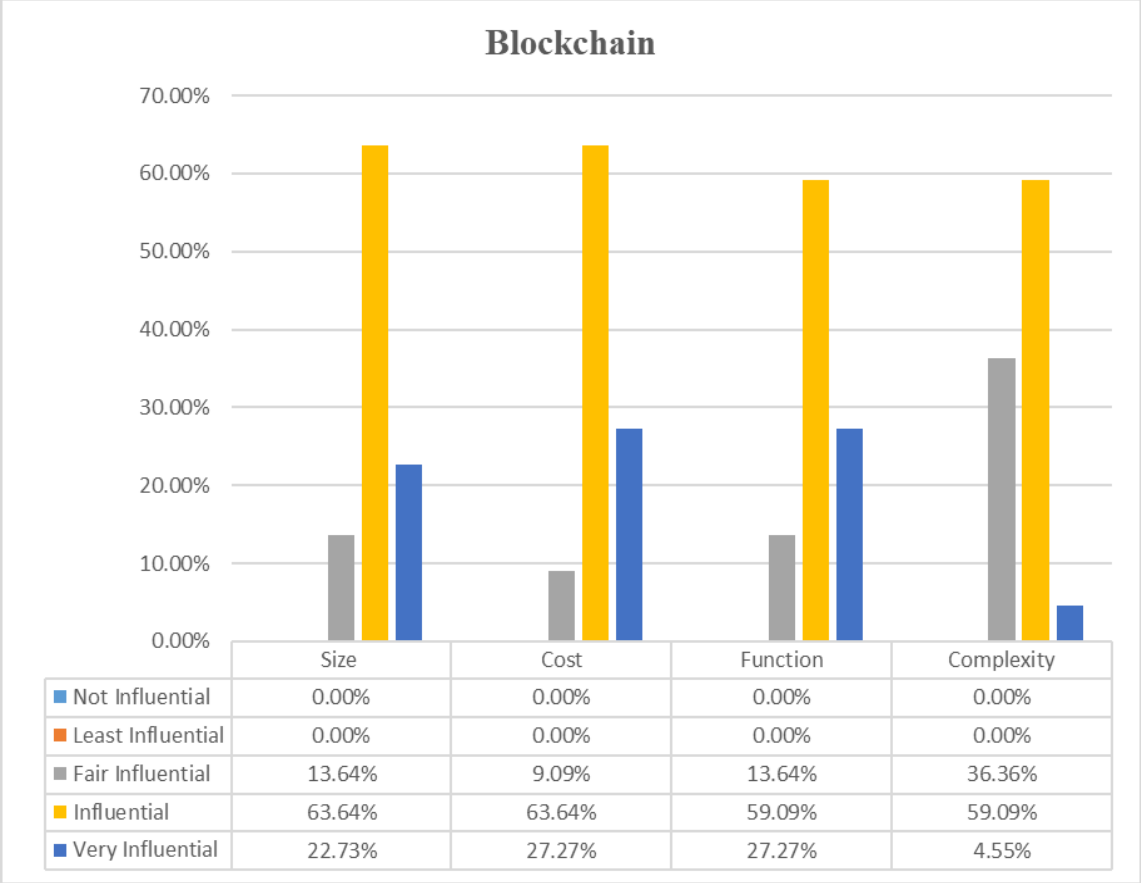


Figure 4.5 Project factors influencing the adoption of blockchain in Project Management

Table 4.9 and Figure 4.5 show that respondents felt that Cost of the project, followed by size of the project, project function and finally project complexity is the order in which the project factors influence the adoption of blockchain technology in project management.

Table 4.10 Project factors influencing the adoption of machine learning technology in project management

	Size	Cost	Function	Complexity
Not Influential	0.00%	0.00%	0.00%	0.00%
Least Influential	34.09%	0.00%	6.82%	0.00%
Fair Influential	63.64%	0.00%	20.45%	9.09%
Influential	2.27%	34.09%	63.64%	59.09%
Very Influential	0.00%	65.91%	9.09%	31.82%

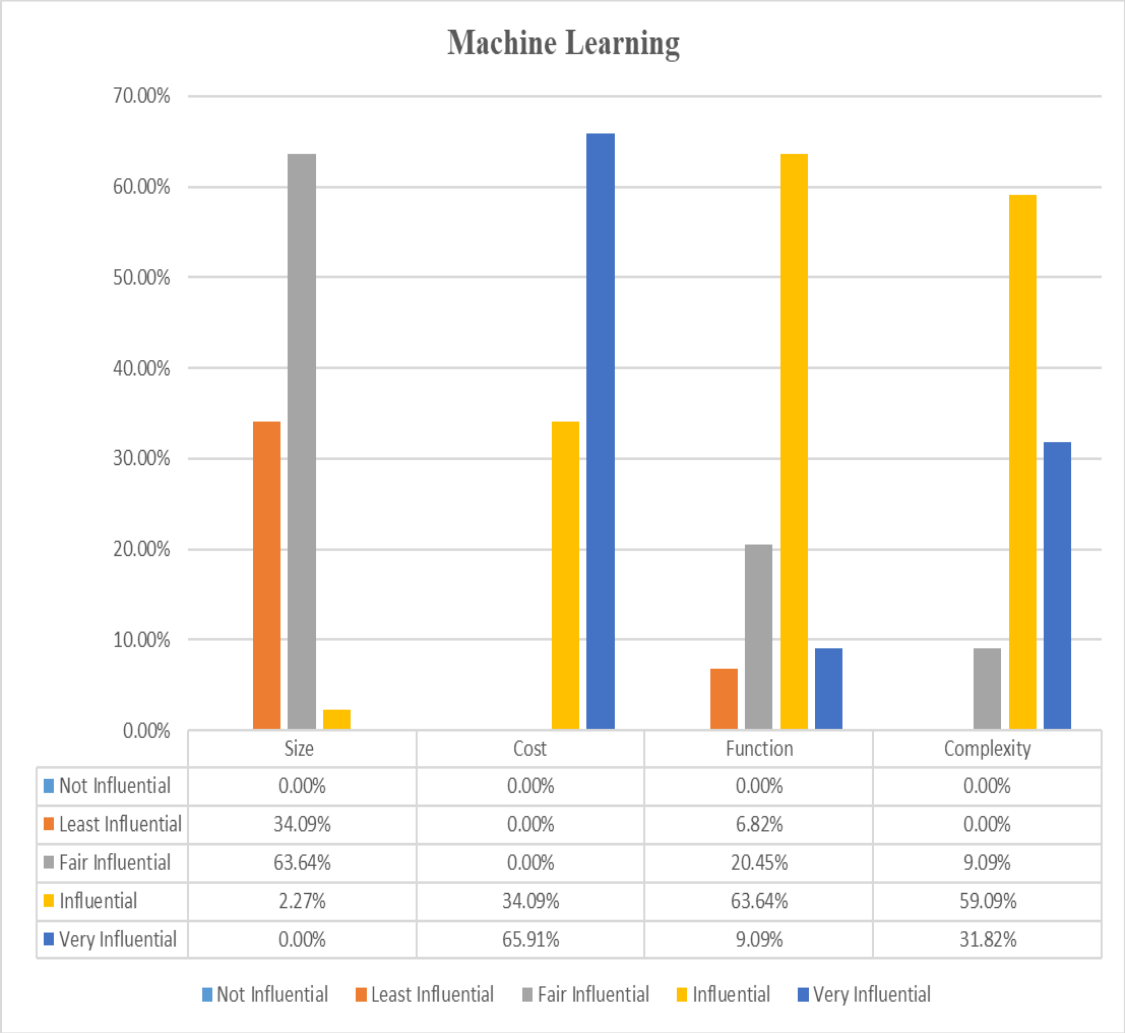


Figure 4.6 Project factors influencing the adoption of machine learning in Project Management

Table 4.10 and Figure 4.6 show that respondents felt that Cost of the project, followed by complexity of the project, project function and finally project size is the order in which the project factors influence the adoption of machine learning technology in project management.

Table 4.11 Project factors influencing the adoption of Artificial Intelligence technology in project management

	Size	Cost	Function	Complexity
Not Influential	0	0	0	0
Least Influential	18	0	3	0
Fair Influential	34	0	13	4
Influential	14	15	46	42
Very Influential	0	51	4	20
Total	66	66	66	66
Average	2.94	4.77	3.77	4.24

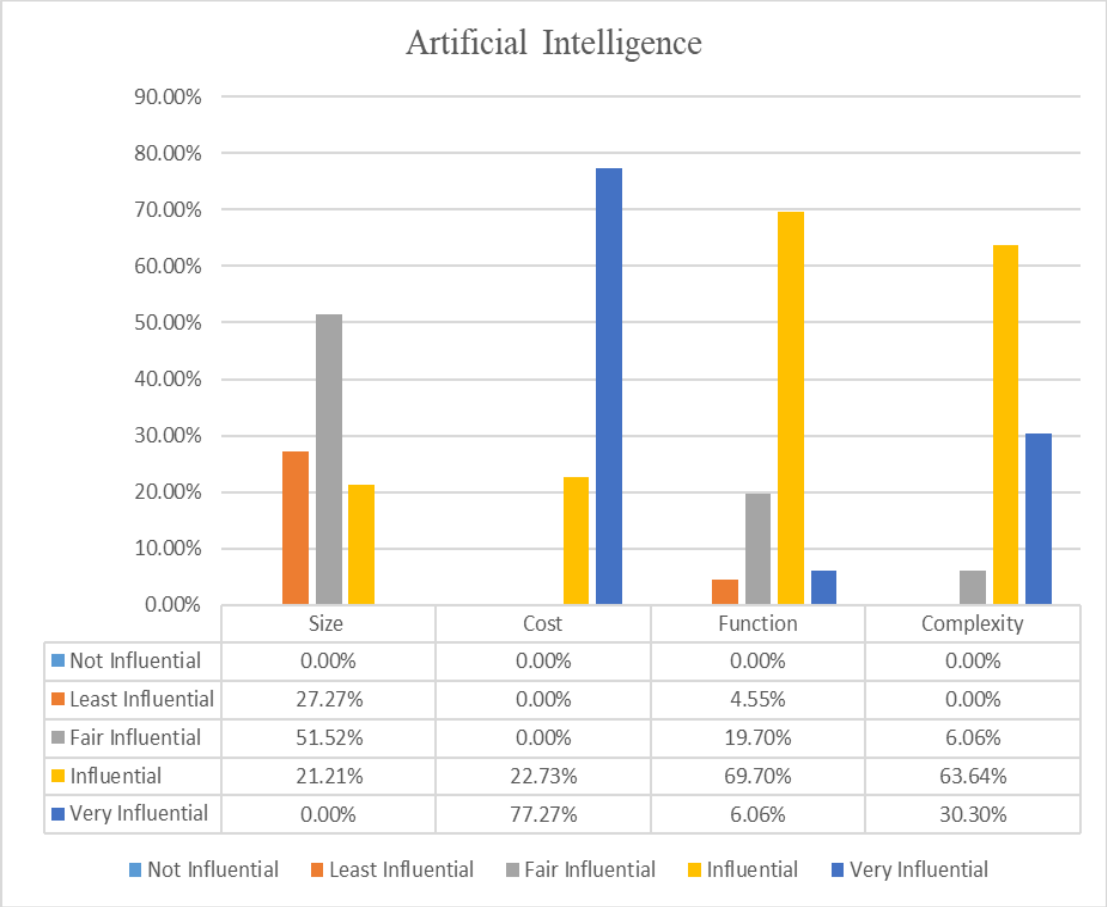


Figure 4.7 Project factors influencing the adoption of artificial intelligence in Project Management

Table 4.11 and Figure 4.7 show that respondents felt that cost of the project, followed by complexity of the project, project function and finally project size is the order in which the project factors influence the adoption of artificial Intelligence technology in project management.

4.4.3 Role of New Technologies in the different project management phases

Table 4.12 and figures 4.8 to 4.11 summarize the role of new technologies in various aspects of project management phases.

Table 4.12 Relevance of New Technologies in the project management phases

Blockchain Technology	Initiation	Planning	Execution	Monitoring	Controlling	Closure
Not Relevant	61	72	0	0	0	66
Fairly Relevant	13	2	9	8	63	8
Highly Relevant	0	0	65	66	11	0
Total	74	74	74	74	74	74
Machine Learning	Initiation	Planning	Execution	Monitoring	Controlling	Closure
Not Relevant	40	47	0	0	6	46
Fairly Relevant	23	27	9	28	58	28
Highly Relevant	11	0	65	46	10	0
Total	74	74	74	74	74	74
Artificial Intelligence	Initiation	Planning	Execution	Monitoring	Controlling	Closure
Not Relevant	45	37	0	0	0	15
Fairly Relevant	12	1	10	14	63	24
Highly Relevant	17	36	64	60	11	35
Total	74	74	74	74	74	74
Robotic Process Automation	Initiation	Planning	Execution	Monitoring	Controlling	Closure
Not Relevant	61	72	0	0	0	66
Fairly Relevant	13	2	10	14	63	8
Highly Relevant	0	0	64	60	11	0
Total	74	74	74	74	74	74

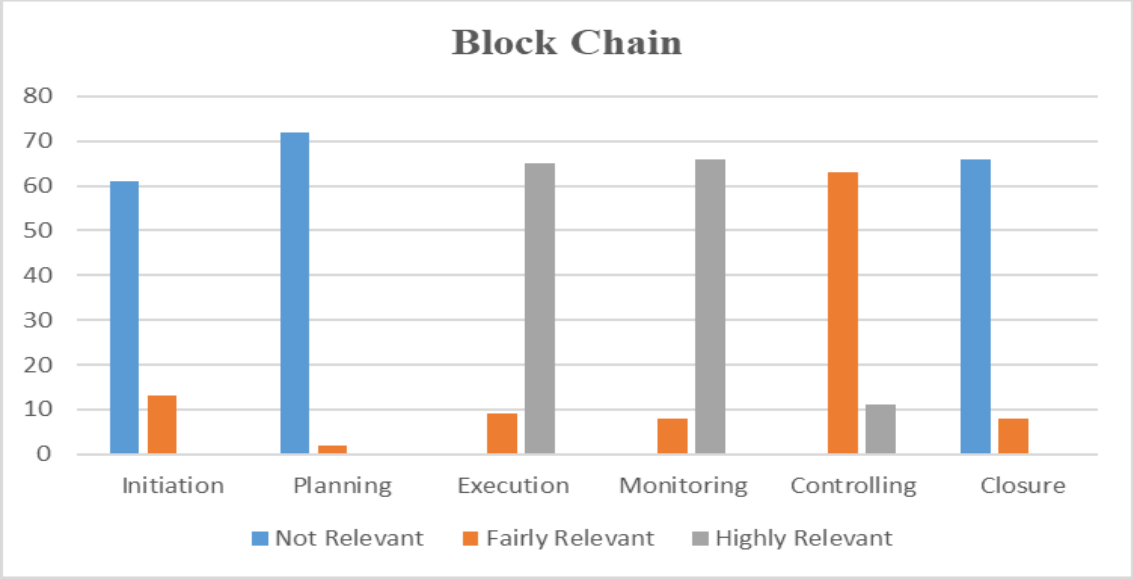


Figure 4.8 Relevance of blockchain technology in Project Management Phases

According to Table 4.12 and figure 4.8, the majority of the respondents felt that blockchain technology is highly relevant in execution and monitoring of the project while not relevant in initiation and closure.

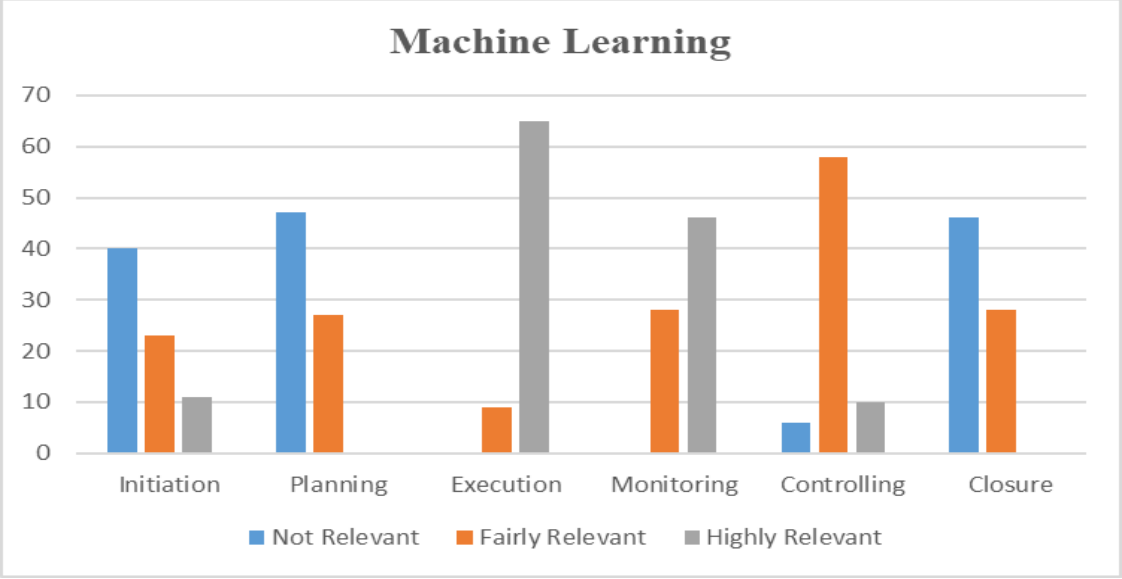


Figure 4.9 Relevance of machine learning technology in Project Management Phases

According to Table 4.12 and figure 4.9, the majority of the respondents felt that machine learning technology is highly relevant in execution and monitoring of the project while not relevant in initiation and closure.

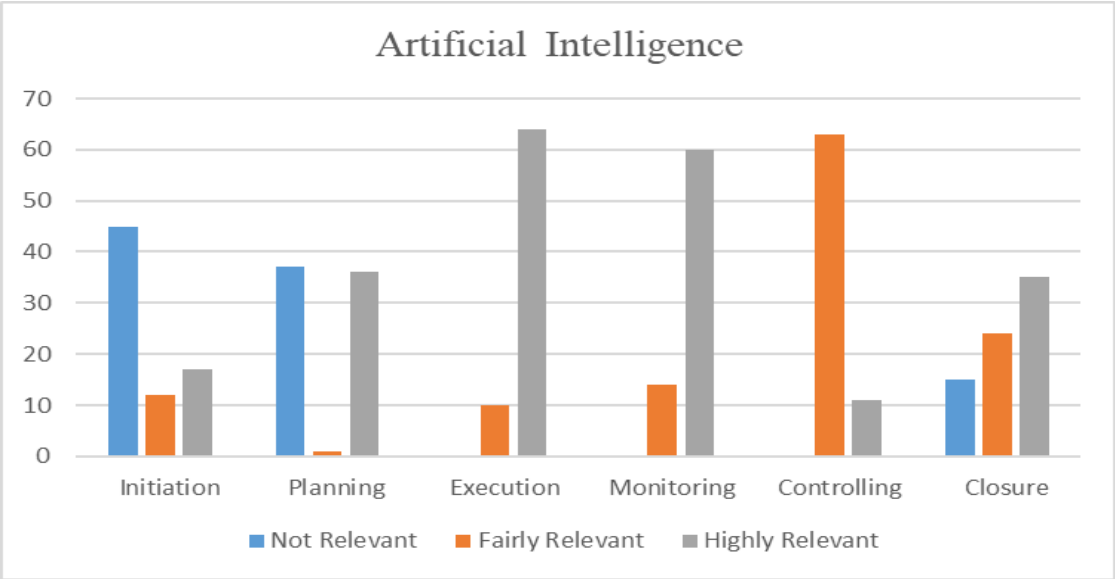


Figure 4.10 Relevance of Artificial Intelligence technology in Project Management Phases

According to Table 4.12 and figure 4.10, the majority of the respondents felt that artificial intelligence is highly relevant across most of the project management phases and even more specifically execution, monitoring, planning, closure and initiation.

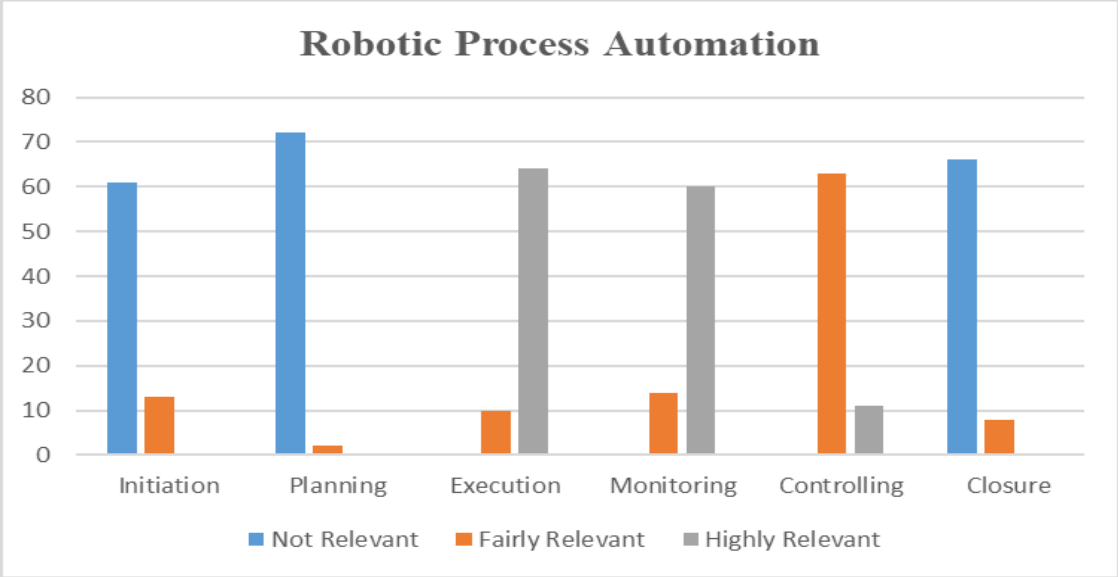


Figure 4.11 Relevance of Robotic Process Automation in Project Management Phases

According to Table 4.12 and figure 4.11, the majority of the respondents felt that robotic process automation technology is highly relevant in project execution and monitoring.

4.4.4 New technologies and application in project management knowledge areas

Table 4.13 separated into Tables 4.13.1 and 4.13.2 summarizes respondents' views on the role of new technologies in project management areas.

Table 4.13.1 Relevance of New Technologies in project management knowledge areas (numbers)

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Project scope management	0	67	71	67
Project schedule management	74	68	72	65
Project cost management	6	64	70	69
Project quality management	65	70	71	66
Project resource management	69	67	71	67
Project communications management	7	16	72	58
Project risk management	49	64	74	66
Project procurement	58	66	71	67
Project stakeholder management	9	61	71	70

Table 4.13.2 Relevance of New Technologies in project management knowledge areas (Percentages)

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Project scope management	0.00%	90.54%	95.95%	90.54%
Project schedule management	100.00%	91.89%	97.30%	87.84%
Project cost management	8.11%	86.49%	94.59%	93.24%
Project quality management	87.84%	94.59%	95.95%	89.19%
Project resource management	93.24%	90.54%	95.95%	90.54%
Project communications management	9.46%	21.62%	97.30%	78.38%
Project risk management	66.22%	86.49%	100.00%	89.19%
Project procurement	78.38%	89.19%	95.95%	90.54%
Project stakeholder management	12.16%	82.43%	95.95%	94.59%

According to the tables, artificial intelligence ranks the best in all aspects of project management phases except in project scheduling, where the respondents ranked blockchain as the best.

4.4.5 New technologies and integration with project management tools

Tables 4.14.1 and 4.14.2 provide a summary of the respondents' view on how the new technologies can be integrated into project management tools.

Table 4.14.1 Relevance of New Technologies in project management tools

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Gantt Charts	62	69	71	65
Work Breakdown Structure	66	71	72	63
Project Network Diagrams	63	72	70	64
Kanban Boards	68	72	73	59
Time Sheets	69	66	71	60
Project evaluation and Review technique	67	70	71	57
Project Dash Boards	67	69	68	68
Project Reports	66	71	69	66

Table 4.14.2 Relevance of New Technologies in project management tools

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Gantt Charts	83.78%	93.24%	95.95%	87.84%
Work Breakdown Structure	89.19%	95.95%	97.30%	85.14%
Project Network Diagrams	85.14%	97.30%	94.59%	86.49%
Kanban Boards	91.89%	97.30%	98.65%	79.73%
Time Sheets	93.24%	89.19%	95.95%	81.08%
Project evaluation and Review technique	90.54%	94.59%	95.95%	77.03%
Project Dash Boards	90.54%	93.24%	91.89%	91.89%
Project Reports	89.19%	95.95%	93.24%	89.19%

According to the responses, artificial intelligence technology outperforms the rest of the technologies and is more important in the use of kanban boards. Meanwhile, the respondents felt that blockchain is more important in using time sheets, machine learning is more important for project network diagram and kanban boards and robotic process automation can be integrated into project dash boards.

4.4.6 Correlation Analysis of project factors influencing the use of new technologies in project management

Table 4.15 provides a summary of the correlation analysis of project factors influencing the use of new technologies in project management.

Table 4.15 Correlation Analysis of project factors influencing the use of new technologies in project management

	MLAdopt	AI Adopt	ML- Project Size	ML - Project Cost	ML - Function	ML - Complexity	AI- Project Size	AI - Project Cost	AI- Function	AI- Project Complexity
MLAdopt	1									
AI Adopt	0.3330*	1								
ML- Project Size	-0.0157	0.0394	1							
ML - Project Cost	0.2415*	-0.0515	0.0763	1						
ML - Function	-0.0379	-0.0562	0.1365	0.0617	1					
ML - Complexity	-0.0056	-0.0132	0.0127	0.1162	0.1134	1				
AI- Project Size	0.0335	0.2756*	0.4870*	0.0596	0.1531	-0.0881	1			
AI - Project Cost	0.0409	0.3735*	0.1884	0.3235*	0.0235	0.0787	0.4506*	1		
AI- Function	0.1371	0.2410*	0.1911	0.0835	0.6517*	0.0895	0.4175*	0.5132*	1	
AI- Project Complexity	0.0181	0.1017	0.0956	0.0708	0.019	0.6266	0.1683	0.5112*	0.3860*	1

According to Table 4.15, there is positive and significance correlation between adoption of Machine Learning and Artificial Adoption and also project costs.

4.4.7 Multivariate Analysis of project factors influencing the use of new technologies in project management

Table 4.16 summarizes the output from the binomial regression model on project factors that influence the adoption of new technologies. Note that data on blockchain adoption for projects was not enough to carry out multivariate analysis. Based on responses received, robotic process automation was not used in projects.

Table 4.16 Multivariate Analysis of project factors influencing the use of new technologies in project management

Variable		Machine Learning	Artificial Intelligence
Model Diagnostics	LR chi2	27.601	20.558

	Prob > chi2	0.2478	0.0166
	Pseudo R2	0.0472	0.0389
Constant	Coeff.	-1.9344	-2.2118
	Std Err	2.65015	1.82399
	z	-0.73	-1.21
	p	0.465	0.225
Project Size	Coeff.	0.1162	0.5065
	Std Err	0.4363	0.7048
	z	0.27	0.72
	p	0.079***	0.0472**
Project Cost	Coeff.	0.8154	1.4465
	Std Err	0.354	0.6425
	z	2.3	2.25
	p	0.021**	0.024**
Project Function	Coeff.	0.2486	0.5622
	Std Err	0.3669	0.6057
	z	0.41	0.1
	p	0.0685***	0.0318**
Project Complexity	Coeff.	-0.1164	-0.8598
	Std Err	0.43	0.5688
	z	0.27	-1.51
	p	0.791	0.131

**5% and ***10% significance levels.

According to Table 4.16, there is a positive and significant association between project size, project cost and project function in the adoption of Machine Learning and Artificial Intelligence at 10% and 5% significant levels respectively. This means participants feel that project size and function are more important in the adoption of new technologies. The logistic regression model is also significant as shown by the LR Chi2 (27.61) and (20.558) respectively being the Odds ratio and the probability (0.0472) and (0.0389) which is less than 0.05. Pseudo R squared values is used to compare multiple models fit to the same dataset. STATA uses the McFadden's Pseudo R, in this case a level between 0.2 to 0.4 shows the model is a good fit, though minimally falling off the brackets.

Project complexity is negatively associated with the adoption of new technologies, though this is not significant.

4.5 Individual Features influencing application of new technologies in project management

4.5.1 Overall work experience and project management experience

Table 4.17 provides a summary of the descriptive statistics of the respondents' work experience and project management experience.

Table 4.17 Descriptive Statistics on Work experience and project management experience of respondents

	Work Experience	Project Management Experience
Mean	18.66216216	13.94594595
Standard Error	1.107056734	0.963205322
Median	17	13
Mode	30	4
Standard Deviation	9.523262114	8.285805476
Sample Variance	90.69252129	68.65457238
Kurtosis	-1.316463878	-0.904225696
Skewness	0.141198808	0.219301616
Range	32	30
Minimum	3	0
Maximum	35	30
Sum	1381	1032
Count	74	74

Table 4.17 indicates that the average work experience and average work experience in project management is about 19 years and 14 years respectively. The respondent with the highest work experience has 35 years and the one with the shortest work experience is 3 years. Some respondents do not have work experience in project management, but the highest work experience in project management is 30 years.

4.5.2 Respondents and their Sectors

Table 4.18 provides a summary of the respondents by sector.

Table 4.18 Summary of respondents by Sector

Sector	No	Proportion
Consulting	16	21.62%
Public Sector - National	0	0.00%
Public Sector - County	0	0.00%
Agriculture	9	12.16%
Financial Services	16	21.62%
Commercial Services	11	14.86%
Construction and Manufacturing	14	18.92%
Energy	4	5.41%
Telekom	2	2.70%
Other	2	2.70%
	74	100.00%

The table shows that the majority of the respondents work in consulting and financial services at 21.62% each. No response was received from the public sector. Others include one respondent from health and another form education.

4.5.3 Respondents and their academic qualifications

Table 4.19 and figure 4.12 summarizes the qualifications of respondents.

Table 4.19 Summary Qualifications of respondents

Qualification	Number
Diploma	4
Bachelors	36
Graduate (Masters)	33
Postgraduate (PhD)	1
	74

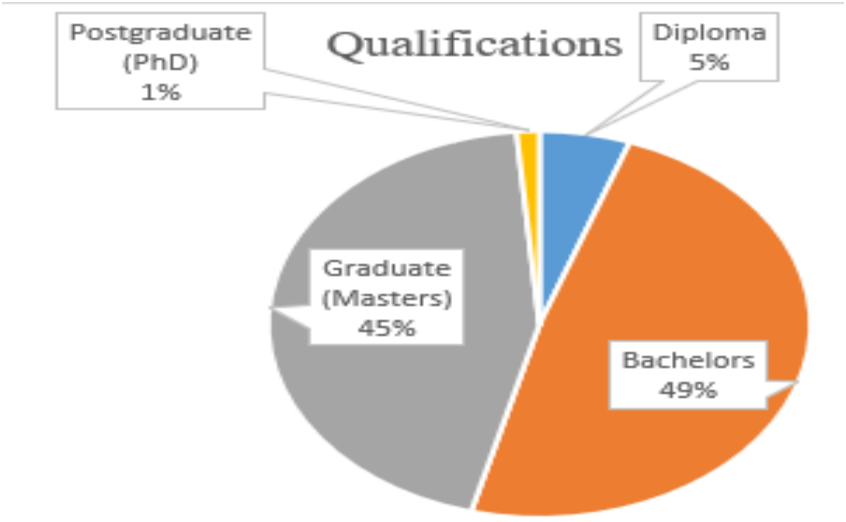


Figure 4.12 Respondents classified based in the qualifications

Table 4.19 and Figure 4.12 demonstrate that most of the respondents have a Bachelors degree, followed by a Masters degree.

4.5.4 Levels of Proficiency in Software and New technologies in Project Management

Tables 4.20.1 and 4.20.2 provide a summary of the level of ICT knowledge relevant to project management.

Table 4.20.1 Summary of respondents Level of Technology Knowledge (Numbers)

	Project Management Software	Blockchain Technology	Machine Learning	Artificial Intelligence	Robotic Process Automation
Not Adequate	0	56	27	5	45
Fairly Adequate	13	16	43	11	26
Very Adequate	61	2	4	58	3
	74	74	74	74	74

Table 4.20.2 Summary of respondents Level of Technology Knowledge (in %)

	Project Management Software	Blockchain Technology	Machine Learning	Artificial Intelligence	Robotic Process Automation
Not Adequate	0.00%	75.68%	36.49%	6.76%	60.81%
Fairly Adequate	17.57%	21.62%	58.11%	14.86%	35.14%
Very Adequate	82.43%	2.70%	5.41%	78.38%	4.05%
	100.00%	100.00%	100.00%	100.00%	100.00%

The tables show that the majority of the respondents have fairly adequate knowledge of project management software, followed by artificial intelligence, then machine learning, robotic process automation, and then blockchain technology.

4.5.5 Levels of New Technologies adoption by Individuals in project management

Table 4.21 and Table 4.23 provide a summary of adoption of new technologies at individual level.

Table 4.21 Summary of adoption of new technology in project management by individuals (Numbers)

	Blockchain Technology	Machine Learning	Artificial Intelligence	Robotic Process Automation
Yes	11	57	68	0
No	63	17	6	74
	74	74	74	74

Table 4.22 Summary of adoption of new technology in project management by individuals (In %)

	Blockchain Technology	Machine Learning	Artificial Intelligence	Robotic Process Automation
Yes	14.86%	77.03%	91.89%	0.00%
No	85.14%	22.97%	8.11%	100.00%
	100.00%	100.00%	100.00%	100.00%

The two tables report that Artificial Intelligence is the most popular software, followed by machine learning, then blockchain. No individual has used robotic process automation.

4.5.6 Correlation Analysis of individual factors affecting the adoption and use of new technologies in project management

Table 4.23 provides a summary of correlation analysis on the individual factors that influence the adoption of new technologies in project management.

Table 4.23 Correlation Analysis of Individual factors influencing the adoption of new technologies in project management

	Ml Adopt	AI Adopt	Work Exp	PM Exper	Qualificati	PMS Kno	Blockchai	Machine L	Artificial I	Robotics K
Ml Adopt	1									
AI Adopt	0.0732	1								
Work Experience	0.0382	-0.2095	1							
PM Experience	0.094	-0.1824	0.9016*	1						
Qualifications	0.1108	-0.1196	0.4585*	0.5196*	1					
PMS Knowledge	0.0011	-0.1371	0.1825	0.2386*	0.0835	1				
Blockchain Knowledge	-0.0901	0.1602	0.0791	-0.0227	-0.0166	0.0364	1			
Machine Learning Knowle	0.2103	0.0118	0.0962	0.0514	0.0246	-0.0651	0.1052	1		
Artificial Intelligence Know	-0.0455	0.0253	0.0047	0.0024	-0.0832	0.08	-0.0614	0.0194	1	
Robotics Knowledge	-0.2051	0.0515	-0.0455	-0.0582	-0.1693	-0.1478	0.2053	-0.1689	0.0033	1

*5% significance level

According to the table, there is a positive correlation between work experience and project management experience. There is also a high positive and significant correlation between project management experience and project management software.

4.5.7 Multivariate Analysis of individual factors affecting the adoption and use of new technologies in project management

Table 4.24 presents a summary of the binomial regression model on the individual factors influencing the adoption of new technologies in project management.

Table 4.24 Multivariate Variate Analysis of individual factors influencing the adoption of new technologies in project management

Variable		**Machine Learning**	**Artificial Intelligence**
Model Diagnostics	LR chi2	26.0004	25.6561
	Prob > chi2	0.04749	0.0667
	Pseudo R2	0.0472	0.021
Constant	Coeff.	1.7565	4.2549
	Std Err	3.3555	3.8967
	z	0.52	1.09
	p	0.601	0.275
Work Experience	Coeff.	-0.0659	-0.19593

	Std Err	0.0695	0.14106
	z	-0.95	-1.39
	p	0.343	0.165
PM Experience	Coeff.	0.0875	0.1526
	Std Err	0.0846	0.1679
	z	1.03	0.91
	p	0.301	0.363
Qualifications	Coeff.	0.1823	0.5687
	Std Err	0.5068	0.8224
	z	0.36	0.69
	p	0.0419**	0.0489**

Table 4.24 Continued

Variable		**Machine Learning**	**Artificial Intelligence**
PMS Knowledge	Coeff.	-0.2038	-0.029956
	Std Err	0.7806	4.416396
	z	-0.26	-0.41
	p	0.794	0.362
Blockchain Knowledge	Coeff.	0.2513	0.564907
	Std Err	0.6139	0.186081
	z	0.41	1.32
	p	0.682	0.187
Machine Learning Knowledge	Coeff.	0.9357	0.2058
	Std Err	0.5176	0.9372
	z	1.81	0.22
	p	0.041**	0.826
Artificial Intelligence Knowledge	Coeff.	0.2114	0.2194
	Std Err	0.5932	0.6248
	z	0.36	0.35
	p	0.0721***	0.0085*
Robotics Knowledge	Coeff.	-0.6449	-0.1026
	Std Err	0.59701	0.7878
	z	-1.08	-0.13
	p	0.601	0.896

*1%, **5 % and ***10%

According to Table 4.24, there is a positive and significant association between qualifications and the adoption of Machine Learning and Artificial Intelligence at 5%. In addition, we have a positive and significant association between machine learning knowledge and adoption of machine learning, and likewise positive association between artificial intelligence knowledge and adoption

of both machine learning and artificial intelligence knowledge. The logistic regression model is also significant as shown by the LR Chi2 (26.004) and (25.5551) respectively being the Odds ratio and the probability (0.0474) and (0.069) which is less than 0.05 (except for the artificial intelligence). Pseudo R squared values is used to compare multiple models fit to the same dataset. STATA uses the McFadden's Pseudo R, in this case a level between 0.2 to 0.4 shows the model is a good fit, though minimally falling off the brackets.

The rest of the individual factors have mixed association with new technologies' adoption, but these are not significant.

4.6 Benefits and challenges of adopting new technologies in project management

This part of the questionnaire received very few responses, with only 12 giving answers to some, but not to all the new technologies. Table 4.25 provides a summary of the benefits and table 4.26 provides a summary of the challenges as given by the respondents.

Table 4.25 Benefits of adopting new technologies in Project Management

Respondent No.	Blockchain	Machine Learning	Artificial Intelligence	Robotic process Automation
1	Sharing			
2		Automation	Automation	Automation
3			Analytics	
4		Monitoring		
5	Data Integrity			
6			Monitoring	
7		Estimation		
8			Risk management	
9	Data protection			
10			Better communication	
11				Automation
12	Traceability			

Table 4.26 Challenges of adopting new technologies in Project Management

Respondent No.	Blockchain	Machine Learning	Artificial Intelligence	Robotic process Automation
1	Complexity			Not available
2		Complexity	Costs	
3			Integration Issues	
4		Cost		
5	Cost			Cost
6			Technical	
7		Integration		
8			Data Quality	
9	Not integrated			
10			Costs	
11				Not aware
12				Lack of Knowledge

According to Table 4.25, process and task automation appears to be the main benefit of adopting new technologies. Table 4.26 also shows that cost is a major impediments across the four new technologies.

4.7 Summary of the chapter

Chapter Four has presented the results and findings. 74 respondents filled the online questionnaire. Overall, the results indicate that artificial intelligence, followed by machine learning, then block chain are the new technologies adopted at organization, project and individual levels. Robotic process automation has not been adopted at all levels. The size of the firm and sector are the organizational factors that will likely influence the adoption of new technologies in project management. Meanwhile, project size, project cost and the function of the project will likely influence the adoption of new technologies. Individual qualifications and machine learning knowledge will likely influence the adoption of new technologies in project management.

Next is Chapter Five to provide discussions, conclusions and recommendations for further studies.

CHAPTER FIVE: DISCUSSIONS AND CONCLUSIONS

5.1 Introduction

Chapter One introduced the study, providing background and motivation for the study. The chapter also presented the problem statement and the research objectives. The objectives were first to establish organizational features, secondly project features and third individual features that influence the use of new technologies by project managers in Kenya. Chapter Two presented the theories that the study is anchored on being the resource-based view and diffusion of innovation theories. The chapter also provided a highlight of the empirical studies. Chapter Three presented the research philosophy, the research design, the population, data collection instrument, and data analysis. Chapter Four presented the results and findings, from 74 respondents of the Kenya Association of project Managers.

Chapter Five, being the last chapter of the study has the following sections: 5.2 Discussions, 5.3 Conclusions (contribution to theory, contribution to empirical literature and contribution to policy/industry), 5.4 limitations of the study and 5.5 recommendations further studies.

5.2 Discussions

5.2.1 Organizational Factors influencing the adoption of new technologies in project management

Results show that artificial intelligence technology is the commonly adopted technology by organizations, followed by machine learning, then blockchain. No organization had adopted robotic process automation. Respondents felt that board/management support is most important in adopting blockchain technology. Size, board/management support, ICT committee, age and sector all influence the adoption of machine learning. In the case of Artificial intelligence, firm size, profitability and age were the main factors. Finally, according to the multivariate analysis, firm size and sector are the main organizational factors influencing the adoption of machine learning and artificial intelligence. The rest of the organizational factors are not significant.

Overall, the study has found that, organizations in Kenya are benefitting immensely from new technologies, more specifically artificial intelligence in project management. However, there is

room for improvement in the adoption of robotic process automation and blockchain technologies. Large organizations and management support also appear to be important factors in adopting new technologies in the case of organizational factors.

5.2.2 Project features influencing the adoption of new technologies in project management

Artificial intelligence is the popular technology for projects, followed by machine learning, then blockchain technology. However, the respondents had not adopted robotic processing in project management. This means that artificial intelligence is the most popular technology for project management, followed by machine learning. Respondents indicated that for blockchain, cost of the project and size of the project are more influential. For machine learning, cost of the project and project complexity are more influential, which is also applicable to artificial intelligence. Overall, it appears that project costs will likely motivate the use of new technologies.

The respondents explained that blockchain technology and machine learning are more relevant in project execution as well as monitoring, while artificial intelligence is more versatile as it can be used across the phases, hence the reason for its popularity. Despite having not adopted robotic process automation, the respondents viewed that project execution and monitoring can benefit. Overall, the respondents ranked artificial intelligence first in all aspects from scope, schedule, cost, quality, resources, communication, risk, procurement and stakeholder management. However, the respondents also indicated that blockchain is more useful in project scheduling. Respondents also demonstrated the popularity of artificial intelligence in integrating some project management tools. Artificial Intelligence can be integrated with Gantt charts, work breakdown structure, kanban boards, project evaluation and review technique. Multivariate analysis reported a positive and significant association between project size, project cost and project function in the adoption of Machine Learning and Artificial Intelligence. This means participants feel that project size and the function of the project are important project factors that influence the adoption of new technologies.

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5.2.3 Individual Factors influencing the use of new technologies in project management

In terms of ICT knowledge, the respondents have adequate knowledge of the project management software, artificial intelligence knowledge, and not adequate knowledge in blockchain technology.

As individuals, most of the respondents have adopted artificial intelligence followed by machine learning, and then blockchain technology. No individual has adopted robotic process automation. This means that the adoption of new technologies is consistent across organizational, project and individual level. Artificial intelligence is the preferred new technology. A project manager's qualification, will likely influence the adoption of machine learning and artificial intelligence. Furthermore, knowledge of artificial intelligence contributes largely to individuals adopting both machine learning and artificial intelligence.

5.3 Conclusion

5.3.1 Contribution to Theory

This study was anchored on resource-based view (RBV) theory (popular in project management research and has been used in various themes such as project management knowledge, project management tools and methodologies, project complexity and transforming organizations through project management. The study was also anchored on Diffusion of Innovation Theory (DOI), which is relevant when evaluating the use/application of new technologies (García-Avilés, 2020).

The results and findings of the study, to some extent support the two theories. First, the adoption of artificial intelligence and machine learning across organizational, project and individual levels support the Diffusion of Innovation Theory (DOI). Meanwhile, the size of the organization, which implies resource endowed organization will also influence the adoption of new technologies, which support resource-based view theory.

However, the fact that there is low adoption of blockchain technology and no adoption of robotic process automation, may indicate a lack of support for diffusion of innovation theory. In addition, cost being a major factor in adoption of new technologies for projects may also provide less support for resource -based view theory.

5.3.2 Contribution to Empirical Literature

The results and findings of these study contribute to empirical literature in several ways.

First, this study confirmed the findings of Kulkarni and Patil (2020) and Newby, Nguyen, and Waring (2014) on sector and size on the uptake of blockchain technology in addition to the support of top management (the board and the existence of an ICT committee), according to research by Orji, Kusi-Sarpong, Huang, and Vazquez-Brust (2020) and Clohessy and Acton (2019). However, the findings from this study contradicted those of Wong and colleagues (2019) who reported little effect of senior management backing on the adoption of blockchain technology.

The study also extended the findings on the use of artificial intelligence and machine learning, Nguyen et al. (2022) who found that vendor collaboration, government involvement, market uncertainty, technical compatibility, relative advantage, technical complexity, technical capability, managerial ability, and organizational preparation has positive factors in adoption of new technologies in project management. The study has considered project and individual factors.

The study also contributed to the findings of Pasupuleti (2018) who evaluated the application of various studies and usefulness of machine learning technology to project management. Similarly, Wei and Rana (2019) also evaluated the application of machine learning to the aspect of project management scheduling and noted that most organizations that use Machine Learning. Kanakaris, et al. (2020) carried out similar studies on project management for construction projects in Greece and found that machine learning was useful in resource assignment problems, task(s) duration estimation and task accomplishment prediction for large projects. This study has extended the role of blockchain and artificial intelligence in these areas, in which case artificial intelligence is popular in all aspects of project management.

Like in Butt (2018) who interviewed around 56 project managers who reported that artificial intelligence is useful in process management, from project planning to change management and also more useful for large and complex projects. Meanwhile Shoushtari, Daghighi, and Ghafourian (2024) reported that using AI for project management in project resource allocation tool resulted in a 20% led to efficiency. This study has also confirmed the role of blockchain and machine learning in the same perspectives.

The study also confirmed the findings of El Khatib et al. (2023) on Robotic Process Automation (RPA). Their study found that RPA has a lot to offer in terms of project automation, particularly when combined with AI. The findings in this study had reported similar findings as well as those from machine learning and artificial intelligence.

In line with the above studies, it is evident that there is room for more studies that focus on the extent to which the different technologies have been adopted and the project features that will likely influence the adoption of the new technologies in project management.

Finally, this study has extended the study of Liberatore and Bruce Pollack-Johnson, (2003) on the project management software use by project managers. They highlighted additional aspects that influence the use of project management software by project managers based on individual characteristics. In addition to the firm size, the study found that years of experience in an organization and in the role of the project manager will likely influence the type of software used in project management. The current study evaluated additional individual factors such as qualifications. However, the study did not find evidence of the significance of work experience in the adoption of new technologies.

5.3.3 Contribution to Industry/policy

The results and findings of this study are useful to various stakeholders in various ways. The results and findings of this study provide regulators with information about the degree of use and applicability of new technologies in project management. The findings indicate that regulators should find ways to support the adoption of blockchain and robotic process automation in order to improve project outcomes.

The results of this study educate organizations about project management trends, applicable technologies, and the advantages and drawbacks of implementing new technologies. The use of AI and ML in projects is important but also indicate the opportunities to adopt blockchain and robotic process automation.

The results and findings from the study provide shared experiences on the perspectives of new technologies in project management. Project managers now know organizational factors and project factors that influence the application of new technologies in project management. This will enable the managers acquire sufficient skills and ensure organizations have appropriate strategies to adopt new technologies in project management.

5.4 Limitations of the Study

Some challenges and other limitations arose when conducting this study. The first challenge was on the little response rate by participants. This was further compounded by relying on a third party to encourage the members of the project management to fill the questionnaire. However, given that 74 participants responded, this is sufficient to carry out some aspects of multivariate analysis.

Secondly, given that very few organizations and individuals have adopted blockchain technology and no one has adopted robotic process automation, the data available was not sufficient to enable multivariate analysis.

5.5 Recommendations for further studies

Further studies can expand on other technologies and their relevance to project management. These technologies may include internet of things. In addition, other studies can use different techniques to collect data such as document reviews and interviews. In addition, studies may focus on company and policy strategies to enhance the use and adoption of new technologies such as robotic process automation.

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APPENDICES

Appendix I: Letter of Introduction

Dear Sir/Madam,

RE: Letter of Request for Permission to Collect Data

I am currently a Master of Business Administration student at Strathmore University Business School. I am kindly requesting for your support in providing data on for my research titled '**ORGANIZATIONAL, PROJECT AND INDIVIDUAL FEATURES INFLUENCING THE APPLICATION OF NEW TECHNOLOGIES BY PROJECT MANAGERS IN KENYA"**

Please be assured that any data and additional information you provide will be kept private and used only for academic purposes.

Yours Sincerely
Florence Ilovi
Student Reg No. MBA/45509/13

Appendix II: Questionnaire

Instructions

Appendix II Questionnaire

Kindly complete the following questions based on your experience. Please tick where appropriate and provide more written information in the sections indicated.

Confidentiality

Every piece of information provided will be kept strictly confidential. The study's report will not include any mention of any person or organization.

The study is about the application of the following technologies in project management:

Technology	Meaning
Blockchain	A ledger of decentralized data that is securely shared
Machine Learning	Machine Learning is the application and creation of computer programs that, by utilizing statistical models and algorithms to examine data patterns and make deductions, can learn and adapt without being given explicit instructions.
Artificial Intelligence	Artificial intelligence is the term used to describe computer programs that are capable of performing tasks such as speech recognition, visual perception, language translation, and decision making that would normally require human intelligence.
Robotics Process Automation	RPA is the term used to describe how digital software robots automate business processes for tasks that are repetitive and rule-based.

Part A: ORGANIZATIONAL FEATURES INFLUENCING USE OF TECHNOLOGIES IN PROJECT MANAGEMENT

1.Has the organization adopted the following technologies for project management?

	Yes	No
Blockchain		
Machine Learning		
Artificial Intelligence		
Robotics Process Automation		

2. Where relevant, indicate which organizational factor has influenced the use of the technology in project management?

1.Blockchain	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Board/management support					
ICT Committee					
Firm Size					
Profitability					
Age					
Sector					
2.Machine Learning	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Board/management support					
ICT Committee					
Firm Size					
Profitability					
Age					
Sector					
3.Artificial Intelligence	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Board/management support					
ICT Committee					
Firm Size					
Profitability					
Age					
Sector					
4.Robotic Process Automation	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Board/management support					
ICT Committee					
Firm Size					

Profitability					
Age					
Sector					

3. Indicate ANY other organizational factors that may influence the use these technologies in project management:

Technology	**Organizational Factor(s)**
Blockchain	
Machine Learning	
Artificial Intelligence	
Robotics Process Automation	

Part B: PROJECT FEATURES INFLUENCING USE OF TECHNOLOGIES IN PROJECT MANAGEMENT

1.Have you adopted the following technologies for specific projects?

	Yes	No
Blockchain		
Machine Learning		

Artificial Intelligence		
Robotics Process Automation		

2. Where relevant, indicate which project factor has influenced the use of the technology in project management?

1.Blockchain	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Size (Cost)					
Type of Function					
Complexity					
2.Machine Learning	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Size (Cost)					
Type of Function					
Complexity					
3.Artificial Intelligence	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Size (Cost)					
Type of Function					
Complexity					
4.Robotic Process Automation	Not Influential	Less Influential	Fairly Influential	Influential	Very Influential
Size (Cost)					
Type of Function					
Complexity					

3. Indicate ANY other project factors that may influence the use these technologies in project management:

Technology	**Project Factor(s)**
Blockchain	

Machine Learning	
Artificial Intelligence	
Robotics Process Automation	

4.In the adoption of new technologies indicate the relevance of the following technologies in the various project management phases:

1.Blockchain	Not Relevant	Fairly Relevant	Highly Relevant
Initiation			
Planning			
Execution			
Monitoring			
Controlling			
Closure			
2.Machine Learning	Not Influential	Less Influential	Fairly Influential
Initiation			
Planning			
Execution			
Monitoring			
Controlling			
Closure			
3.Artificial Intelligence	Not Influential	Less Influential	Fairly Influential

Initiation			
Planning			
Execution			
Monitoring			
Controlling			
Closure			
4.Robotic Process Automation	Not Influential	Less Influential	Fairly Influential
Initiation			
Planning			
Execution			
Monitoring			
Controlling			
Closure			

5. Tick the relevant section to indicate if a new technology is useful to the following project management knowledge areas:

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Project scope management				
Project schedule management				
Project cost management				
Project quality management				
Project resource management				
Project communications management				
Project risk management				
Project procurement				
Project stakeholder management				

6. Tick the relevant section if the new technologies can be easily integrated with the following project management tools.

	Block Chain	Machine Learning	Artificial Intelligence	Robotic Process Automation
Gantt Charts				
Work Breakdown Structure				

Project Network Diagrams				
Kanban Boards				
Time Sheets				
Project evaluation and Review technique				
Project Dash Boards				
Project Reports				

Part C: INDIVIDUAL FEATURES INFLUENCING USE OF TECHNOLOGIES IN PROJECT MANAGEMENT

1. Title in the Organization_____
2. Age in Years_____
2. Work Experience in Years_____
3. Work Experience in Project Management in Years_____
4. Type of organization:

Organization	**Sector**	**Tick Where applicable**
Private Consulting		
Public	National Level	
	County Level	
Private	Agriculture	
	Financial Services	
	Commercial Services	
	Construction and Manufacturing	
	Energy	
	Telekom	
	Other	

5. Level of academic qualification:

Academic Qualification	
Diploma	

Bachelors	
Graduate (Masters)	
Postgraduate (PhD)	

6. Which of the following correctly describes your level of Information Technology Proficiency for project management?

	Not Adequate	Fairly Adequate	Very Adequate
Basic Project management software			
Blockchain			
Machine Learning			
Artificial Intelligence			
Robotic Process Automation			

7. Select the new technology that you utilize for project management.

	Yes	No
Blockchain		
Machine Learning		
Artificial Intelligence		
Robotics Process Automation		

8. Provide a summary of the KEY benefits of adopting these technologies at Organization, Project and Individual level:

	Organization	Project	Individual
Basic Project management software			
Blockchain			
Machine Learning			
Artificial Intelligence			
Robotic Process Automation			

9. Provide a summary of the KEY challenges that are faced in adopting these new technologies at Organization, Project and Individual Level:

	Organization	Project	Individual

Basic Project management software			
Blockchain			
Machine Learning			
Artificial Intelligence			
Robotic Process Automation			

Appendix III Ethical Approvals

Strathmore UNIVERSITY

17th March 2025

Ms Ilovi Florence,
florence.ilovi@strathmore.edu

Dear Ms Ilovi,

RE: Organizational, Project and Individual Features Influencing the Use of Emerging Technologies by Project Managers in Kenya

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** proposal. Your application reference number is **SU-ISERC2745/25.** The approval period is from **17th March 2025 to 16th March 2026.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

Mr Ambrose Rachier,
Chairperson; SU-ISERC

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REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **582829**

Date of Issue: **01/April/2025**

RESEARCH LICENSE

This is to Certify that Miss. Florence Ilovi of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: ORGANIZATIONAL, PROJECT AND INDIVIDUAL FEATURES INFLUENCING THE USE OF EMERGING TECHNOLOGIES BY PROJECT MANAGERS IN KENYA for the period ending : 01/April/2026.

License No: **NACOSTI/P/25/417550**

582829

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY &
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