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Artificial Intelligence in Project Management: Transforming Traditional Project Management Practices in Malawi

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ABSTRACT

The integration of Artificial Intelligence (AI) in project management has the potential to revolutionize efficiency, decision-making, and resource optimization. This study examines the current state of AI adoption in project management in Malawi, identifying key challenges and opportunities. The primary objective is to develop a Strategic Framework for AI Integration that addresses infrastructural gaps, policy considerations, capacity-building needs, and ethical concerns. A mixed-methods approach was employed, incorporating surveys, expert interviews, and secondary data analysis to assess AI readiness and adoption barriers in Malawi's project management sector.

The findings reveal that while there is growing interest in AI adoption, challenges such as limited digital infrastructure, lack of AI literacy, regulatory gaps, and financial constraints hinder widespread implementation. Despite these barriers, AI presents significant opportunities for enhancing risk management, automation of routine tasks, and data-driven decision-making in projects. Based on these insights, the study proposes a Strategic Framework for AI Adoption, emphasizing key pillars such as digital infrastructure enhancement, regulatory frameworks, financial support, educational programs, public-private partnerships, and international collaboration. By adopting this framework, Malawi can create an enabling environment for AI-driven project management, fostering innovation and sustainable development.

Keywords: - Artificial Intelligence (AI), Project Management, AI Adoption, Digital Infrastructure, Regulatory Framework, Capacity Building, Public-Private Partnerships, AI Integration, Sustainable Development, Malawi.

1. INTRODUCTION

Introduction

Around 200 years ago the industrial revolution changed society in unimaginable ways for the time. Today another revolution is under way, with even farther-reaching consequences. Artificial Intelligence (AI), experts are predicting, will change everything about the way we produce, manufacture and deliver. From manufacturing to utilities and transport to financial services, AI is present in nearly every industry. AI will also change the course of project management practice. Even though the application of AI software to project management dates back as far as 19872, it is only now that it is really taking off. Beyond data integration and process automation, self-driven project management no longer looks like mere science fiction. However, as we have previously seen with the Internet, big data and all the other technological revolutions of recent times, there are obstacles to be overcome before we reach this technological utopia.

Background of the study

AI is one of the newest fields in science and engineering. Handzic and Bassi (2017) emphasize the importance of finding a balance between integrating AI and utilizing human expertise to maintain effective project management practices. The work of AI started in earnest soon after World War II, and the name itself was coined in 1956 (Russell & Norvig, 2010). The emergence of Artificial Intelligence (AI) has significantly impacted various industries on a global scale, resulting in the restructuring of traditional approaches and the introduction of innovative solutions. In the field of project management, AI offers alot of tools and techniques that improve efficiency, accuracy, and decision-making processes. This transformation is particularly relevant in emerging economies like Malawi, where traditional project management practices often face challenges such as limited resources, a shortage of skilled personnel, and inefficient procedures. This thesis explores the potential benefits and implementation challenges of using AI to revolutionize project management practices in Malawi, providing valuable insights on the subject.

Takyar (2022) argues that the inclusion of artificial intelligence (AI) in project management is not a passing phenominon, but rather a significant advancement in how we plan, execute, and achieve project success. AI offers compelling benefits, such as automating repetitive tasks, providing real-time insights and predictions, and revolutionizing project management through efficiency, adaptability, and data-driven decision-making. Moreover, Takyar suggests that the future of AI in project management holds great promise. We can expect a continued shift towards automation and data-driven

insights, resulting in more personalized and agile project management experiences. As organizations invest in upskilling their workforce, the collaboration between human expertise and AI capabilities will help projects to new levels of success. In this changing landscape, staying informed and embracing the potential of AI is not merely a choice, but a necessity for project managers and organizations looking for a competitive advantage. Therefore, if you are prepared to discover the full potential of AI in your project management career, now is the ideal time to embrace this transformative technology and improve your projects towards even greater achievements.

Governments worldwide are acting swiftly to utilize artificial intelligence; however, the development of AI strategies across Africa varies considerably by country and region. According to oxford insights (2022), most sub-Saharan African countries fall below the global average in terms of their AI readiness, demonstrating a technology and infrastructure gap that could cement existing inequalities. Wealthier countries are channeling funding into new technologies at levels that developing economies cannot match. Malawi, despite being one of the very poorest countries in the world (ranked 174 of 189 countries on the Human Development Index); itches with ambition and has identified digitization as integral to its long-term development vision, the Malawi Vision 2063. The National Digitization Policy for 2023-2028 aligns with this thinking, emphasizing the importance digital transformation in delivering economic growth, good governance and overall improvements in quality of life. With the emergence of AI as a key enabler, Malawi's government is committed to creating an environment in which AI can thrive, benefiting professionals, industries, businesses and entrepreneurs. The government of Malawi believes that AI has the potential to transform the government's service delivery by providing insights, informing targeted interventions and underpinning proactive public services.

On this background, this thesis seeks to discuss how AI addresses common challenges faced by project managers in Malawi, transforming resource allocation, risk management, communication, and task scheduling. It argues that AI offers valuable insights into project trends and areas for improvement, optimizing resource utilization, and mitigating risks. Real-world examples from leading companies demonstrate the practical applications of AI in project management, highlighting its growing significance in the corporate world.

Statement of the problem

Despite significant improvements in project management methodologies, many organizations still face challenges in optimizing their project management processes, resulting in days, cost overruns, and non-efficient resource utilization (Muller et al., 2023). This is also true in Malawi, where traditional project management practices often struggle with accurately predicting project outcomes, efficiently allocating resources, and effectively managing risks. The integration of AI in project management is becoming more common. AI takes the form of different algorithms and machine learning programs, offering the possibility of daily project management and administration without human intervention. It allows managers to predict, solve and predict issues like the scope, budget and risks of the project, create preliminary schedules and automatically allocate material resources and tasks to employees. According to Nieto-Rodriguez (2019), the emergence of Artificial Intelligence (AI) offers a promising solution to these challenges by providing advanced data analytics, predictive capabilities, and automation. However, the integration of AI into project management is not yet fully understood, and its potential to transform and innovate traditional practices calls for deeper investigation. Therefore, this research aims to explore the transformative impact of AI on traditional project management practices, examining how AI can enhance efficiency, accuracy, and overall project success. The study will specifically focus on the development sector in Malawi as a case study.

Objectives of the study

Main objective

- Investigate how AI can enhance efficiency, accuracy, and overall project success in Malawi

Specific objective

- Identify the AI technologies currently being utilized in project management, such as machine learning, natural language processing, and predictive analytics.
- To Identify the Challenges and Barriers to AI Adoption in Project Management
- Develop a conceptual framework outlining the future integration of AI in project management, including potential trends and innovations

Research Question and Hypothesis

How can the effective integration of Artificial Intelligence (AI) into project management practices be achieved in Malawi, with the aim of enhancing efficiency, accuracy, and project outcomes? Additionally, what are the key challenges that are derailing this integration and how can they be addressed?

In the field of project management, the integration of AI has significant potential to enhance efficiency and decision-making. AI can be applied to key areas such as task allocation, risk prediction, and data analysis, improving project management processes (Handzic & Bassi, 2017). However, the successful integration of AI requires robust data collection and analysis to effectively train AI models (GSMA, 2024). This involves collecting project-related data and using machine learning algorithms and natural language processing for model development. The seamless operation of AI relies on integration with existing systems, considering compatibility and potential disruption. Continuous monitoring and enhancement of AI models are crucial to ensure accuracy and relevance over time (GSMA, 2024). Addressing challenges like data quality, integration complexity, ethical considerations, skill gaps, cost, security, and resistance to change is essential. Despite these obstacles, integrating AI can significantly improve project outcomes by streamlining workflows, enhancing decision-making, and promoting strategic planning (GSMA, 2024). These advancements are particularly beneficial

for project management practices in regions like Malawi. AI has the potential to innovate project management by automating tasks, predicting risks, and analyzing data to improve efficiency and accuracy. Doing away with challenges related to data quality, integration complexity, and ethical considerations while enhancing opportunities to improve decision-making and operations is essential for successful AI integration. Accepting and integrating AI in project management offers great benefits for advancing practices in countries like Malawi, allowing for more effective and innovative project management strategies. Hence this thesis is hypothesized as follows:

Null Hypothesis (H_0):

The integration of Artificial Intelligence (AI) into project management practices in Malawi does not significantly enhance efficiency, accuracy, or project outcomes compared to traditional project management approaches.

Alternative Hypothesis (H_1):

The integration of Artificial Intelligence (AI) into project management practices in Malawi significantly enhances efficiency, accuracy, and project outcomes compared to traditional project management approaches.

Characteristics of the Phenomenon

Project management is the application of specific knowledge, skills, methodologies, and techniques aimed at achieving specific and measurable project goals, including successful project completion (Larson & Gray, 2019). Additionally, Project management can be defined as the systematic achievement of project objectives through the coordination of personnel and the organization, planning, and control of resources allocated to the project. This process necessitates the building of positive interpersonal relationships among all stakeholders, including those within the organization and other companies that may be involved (Harrison & Lock, 2004). Projects require specialized information systems, scheduling methodologies, and control techniques.

Project management has evolved into a management-oriented and integration demanding situation, usually operating under a board and top management, with its main goal being project success. Project success is a multifaceted concept that goes beyond the mere fulfillment of technical requirements (KPMG et.al, 2019). It encompasses a range of factors, including stakeholder satisfaction, compliance with constraints, quality of deliverables, realization of benefits, and alignment with strategic objectives (KPMG et.al, 2019). To accurately assess project success, it is essential to consider all these dimensions in conjunction and understand the specific criteria that define success within the distinct context of each project.

Effective project management leads various individuals and groups into one functional organization, promoting teamwork and fostering commitment to project objectives (Harrison & Lock, 2004). It is widely recognized that project management is essential for all projects such as small, large and complex, and the effectiveness of project management significantly influences both the cost of a project and the duration of its completion (Larson & Gray, 2019).

Artificial intelligence (AI) refers to the intelligence demonstrated by machines, specifically computer systems (Johnson et al, 2021). It is a research field within computer science that focuses on the development and study of methods and software enabling machines to perceive their environment (Johnson et al, 2021). Using learning and intelligence, these machines can take actions that optimize their chances of achieving predefined goals.

To understand artificial intelligence (AI) within the scope of current research, it is essential to examine its characterization in existing policy frameworks. For instance, UNESCO indicates AI primarily by its capacity to learn and adapt, distinguishing between two principal approaches: symbolic reasoning, which relies on human-defined rules, and neural machine learning, which is data-driven and evolves as new data is introduced (UNESCO, 2021a; Sarker et al., 2021). Similarly, the Organisation for Economic Co-operation and Development (OECD) describes AI as being constructed either through data-driven models that automatically update or through human knowledge guided by fixed rules (OECD, 2019a; OECD, 2022). Both approaches symbolic and neural, underline the automation of processes, although they emphasize different surfaces. Symbolic AI is governed by the examination of fixed rule configurations, whereas neural AI necessitates scrutiny of data quality, training methodologies, and the model's adaptability and accuracy (OECD, 2019a; OECD, 2022).

In African contexts, where values and cultural considerations significantly influence technology adoption, the definition of responsible AI exceeds mere technical specifications to include the broad socio-cultural environment and ethical principles. Issues such as transparency, accountability, and fairness are very important, yet their interpretations can be very different. For instance, the concept of autonomy in many African contexts prioritizes relational connections over individualistic interpretations, as articulated in the African Charter on Human and Peoples' Rights (ACHPR), which advocates for collective rights alongside individual ones Consequently, effective AI governance in Malawi must account for these relational values and address the challenge of balancing individual and collective rights in the context of AI adoption.

Machine Learning, A subfield of artificial intelligence, which can be broadly defined as the ability of a machine to replicate intelligent human behavior and acquire knowledge from data without explicit programming (Jordan and Mitchell, 2015). Machine learning is a significant subset of artificial intelligence, primarily used for predictive analytics across various domains, including project management. This technology involves developing models through experiential learning, integrating principles from computer science, statistics, and data science to enhance decision-making with evidence-based insights (Jordan and Mitchell, 2015).

Its application in project management is expanding, as various algorithms analyze project data for training, pattern recognition, and forecasting (Niederman, 2021). Machine learning builds on established management techniques to tackle complex predictive tasks . The applications of machine learning are extensive, ranging from computer vision and speech recognition to natural language processing and robotics (Jordan and Mitchell, 2015). In the construction sector, for instance, machine learning helps in monitoring through virtual reality and building information modeling, as well as in risk

prediction (Rahimian et al., 2020). Beyond construction, machine learning enhances consumer experiences and reduces errors in traffic management. Recent advancements focus on techniques such as classification, regression, clustering, and dimensionality reduction. Research highlights the value of machine learning in supply chain management and its positive impact on production quality control (Uddin, Ong, and Lu, 2022). Moreover, machine learning-based frameworks are emerging to tackle project performance challenges, including cost overruns (Uddin, Ong, and Lu, 2022).

The potential benefits of machine learning in project management are extensive, offering improvements in productivity, profitability, and cost/time efficiency through its ability to process large datasets, manage risks, forecast trends, and benchmark against other projects. As project analytics continues to evolve, machine learning is expected to play a pivotal role in improving project outcomes and adapting to dynamic environments.

Factors of related to the Phenomenon

The technical factors of AI integration are foundational to its success. One key factor is data quality and availability. AI models rely heavily on accurate, complete, and timely data to perform functions such as predictive analysis, task allocation, and risk management (GSM, 2024). However, inconsistencies and gaps in project-related data can compromise the performance of these systems. Establishing standardized and robust data collection procedures is therefore very crucial.

Another important consideration is system compatibility. AI tools must integrate seamlessly with existing project management platforms to avoid disruption and ensure efficiency (Marnewick, C. & Marnewick, A., 2021). In contexts like Malawi, where infrastructure may vary significantly across organizations, ensuring compatibility with local systems is vital. Similarly, the design and functionality of AI models play a significant role. Models tailored to address the specific challenges and objectives of development projects in Malawi are likely to deliver better outcomes than generic, off-the-shelf solutions.

Technological infrastructure also impacts AI adoption. Reliable internet connectivity, access to cloud computing, and affordable data storage solutions are prerequisites for deploying and maintaining AI systems (Marnewick, C. & Marnewick, A., 2021). Furthermore, cybersecurity considerations are critical to protecting sensitive project data from breaches and misuse, particularly when AI systems are integrated into organizational workflows (Marnewick, C. & Marnewick, A., 2021).

Within organizations, leadership and strategic vision significantly influence the adoption of AI. Leadership support and a commitment to innovation are essential for driving AI integration. When leaders actively champion AI initiatives, teams are more likely to embrace the change and work toward successful implementation (Müller, R., & Turner, J. R., 2010).

Skills and capacity building are equally important. Many project management teams may lack the technical expertise to use AI tools effectively. Training programs and upskilling initiatives can bridge this gap, equipping staff with the knowledge and confidence to work with AI systems (Hwang, B. G., & Ng, W. J., 2013). However, successful integration also requires change management strategies to address resistance from employees who may view AI as a threat to their roles (GSMA, 2024). Transparent communication about the benefits of AI and its role in enhancing not replacing human decision-making can alleviate such concerns (Hwang, B. G., & Ng, W. J., 2013).

The availability of financial resources also determines the feasibility of AI projects. Organizations need to allocate budgets not only for the initial implementation but also for ongoing maintenance and updates (Hwang, B. G., & Ng, W. J., 2013). Additionally, ethical and governance frameworks are necessary to ensure the responsible use of AI, addressing concerns such as bias in decision-making and data privacy.

Beyond organizational and technical aspects, external factors also influence AI integration. The regulatory environment in Malawi plays a pivotal role. Supportive policies and legal frameworks can encourage AI adoption, while stringent or unclear regulations may hinder progress. Governments and regulatory bodies need to establish guidelines that balance innovation with accountability (Mutula, S. M., & Mostert, 2010).

Partnerships and collaboration are another critical factor. Collaborating with international organizations, technology providers, and academic institutions can provide access to technical expertise, funding, and resources (Mutula, S. M., & Mostert, 2010). Public-private partnerships can enhance the accessibility and scalability of AI solutions.

Cultural acceptance is also crucial in shaping the success of AI integration. In some cases, societal perceptions of AI as a disruptive or overly complex technology can create resistance (Zakaria, N., & Stanton, J. M., 2003). Efforts to raise awareness about the tangible benefits of AI in project management can help build trust and acceptance among stakeholders.

Finally, economic conditions and infrastructure challenges must be addressed. Limited financial resources, unreliable power supply, and low internet connectivity, particularly in rural areas, can hinder AI adoption (Aker, J. C., & Mbiti, I. M., 2010). Organizations must explore innovative solutions, such as leveraging cloud-based platforms and renewable energy sources, to overcome these barriers.

Global Statistical Scenario

Globally, the integration of Artificial Intelligence (AI) in project management has garnered significant attention, with countries like China, the United States, and the United Kingdom leading in terms of research output and policy initiatives. According to Kratochwill et al. (2020), China is credited with 17% of global publications on AI in project management, followed by the United Kingdom with 10%, and the United States with 8%. These high publication rates and advancements are largely driven by government policies that prioritize AI research and application, particularly in nations like China and the U.S., which have positioned themselves as leaders in the AI landscape. For instance, both countries have invested billions of dollars into AI research and development, with China alone allocating $2 billion for AI R&D and creating a dedicated AI research park in 2018 (Kumar, 2021). Similarly,

the U.S. government's "American AI Initiative" further accelerated AI research, enabling access to government data for scientists and researchers (Wiltz, 2019).

Globally, AI-driven project management is gaining traction, particularly in developed economies. AI has become an essential component of business operations, with industries leveraging AI tools to streamline workflows, optimize decision-making, and enhance productivity. The PwC Global AI Report (2024) estimates that AI will contribute $15.7 trillion to the global economy by 2030, with over 80% of Fortune 500 companies incorporating AI into project workflows.

AI Adoption in Major Global Markets

i. North America

In North America, particularly the United States and Canada, AI has significantly transformed industries such as finance, healthcare, manufacturing, and project management. 74% of enterprises now utilize AI for risk assessment, automation, and project planning. The growing trend of AI-powered predictive analytics allows companies to assess potential risks in project execution and make informed decisions. AI is also playing a crucial role in human resource management, where machine learning models analyze workforce performance and recommend hiring strategies.

ii. Europe

Europe follows closely behind, with AI adoption rates exceeding 65% in industries like construction, technology, and finance. The European Union (EU) has implemented strict AI regulations through its Artificial Intelligence Act, ensuring responsible AI use while fostering innovation. Germany and France are leading the way in AI-based automation, with companies using AI-powered digital twins to simulate construction projects and optimize outcomes. The UK government has also invested heavily in AI research, funding various AI-driven initiatives aimed at improving urban planning and infrastructure development.

iii. Asia-Pacific

The Asia-Pacific region, particularly China, South Korea, and Japan, has emerged as a global leader in AI development. China has invested billions of dollars into AI-powered smart management solutions, and AI-driven automation has revolutionized its manufacturing and logistics sectors. The Chinese government has set ambitious AI targets, aiming to be the global leader in AI innovation by 2030. South Korea and Japan have also heavily integrated AI into robotics, healthcare, and engineering to enhance precision and efficiency. The region is witnessing 20% annual growth in AI investment, indicating a strong commitment to leveraging AI technologies.

Outlook for AI on a Global Scale

As AI continues to evolve, its impact on project management, finance, healthcare, and education will become even more profound. The global AI market is projected to grow at a CAGR (Compound Annual Growth Rate) of 35% between 2024 and 2030, signaling continued investment and innovation.

Countries that prioritize AI infrastructure development, education, and ethical AI governance will be at the forefront of technological advancements. As AI becomes more accessible, developing nations, including Malawi, have an opportunity to leverage AI for economic growth and digital transformation.

Regional Statistical Scenario

In the realm of Artificial Intelligence (AI) integration, Malawi trails behind several neighboring countries, notably Kenya, Zambia, and Tanzania, which have made significant advancements in leveraging AI for economic development and project management (African Union, 2024).

Kenya's AI Advancements

Kenya stands out in the region for its substantial investments in AI, particularly in financial and agricultural sectors. The country has seen a proliferation of AI applications, with 49 identified across 15 sectors, including finance and agriculture (Paradigm Initiative, 2022). In agriculture, AI tools like Virtual Agronomist and PlantVillage assist farmers with precise fertilization, pest identification, and soil health recommendations, leading to increased productivity. For instance, farmers using Virtual Agronomist have reported yield improvements from 2.3 tonnes to 7.3 tonnes of coffee (The Guardian, 2024).

Zambia's AI Integration

Zambia has also made notable progress in AI adoption, particularly among Civil Society Organizations (CSOs). A recent survey indicates that 44% of Zambian CSOs are utilizing AI tools, with generative AI being the most widely used. Among these organizations, 25% employ AI-powered chatbots and conversational AI, while 20% use AI for social media management (Internews, 2024). Additionally, 96% of non-users are considering integrating AI into their operations, reflecting a growing recognition of AI's potential to enhance efficiency and impact.

Tanzania's AI Adoption

Tanzania is progressively integrating AI into various sectors, including e-commerce, financial services, and public health. The country's AI penetration is facilitated by public-private partnerships that foster AI growth through incentives for research, tax reductions for startups, and funding for educational programs (African Union, 2024). These collaborative efforts have been instrumental in enhancing operational efficiency across key industries.

Challenges in AI Adoption

Despite these advancements, several challenges persist across the region:

1. **Limited Funding** – Many AI initiatives rely heavily on donor funding and grants. AI startups and research institutions struggle to secure local investments (Paradigm Initiative, 2022).
2. **Skill Gaps** – There is a shortage of AI-skilled professionals, as educational institutions have yet to produce graduates in sufficient numbers to meet the growing demand (Internews, 2024).
3. **Regulatory Uncertainty** – The absence of comprehensive AI legislation creates ethical and operational risks, including concerns around data privacy and AI bias (African Union, 2024).
4. **Data Infrastructure Issues** – The high cost of data storage, lack of cloud computing services, and insufficient access to big data resources hinder AI adoption (CTF Assets, 2024).
5. **Cultural Resistance** – Skepticism towards AI technologies and fears of job displacement impede widespread acceptance, particularly in traditional industries (African Union, 2024).

Government Strategies for Advancing AI

To address these challenges, regional governments have implemented several strategic measures:

- Kenya's National AI Strategy (2023-2028) – Focuses on AI governance, ethics, and investment incentives to boost AI-driven economic growth (Paradigm Initiative, 2022).
- Zambia's Smart Cities Initiative – Integrates AI-powered surveillance, smart traffic management, and AI-enhanced public safety programs (Internews, 2024).
- Tanzania's AI in Public Health Program – Aims to deploy AI-assisted diagnostic tools and real-time disease surveillance across national healthcare systems (African Union, 2024).
- Regional Collaboration on AI Development – Countries are forming cross-border partnerships, investing in shared research hubs, and promoting knowledge exchange programs (CTF Assets, 2024).

Outlook for AI in the Region

With increasing government support, private sector investments, and regional collaborations, the future of AI in Southern and East Africa appears promising. AI adoption is expected to grow significantly in finance, agriculture, healthcare, education, and infrastructure development (African Union, 2024). Continued support for AI-driven policies and investments could position these countries as innovation hubs on the African continent (CTF Assets, 2024).

Local Statistical Scenario

Artificial Intelligence (AI) adoption in Malawi is in its nascent stages, with both government initiatives and private sector investments contributing to its gradual integration. The National Digitalization Policy (2023–2028) identifies AI as a key component of digital transformation, emphasizing its role in enhancing efficiency, reducing costs, and optimizing decision-making processes. Despite its potential, AI implementation remains limited across various industries due to structural, economic, and educational barriers.

AI Adoption in Key Sectors

According to the National Commission for Science and Technology (NCST), AI adoption in Malawi is progressing, with applications emerging in sectors such as agriculture and education. However, the overall adoption rate is still relatively low compared to regional and global statistics.

Barriers to AI Adoption in Malawi

Several challenges hinder the widespread adoption of AI in Malawi:

1. **Infrastructure Constraints**

Malawi faces significant internet connectivity gaps, particularly in rural areas. AI applications, especially those reliant on cloud computing and big data processing, require stable and high-High Implementation Costs. AI adoption requires substantial financial investment in hardware, software, and training. Many small and medium-sized enterprises (SMEs) struggle to afford AI-based solutions, slowing down overall AI penetration in the country.

2. **Limited AI Expertise**

Malawi currently has a shortage of AI professionals. The country's education system has yet to fully integrate AI-related courses in universities, leading to a skills gap in AI development and implementation. Most AI initiatives rely on foreign expertise, which raises costs and limits sustainability.

3. **Regulatory Uncertainty**

AI governance frameworks in Malawi remain underdeveloped. There are no clear policies on AI ethics, data protection, and cybersecurity, which raises concerns about data misuse and biases in AI decision-making.

4. **Cultural and Organizational Resistance**

Many organizations remain skeptical about AI's potential benefits. Resistance to change, fear of job losses, and a lack of awareness about AI's capabilities slow down adoption in both private and public sectors.

Government Initiatives and Future Prospects

Recognizing these challenges, the Malawian government is taking steps to create a more AI-friendly environment. Ongoing initiatives include:

- National AI Strategy Development: Policymakers are working on formulating a national AI strategy to define AI governance frameworks, funding mechanisms, and innovation hubs.
- Digital Skills Training Programs: Universities and technical colleges are introducing AI-related courses to build local expertise in AI development and deployment.
- Public-Private Partnerships (PPPs): The government is encouraging collaboration between technology firms, universities, and international organizations to accelerate AI adoption.

Despite existing barriers, Malawi has significant potential to leverage AI for national development. By addressing infrastructure limitations, increasing AI awareness, and implementing clear regulatory frameworks, the country can position itself as a leader in AI-driven innovation within the region.

AI Use Cases in Malawi

AI is increasingly being applied in various sectors in Malawi, although at a slower pace compared to global trends. The integration of AI in different industries presents opportunities for improving efficiency, accuracy, and accessibility while reducing operational costs and human error. This section explores how AI is being utilized in agriculture, healthcare, finance, education, and government services in Malawi, emphasizing both current applications and future potential.

1. **AI in Agriculture**

Agriculture is the backbone of Malawi's economy, employing over 80% of the population. AI-driven solutions are being explored for precision farming, weather prediction, soil health analysis, and pest control. Organizations such as the Malawi Agricultural Technology Initiative have started integrating AI-powered drones for monitoring crop health, detecting plant diseases, and optimizing irrigation practices. These drones use computer vision and machine learning algorithms to analyze real-time farm data, enabling farmers to make data-driven decisions to maximize crop yields.

AI-powered sensors and Internet of Things based farming solutions are also gaining traction. For example, machine learning models can analyze soil composition and recommend optimal planting strategies, ensuring that farmers use the right fertilizers and irrigation schedules. Additionally, AI-driven weather forecasting tools provide smallholder farmers with accurate climate predictions, helping them plan planting and harvesting activities more effectively.

Despite these advancements, the adoption of AI in agriculture remains low due to limited access to AI technology, digital illiteracy among farmers, and financial constraints. Expanding AI-based agricultural solutions requires investment in digital literacy programs, affordable AI-powered equipment, and government-backed incentives.

2. **AI in Healthcare**

AI is beginning to revolutionize medical diagnostics, predictive analytics, and telemedicine in Malawi. The Ministry of Health, in partnership with international health organizations, is piloting AI-driven diagnostic tools for malaria detection, tuberculosis screening, and maternal health monitoring. These tools use deep learning algorithms to analyze medical images and detect diseases with high accuracy, assisting healthcare professionals in making faster and more accurate diagnoses.

The use of AI-powered chatbots for basic medical consultations is also emerging, especially in rural areas where healthcare professionals are scarce. These chatbots, equipped with natural language processing (NLP) capabilities, can provide preliminary diagnoses, offer medical advice, and refer patients to healthcare centers when necessary. In addition, AI-driven electronic health record (EHR) systems are being tested to improve patient data management, ensuring that medical professionals have access to real-time health records.

A major barrier to AI adoption in healthcare is the lack of digital infrastructure and trained AI specialists. To fully leverage AI in the medical field, healthcare institutions must invest in AI training programs for medical practitioners, establish secure health data repositories, and integrate AI into national health policies.

3. **AI in Finance**

The financial sector in Malawi has increasingly embraced artificial intelligence (AI) as a transformative tool to revolutionize its operations, particularly in enhancing banking services, improving fraud detection mechanisms, and refining credit scoring systems. By integrating AI-driven technologies, financial institutions in the country are now able to offer more personalized and efficient customer experiences, such as tailored financial advice and

streamlined digital banking platforms. Additionally, AI-powered fraud detection systems have significantly bolstered security measures, enabling real-time monitoring and rapid response to suspicious activities. In the realm of credit scoring, AI algorithms are being utilized to analyze vast datasets, including non-traditional data sources, to assess creditworthiness more accurately and inclusively. This shift not only promotes financial inclusion but also strengthens the overall stability and competitiveness of Malawi's financial ecosystem.

Significance of the study

The integration of artificial intelligence (AI) into project management practices in Malawi holds significant importance due to its potential to address longstanding challenges and drive development across various sectors. This aligns with the Malawi 2063 agenda, specifically the sustainable development goal of "industry, innovation, and infrastructure," which aims to enhance the technological capabilities of industrial sectors. By harnessing AI technologies, Malawi can overcome limitations brought by traditional project management methods, such as resource constraints, inefficient processes, and limited utilization of data.

This study aims to explore the practical applications of AI in enhancing decision-making, automating routine tasks, and improving project outcomes. These advancements are crucial for the progress of infrastructure projects, economic growth, and social development in the country. For instance, Chirwa (2019) discovered that out of the 184 education projects administered between 2003 and 2015, less than one-third achieved timely completion and project success in Malawi. This highlights the pressing need for a deliberate effort to improve project outcomes, in which AI has demonstrated great potential.

Additionally, this research adds to the growing body of knowledge on the role of AI in project management, particularly in developing economies. It provides insights into the specific challenges and opportunities faced by Malawi in adopting AI and offers practical recommendations for policymakers, project managers, and stakeholders. By examining the feasibility and benefits of integrating AI, this study aims to guide strategic investments and initiatives that can optimize the efficiency and effectiveness of project management practices in Malawi. Ultimately, this will contribute to sustainable development and enhance the quality of life for its citizens.

Scope of the study

Integrating Artificial Intelligence (AI) into project management practices in Malawi has the potential to significantly enhance efficiency, accuracy, and decision-making across various sectors. This thesis aims to comprehensively examine the integration of AI within Malawi's development context, including the identification of suitable applications, the addressing of challenges, the evaluation of opportunities, and the alignment with national development agendas such as Malawi's Vision 2063. As part of this exploration, Key Informant Interviews (KII) were conducted with project managers to obtain valuable insights and perspectives directly from professionals involved in project management in Malawi.

To enhance the understanding of AI's potential and challenges in Malawi's project management sector, this thesis incorporated Key Informant Interviews (KII) with experienced project managers. These interviews looked to gather firsthand insights, perspectives, and practical experiences concerning current project management practices, perceptions of AI technology, readiness for AI integration, identified barriers, and recommendations for effective implementation. By directly engaging project managers, the research captured broad perspectives that will inform strategic recommendations and implementation strategies tailored to Malawi's unique socio-economic and institutional context.

Definition of key terms

Project management is the application of specific knowledge, skills, methodologies, and techniques aimed at achieving specific and measurable project goals, including successful project completion (Larson & Gray, 2019). Additionally, Project management can be defined as the systematic achievement of project objectives through the coordination of personnel and the organization, planning, and control of resources allocated to the project. This process necessitates the building of positive interpersonal relationships among all stakeholders, including those within the organization and other companies that may be involved (Harrison & Lock, 2004). Projects require specialized information systems, scheduling methodologies, and control techniques.

Project management has evolved into a management-oriented and integration demanding situation, usually operating under a board and top management, with its main goal being project success. Project success is a multifaceted concept that goes beyond the mere fulfillment of technical requirements (KPMG et.al, 2019). It encompasses a range of factors, including stakeholder satisfaction, compliance with constraints, quality of deliverables, realization of benefits, and alignment with strategic objectives (KPMG et.al, 2019). To accurately assess project success, it is essential to consider all these dimensions in conjunction and understand the specific criteria that define success within the distinct context of each project.

Effective project management leads various individuals and groups into one functional organization, promoting teamwork and fostering commitment to project objectives (Harrison & Lock, 2004). It is widely recognized that project management is essential for all projects such as small, large and complex, and the effectiveness of project management significantly influences both the cost of a project and the duration of its completion (Larson & Gray, 2019).

Artificial intelligence (AI) refers to the intelligence demonstrated by machines, specifically computer systems (Johnson et al, 2021). It is a research field within computer science that focuses on the development and study of methods and software enabling machines to perceive their environment (Johnson et al, 2021). Using learning and intelligence, these machines can take actions that optimize their chances of achieving predefined goals.

To understand artificial intelligence (AI) within the scope of current research, it is essential to examine its characterization in existing policy frameworks. For instance, UNESCO indicates AI primarily by its capacity to learn and adapt, distinguishing between two principal approaches: symbolic reasoning, which relies on human-defined rules, and neural machine learning, which is data-driven and evolves as new data is introduced (UNESCO, 2021a; Sarker

et al., 2021). Similarly, the Organisation for Economic Co-operation and Development (OECD) describes AI as being constructed either through data-driven models that automatically update or through human knowledge guided by fixed rules (OECD, 2019a; OECD, 2022). Both approaches symbolic and neural, underline the automation of processes, although they emphasize different surfaces. Symbolic AI is governed by the examination of fixed rule configurations, whereas neural AI necessitates scrutiny of data quality, training methodologies, and the model's adaptability and accuracy (OECD, 2019a; OECD, 2022).

In African contexts, where values and cultural considerations significantly influence technology adoption, the definition of responsible AI exceeds mere technical specifications to include the broad socio-cultural environment and ethical principles. Issues such as transparency, accountability, and fairness are very important, yet their interpretations can be very different. For instance, the concept of autonomy in many African contexts prioritizes relational connections over individualistic interpretations, as articulated in the African Charter on Human and Peoples' Rights (ACHPR), which advocates for collective rights alongside individual ones Consequently, effective AI governance in Malawi must account for these relational values and address the challenge of balancing individual and collective rights in the context of AI adoption.

Machine Learning, A subfield of artificial intelligence, which can be broadly defined as the ability of a machine to replicate intelligent human behavior and acquire knowledge from data without explicit programming (Jordan and Mitchell, 2015). Machine learning is a significant subset of artificial intelligence, primarily used for predictive analytics across various domains, including project management. This technology involves developing models through experiential learning, integrating principles from computer science, statistics, and data science to enhance decision-making with evidence-based insights (Jordan and Mitchell, 2015).

Its application in project management is expanding, as various algorithms analyze project data for training, pattern recognition, and forecasting (Niederman, 2021). Machine learning builds on established management techniques to tackle complex predictive tasks . The applications of machine learning are extensive, ranging from computer vision and speech recognition to natural language processing and robotics (Jordan and Mitchell, 2015). Machine learning enables predictive analytics and can provide advice to the project manager, for example on how to set up and steer the project given certain parameters, and/or how to react to certain issues and risks to reach the best possible outcome based on what worked in past projects. Soon, AI could convert mind maps created by project professionals into a semantic network and derive tasks and their relationships from it. For instance, AI based project scheduling could include lessons learned from previous projects and suggest multiple possible schedules based on the context and dependencies. Furthermore, project plans could be adapted and re-baselined in near-real-time based on historical team performance and project progress. An AI system could even alert the project manager to potential risks and opportunities by using real-time project data analysis

The potential benefits of machine learning in project management are extensive, offering improvements in productivity, profitability, and cost/time efficiency through its ability to process large datasets, manage risks, forecast trends, and benchmark against other projects. As project analytics continues to evolve, machine learning is expected to play a pivotal role in improving project outcomes and adapting to dynamic environments.

2. LITERATURE REVIEW

Introduction

Artificial Intelligence (AI) has the potential to greatly improve Africa's economy and contribute to the achievement of the Sustainable Development Goals (SDGs) on the continent (GSMA, 2024). While AI is already being developed and used to support various applications in African countries, there is limited research on its specific use cases for development in this context. AI can be applied to sectors such as agriculture, food security, energy, and climate. While many AI applications are still in the early stages of development, some commercially viable solutions have already emerged. AI is often integrated into existing digital products and services, making them more relevant, efficient, and scalable (GSMA, 2024).

The rise of Artificial Intelligence (AI) has redefined a lot of industries globally, offering innovative solutions that significantly enhance efficiency, accuracy, and decision-making processes. This chapter presents a thorough literature review on the integration of AI in project management, with a particular focus on its transformative potential in Malawi. The review covers key theoretical frameworks, conceptual discussions, and identifies gaps in current research. It aims to provide a detailed understanding of AI’s current role in project management and to highlight the opportunities and challenges specific to the Malawian context.

Project management in Malawi, like in other regions, faces various challenges such as delays, cost overruns, and resource misallocation, despite advancements in methodologies (Winiko, 2018). The integration of Artificial Intelligence (AI) offers promising solutions to these challenges by enhancing data analytics, predictive capabilities, and automation. This literature review explores the transformative potential of AI in project management, with a focus on efficiency, accuracy, and overall project success.

Main and Empirical Literature Review

In a newspaper article titled ‘Is Malawi Ready for AI?,’ Huawei vice-president for the Southern Africa region, Phil Li notes that Malawi is rarely, if ever associated with cutting-edge technology or modern innovations such as artificial intelligence. Li discusses some of the drawbacks of AI that are more pressing for Malawi. For example, the fact that artificial intelligence can perform repetitive tasks has the consequence of displacing people who work in those areas, thus contributing to unemployment. As a striking 91 percent of Malawians are currently jobless, Li asserts that this downside is worth careful consideration. Furthermore, the cost of creating a machine that can simulate intelligence requires considerable time and resources. AI requires up-to-date

hardware and software to meet the latest requirements, which makes it an expensive technology to maintain, especially for impoverished and less technologically advanced countries like Malawi. Hence the question: Is Malawi ready for AI?

Scott & Kalima (2023) argues that harnessing Artificial Intelligence to transform public service delivery requires essential raw materials. Big data is paramount, but accessing and utilizing data requires strong digital foundations. That is the reason Malawi has made a partnership with the Tony Blair Institute for Global Change (TBI). TBI has been working closely with Malawi's government to make its digitization vision a reality. This partnership is aimed at nurturing talent by equipping Malawi's public servants and leaders with digital skills in order to deliver the government's strategic plans and digital-transformation vision. To support this, TBI has launched the DigSMART digital-skills training programme, which upskills government workers who are leading digital-transformation initiatives. Furthermore, Scott & Kalima suggest that new policies should be passed to facilitate the country's ability to optimize new technologies. With solid foundations in place and a strong vision for the future, Malawi can leverage AI as it evolves, exploring opportunities and partnerships to harness the technology's power and become a regional leader, Scott & Kalima concludes.

Duica & Vasciuc (2024) examines the role of artificial intelligence in project management. In their article titled 'The Use of Artificial Intelligence in Project Management', they first outline the main AI technologies used in the managerial field, followed by the advantages and potential these technologies offer to organizations. They argue that the use of AI opens new horizons for managing organizations as it facilitates the processes of planning and organizing work, as well as monitoring employees, among other things. However, they also noted that AI comes with challenges particularly due to the rapid pace of change and potential biases related to the design of the algorithms and databases used by the systems, which can affect credibility of results. In conclusion, Duica & Vasciuc (116) argues that with all its advantages and disadvantages, AI is a good support tool for managers, but it does not completely replace them. Henceforth, they suggest that to make the most of AI, managers need to develop complementary skills.

The global survey conducted by IPMA and PwC Romania (2020) analyses the impact of AI in project management. The survey took place between March-July 2020, covering the responses of 295 project management professionals, including IPMA members and future members and PwC contacts. The conclusions of the survey showed that as a general view, employees want to know what AI means for their job and prospects, while businesses are asking how they can capitalize on the opportunities that AI presents and where investment should be targeted. Going through all these considerations, important is how to build AI in a responsible and transparent way needed to maintain the confidence of, skilled professionals and wider stakeholders. Additionally, investment in AI is a leap of faith in the future. Looking ahead, the survey results suggest that digitization and certain foundational practices are important to creating value from AI and enabling progress. The implications related to adoption of AI are significant. In many organizations, they involve drastic changes to core processes and creating new ways in which people, with different capabilities, will work together with the machines. The findings of the survey were aimed at creating a clearer picture of the full potential of AI globally, extending the exploration of AI's potential inside the borders of Project Management, as a driving factor for the workforce and productivity.

S Krishnan & L.R.K Krishnan (2023) studies the impact of Artificial Intelligence on project delivery and implementation. This study is aimed at analyzing the current use of artificial intelligence (AI) on Project Management for enabling project success. The study attempts to investigate the potential application of technology specifically, deploying AI on project management practices across organizations for enhancing project delivery. The existing literature was comprehensively surveyed to unearth potential AI application areas supporting Project Management practices. This study is both quantitative and qualitative in nature with extensive review of literature. Data was collected from leading IT companies in India and abroad, 55 responses from project managers were collected as a simple random sample. The data was run through SPSS to analyze the trends. The results clearly indicated that artificial intelligence can be positively deployed in Project Management for better decision making and project outcome results. Organizations' acceptance of AI tools seems to be generally more common in technology companies than in other sectors as seen on the ground. This review makes way for enhanced scholarly investigation, both qualitative and quantitative. The paper attempts to also bring in the current trends in deployment of AI in Project Management practices and potential focus areas for improvement. Based on the statistical analysis and in-depth discussions on the Impact of Artificial Intelligence in project delivery and implementation, the study concludes that AI soon is going to make giant steps in the areas of project delivery and ensuring business sustainability. AI tools will help optimize costs, project completion times, and capital productivity. The following statement concisely summarizes the facts: Organization in developed and developing countries like Malawi are ready to adopt AI in project management which can help in completion of project on time within cost & improved Quality. Project managers believe AI can help in simplifying the complexity of projects and aid them in executing the project in a complete way.

In his MA thesis titled 'Implementation of Artificial Intelligence (AI) in Project Management and effect in working personnel', Panteleimon Kelepouris examines the implementation of AI in project management, focusing on its impact on the working personnel. Kelepouris argues that AI has the potential to improve project management processes, increase efficiency, and enhance decision-making. The thesis explores the implementation of AI in project management with a focus on the impact on working personnel. It analyzes the benefits and challenges of AI implementation, the impact on the role of managers and team members, and the ethical considerations of using AI in project management. The findings of the research showed that the integration of AI in project management holds incredible potential for changing project practices and outcomes. However, the research asserts that the successful implementation requires organizations to address challenges related to job displacement, ethical concerns, and data privacy.

Hasmukh (2024) studies the application of AI in project management. The research provides an in-depth analysis of the integration of AI into Project Management, exploring its current applications, benefits, challenges, and potential future developments. The study finds that the role and current application of AI in Project Management have been identified as predominantly experimental but growing rapidly, the interviews with project management professionals and reviews both published and grey literature indicate an increasing enthusiasm for using AI to enhance decision-making and operational efficiency in project environments. As the use of AI is still in its early stages, Hasmukh (52) acknowledges that there is still a lot of work to

be done to explore its true potential, many industries tech giants and researchers are already working in tools and models that will be disruptive and will transform the way projects are managed.

In summary, majority of literature stipulate that even though integrating AI into project management has a huge potential in Malawi, there are still a few gaps in the subject needing more clarification. There is a need for explore the barriers and challenges that could potentially hinder the easy and seamless adoption of AI, exploring to extent of AI's capability to adapt in different sectors and contexts and finally come up with a comprehensive roadmap that acts as a blueprint to effectively integrating AI in project management for improved project success. Additionally, while significant strides have been made in the application of AI for task automation and data analysis, there is a huge need to explore the potential of AI in fostering project practices like efficiency, accuracy, and overall project success within project teams. Understanding how AI can augment these practices represents a promising avenue for research.

Evolution of Project Management Theories

The field of project management has undergone significant evolution, progressing from conventional, linear methods to more dynamic and iterative approaches. In the 1970s, the Waterfall Model was introduced, proposing a sequential design process where each phase had to be completed before moving on to the next (Kabeyi M., 2018). While this model offered a structured framework, it often struggled to accommodate changes, leading to delays and increased expenses (Kabeyi M., 2018). In contrast, Agile Methodology emerged in the early 2000s and brought flexibility and iterative progress to project management (Larson & Gray, 2017). It emphasized collaboration, customer feedback, and adaptive planning. Agile methodologies like Scrum and Kanban have gained popularity as the preferred approach for managing complex projects, particularly in the realm of software development (Larson & Gray, 2017).

The coming in of artificial intelligence (AI) has further changed project management by integrating advanced technologies into these methodologies. AI technologies, such as machine learning, natural language processing (NLP), and predictive analytics, enhance traditional models and provide tools for improving decision-making, optimizing resource allocation, and enhancing risk management (GSMA, 2024).

Artificial Intelligence in Project Management

The integration of artificial intelligence (AI) into project management is not merely a passing phenomenon, but a significant advancement that is changing the way projects are planned, executed, and monitored (Daneshpajouh et al, 2023). AI technologies employ sophisticated algorithms to process vast amounts of data, providing actionable insights that enhance project outcomes (Daneshpajouh et al, 2023). Machine Learning: By analyzing historical project data, machine learning algorithms can identify patterns and predict future outcomes, thereby enhancing forecasting accuracy (Fetzer, 2010). Hajiari et al. (2020) conducted a study that demonstrated machine learning models could predict project completion times with an impressive accuracy rate of 85%, greatly enhancing project planning and scheduling. Natural Language Processing (NLP): NLP technologies enable machines to comprehend and generate human language, facilitating improved communication and documentation (Fetzer, 2010). NLP tools can automate the extraction of project-related information from unstructured data sources such as emails, reports, and meeting transcripts, thereby enhancing decision-making and documentation processes (Fetzer, 2010).

Predictive Analytics: By leveraging historical data and statistical algorithms, predictive analytics can forecast future trends and behaviors. This technology is particularly valuable in risk management, as it allows project managers to identify potential risks and take proactive measures to mitigate them (Fetzer, 2010). Owolabi et al. (2020) found in their study that predictive analytics could reduce project risks by up to 30%, resulting in improved project stability and success rates.

Integration of AI in Project Management

The integration of artificial intelligence (AI) in project management involves utilizing AI tools and techniques to enhance various aspects of project management. These aspects include:

1. Planning and Scheduling: By employing AI algorithms, it is possible to analyze historical data and generate optimized project schedules. These algorithms consider various possible barriers and uncertainties. For example, IBM's Watson Project Management utilizes AI to develop dynamic project plans that can adapt to changing conditions.

2. Risk Management: AI-powered predictive analytics can identify potential risks by analyzing historical data and current project metrics. Tools such as RiskWatch and Palantir offer advanced risk assessment capabilities, thereby improving project resilience (Palantir Technologies, 2020).

3. Performance Monitoring: AI systems continuously monitor project performance, providing real-time insights and alerts regarding deviations from the plan. This allows project managers to promptly take corrective actions, ensuring the achievement of project (GSMA, 2024).

The Landscape of AI in Developing Countries

An overview of Adoption Trends: Artificial Intelligence (AI) has emerged as a powerful force shaping the global technological landscape, and its adoption trends in developing countries present a dynamic narrative influenced by a myriad of factors. This section provides an overview of the current landscape of AI adoption in developing nations, highlighting trends and drawing comparisons with the trajectories observed in developed countries (Aderibigbe et al, 2023).

AI Adoption Trends in Developing Nations: In recent years, developing countries have increasingly embraced AI technologies, recognizing their potential to catalyze economic growth, enhance public services, and address pressing societal challenges. The adoption of AI in developing nations is driven by a confluence of factors, including technological advancements, increased connectivity, and a growing awareness of the transformative power of AI applications. Notably, AI is being deployed in diverse sectors such as healthcare, agriculture, education, and governance to unlock efficiencies and drive innovation (Aderibigbe et al, 2023). Governments and businesses in developing countries are strategically leveraging AI to tackle complex issues. For instance, AI-powered healthcare applications are enhancing diagnostic capabilities and healthcare delivery in regions with limited access to medical expertise (Han et al., 2020). In agriculture, AI-driven precision farming is optimizing resource use and improving yields (Han et al., 2020). Education systems are incorporating AI for personalized learning experiences, and governments are exploring AI applications for public service delivery and policy formulation (Han et al., 2020).

Comparison with AI Trends in Developed Countries: While the adoption of AI in developing countries is exponentially growing, it is essential to contextualize these trends within the broader global landscape. Developed countries, often characterized by robust technological infrastructures and well-established innovation ecosystems, have been at the forefront of AI development and implementation (Ahmed & Meraj, 2024). The trends of AI adoption in developed nations have been shaped by significant investments in research and development, a highly skilled workforce, and a conducive regulatory environment (Ahmed & Meraj, 2024). Developed countries have witnessed growing integration of AI across industries, with applications ranging from advanced robotics in manufacturing to sophisticated AI algorithms in finance and business analytics (Wakunuma, Jiya & Aliyu, 2020). The emphasis on AI-driven research and innovation in developed nations has excelled them into leadership positions in AI development and deployment. The evolving landscape of AI adoption in developing countries shows the transformative potential of these technologies in fostering inclusive development (Wakunuma, Jiya & Aliyu, 2020). As the gap narrows, developing nations have an opportunity to harness AI strategically, addressing local challenges and contributing to global innovation.

Impact of AI on Traditional Project Management Practices in Malawi

Adoption of Artificial Intelligence in Malawi

The field of project management is in high in demand in Malawi. The country is undergoing significant economic growth and development, leading to a surge in various projects, both public and private, in sectors like infrastructure, healthcare, agriculture, and education. In the realm of global technological progress, the integration of Artificial Intelligence (AI) has emerged as a transformative force, promising to reshape industries, enhance efficiencies, and foster innovation. While developed nations forge ahead in leveraging the potential of AI, the adoption and effective implementation of these technologies in developing countries like Malawi present a distinctive set of challenges and opportunities. Developing countries, characterized by diverse socio-economic contexts, are at the crossroads of harnessing the potential benefits of AI to address existing challenges and propel economic development (Wakunuma et al., 2020, Guo and Li, 2018, Hendler, 2023). The adoption of AI technologies offers the promise of leapfrogging traditional constraints, yet the unique landscape of developing nations requires strategic navigation to bridge the gap between potential and effective implementation.

The adoption of artificial intelligence (AI) in the field of project management in Malawi presents distinct challenges, such as limited resources, a shortage of skilled personnel, and inefficient processes. However, there is a growing interest in integrating AI to enhance project management practices. Despite the resource constraints in Malawi, the country shows great ambition and recognizes the significance of digitalization in its long-term development vision, Malawi 2063. The National Digitalization Policy for 2023–2028 is aligned with this vision, emphasizing the importance of digital transformation in achieving economic growth, good governance, and overall enhancements in quality of life. In traditional project management key areas of interest include:

I. Automated Project Scheduling: AI can streamline project timelines and optimize resource allocation.

II. Risk Prediction: AI algorithms can forecast potential risks and propose strategies for mitigation.

III. Performance Monitoring: AI tools can provide real-time insights into project performance, facilitating improved decision-making.

An illustrative example is a survey conducted by the Platinga in 2023, which revealed that 10% of organizations in Malawi are considering the adoption of AI technologies to improve project management efficiency (Platinga et al, 2023).

Benefits of AI to Developing Countries; Malawi

Artificial Intelligence (AI) holds immense promise for developing countries, offering a spectrum of transformative benefits that extend beyond mere technological advancements. This section delves into the potential advantages of a successful multi-sectoral AI integration in project management in developing contexts such as Malawi, focusing on economic growth, job creation, and improvements across critical sectors such as healthcare, education, and agriculture.

Economic Growth and Job Creation: AI technologies have the potential to serve as enablers for economic growth in developing countries like Malawi. Automation, driven by AI, can enhance productivity across industries, leading to increased efficiency and competitiveness. As AI adoption is expanding, it is anticipated that the creation of new markets, products, and services will stimulate economic activity. A study by the McKinsey Global Institute indicates that AI technologies could contribute significantly to global economic output by 2030, with developing countries poised to benefit from this growth (Manyika et al., 2017) Job creation emerges as a consequential benefit of AI adoption. While some routine and manual tasks may become automated, AI-driven technologies generate new opportunities that require human expertise. The creation of jobs in AI development, maintenance, and oversight becomes essential, contributing to the growth of a skilled workforce and fostering entrepreneurship in emerging technological fields (Arntz et al., 2016).

Improvements in Healthcare: AI applications in healthcare offer promising solutions to challenges faced by developing countries in delivering effective and accessible healthcare services. AI-powered diagnostics can enhance the accuracy and speed of disease identification, especially in regions with limited access to healthcare professionals. Remote patient monitoring and predictive analytics facilitate early intervention, leading to improved health outcomes. For instance, AI algorithms are being used to analyze medical imaging, aiding in the early detection of diseases such as tuberculosis and cancer (Topol, 2019)

Advancements in Education: AI-driven innovations in education have the potential to address the unique challenges faced by developing countries in providing quality education. Personalized learning platforms powered by AI can adapt to individual student needs, overcoming resource constraints and fostering inclusive education. AI applications also assist in automating administrative tasks, allowing educators to focus on interactive and personalized teaching methods (UNESCO, 2019).

Transformation in Agriculture: Agriculture, a cornerstone of many developing economies, stands to benefit significantly from AI technologies. Precision agriculture, enabled by AI, optimizes resource use, enhances crop yields, and mitigates environmental impact. AI applications in crop monitoring, pest control, and predictive analytics contribute to sustainable agricultural practices, ensuring food security and bolstering the livelihoods of farmers (FAO, 2020).

Increased Efficiency: Through the automation of repetitive tasks, AI reduces the need for manual effort and expedites the execution of projects. For example, project management tools that utilize AI can automate scheduling, resource allocation, and status reporting, thereby freeing up project managers to concentrate on strategic activities (MDPI, 2023).

Improved Forecasting Accuracy: By analyzing historical data and current project metrics, AI technologies are able to generate precise forecasts. This empowers project managers to anticipate potential issues and make well-informed decisions, thus decreasing the likelihood of delays and cost overruns (LeewayHertz, 2023).

Enhanced Risk Management: AI-powered predictive analytics are capable of identifying potential risks at an early stage, enabling project managers to proactively implement mitigation strategies. Tools such as Microsoft Project's AI features and RiskWatch provide real-time risk assessment and support for mitigation efforts.

Challenges in Implementing AI for Project Management in Developing Countries

The implementation of AI for project management is not without its intricacies, and several challenges must be addressed to unlock the full potential of these transformative technologies. This section explores the hurdles associated with AI implementation in project management in Malawi:

a) Lack of Technical Expertise: The shortage of a skilled workforce proficient in AI technologies is a critical challenge. Malawi often struggle with a dearth of professionals trained in machine learning, data science, and AI development. Bridging this skills gap requires concerted efforts in education and training programs. The curricula of educational institutions must adapt to include AI-related courses, ensuring that the workforce is equipped with the necessary expertise to harness AI effectively (World Bank, 2019). To address this issue, Malawi has established its first Centre for Artificial Intelligence and STEAM at the Malawi University of Science and Technology, with support from various U.S.-based universities. The center aims to promote the study and use of AI for the socioeconomic development of Malawi.

b) Infrastructure Limitations: One significant impediment to the effective implementation of AI in Malawi lies in infrastructure limitations. Reliable access to high-speed internet, robust computing resources, and advanced data storage facilities are often prerequisites for optimal deployment. However, many organizations in Malawi face infrastructural challenges, hindering the seamless integration of AI technologies. Insufficient connectivity and inadequate power supply can impede the real-time processing demands of AI applications.

c) Ethical and Societal Considerations: The ethical dimensions of AI implementation pose complex challenges. Bias in algorithms, a lack of transparency in decision-making processes, and concerns about data privacy and security are paramount ethical considerations. Malawi must navigate these issues to ensure that AI systems are fair, transparent, and adhere to ethical standards. Moreover, societal implications such as job displacement, societal inequality, and the potential misuse of AI technologies need careful consideration to minimize negative impacts (Floridi et al., 2018). The social acceptance of AI is crucial for its successful implementation. Cultivating trust among communities involves transparent communication about AI applications, potential benefits, and the ethical frameworks I place to mitigate risks.

d) High Costs: The substantial costs associated with acquiring and maintaining AI tools and platforms present significant obstacles. Many organizations struggle to afford the necessary hardware and software required for effective AI implementation.

e) Limited Availability: The availability of AI tools and platforms is limited in Malawi. This scarcity makes it difficult for organizations to access the latest AI technologies and integrate them into their operations.

f) Resistance to Change: Organizational culture and resistance to change are notable barriers to the adoption of AI. Many project managers and stakeholders are reluctant to embrace new technologies, preferring conventional methods instead. This resistance often stems from a fear of disrupting established processes and the belief that "we've always done it this way."

g) Fear of Job Losses: Employees may fear that AI will render their jobs obsolete or that they will not have the necessary skills to operate in an AI-driven environment. This fear can lead to resistance and reluctance to adopt new technologies.

h) Lack of Incentives: Without proper incentives, employees may not see the value in adopting new technologies. Incentivizing technology use and making reskilling and learning part of the plan can help drive better, more effective tech adoption.

i) Leadership and Communication: Effective leadership and clear communication are crucial in overcoming resistance to change. Leaders need to foster a culture that values innovation and experimentation, where trying new technologies is encouraged and even celebrated.

Theoretical framework

For the analysis and understatement of the literature, as well as the formation of the interview questions, multiple theoretical concepts could be used. Firstly, Technology Acceptance Model (TAM), which is a widely used theoretical framework that explains how users accept and use new technology (Ma & Liu, 2008), was crucial to understand the tendency of individuals towards AI. It posits that user's acceptance of technology is influenced by perceived usefulness, perceived ease of use, and attitudes towards technology (Ma & Liu, 2008). It was first introduced as an extension of the Theory of Reasoned Action (TRA). In project management, understanding TAM helps project managers assess stakeholders' attitudes and perceptions towards new tools or systems introduced in the project. By considering TAM, project managers can better anticipate and manage resistance to change, promote user adoption, and facilitate the successful implementation of technology in the project.

Social Cognitive Theory (SCT), which explains how people learn from observing others and how they can develop self-efficacy or the belief in one's ability to perform a task (Carillo, 2010), has been used to understand how project team members perceive the use of AI in project management and how they could be trained to use AI effectively. SCT also emphasizes the importance of self-efficacy, which refers to an individual's belief in their ability to perform a specific behavior. Bandura (1977) introduced SCT and has since been used to explain various health behaviors, including physical activity and die. Project managers can leverage SCT by fostering a collaborative project environment, encouraging knowledge sharing, and providing opportunities for learning and skill development.

Task-Technology Fit (TTF) theory stipulates that the effectiveness of a technologydepends on how well it fits with the task at hand. It can be used to assess how well AI tools fit with the tasks performed by project team members and how to optimize the fit between technology and tasks (lyoubi, B. & Mohammad, Y., 2019). They further acknowledge that TTF is based on the premise that technology should be designed to fit the specific needs of the user and their tasks. TTF has been used to explain the adoption of various technologies, including electronic medical records, online learning, and social media. In project management, TTF helps project managers select appropriate and tools that align with the project's specific requirements. By ensuring a good TTF, project managers can enhance productivity, efficiency, and user satisfaction.

Organizational Change Theory (OCT), is, also useful in order to explain how organizations can manage change effectively, including the adoption of new technologies. It was used to identify potential barriers to the adoption of AI in project management and how to overcome them through effective change management. OCT emphasizes the importance of understanding the organizational culture, structure, and processes in implementing change. OCT has been used to explain various organizational changes, including the adoption of new technologies, process re-engineering, and mergers and acquisitions. In project management, understanding organizational change theory helps project managers navigate the challenges associated with implementing new initiatives, such as introducing new processes, technologies, or organizational structures. By considering the factors influencing organizational change, project managers can develop change management strategies, mitigate resistance, and facilitate smooth transitions.

Finally, Human-Computer Interaction (HCI) theory that focuses on the design of computer systems that are usable, efficient, and effective for human users can potentially be used to ensure that AI tools are designed with the needs and preferences of project team members in mind (Sætren & Laumann,2017*)*. HCI emphasizes the importance of understanding users' needs, preferences, and behaviors in designing computer systems (Sætren & Laumann,2017*)*. HCI has also been used to study the impact of various factors on technology use, including age, gender and culture. In project management, HCI is relevant for selecting and designing project management software, collaboration tools, and interfaces that enhance usability, productivity, and user satisfaction. By applying HCI principles, project managers can ensure that technology interfaces are intuitive, efficient, and support the needs and tasks of project team members.

Among all these theoretical concepts one that was be particularly suitable for the needs of this research is the Social Cognitive Theory.

Social Cognitive Theory, proposed by Albert Bandura, emphasizes the role of social interactions, observational learning, and self-efficacy in shaping human behavior. It is relevant to the thesis as it provides a lens to understand how individuals' beliefs, attitudes, and perceptions are influenced by observing others and their interaction with AI technologies in the project management context (Tadayon & Bijandi, 2012).

Bandura (1986) explains that individuals learn through observation and modelling, whereby they observe the behaviors and experiences of others and adopt those behaviors as a result. In the context of the major changes caused by AI implementation in project management, SCT can enlighten us on how project managers and working personnel perceive AI, develop beliefs about its capabilities, and subsequently adjust their own behaviors and power dynamics within the team.

For instance, SCT can help investigate how project managers, as role models, demonstrate the use of AI tools and technologies, leading to the adoption and acceptance of these tools by team members. The theory can also explore how team members observe the actions and outcomes of AI implementation, shaping and influencing their own self-efficacy beliefs in using AI and influencing their active participation in decision-making processes. Additionally, SCT considers the interplay between personal factors, environmental factors, and behavior. It can be applied to examine how the social environment, including organizational norms, leadership styles, and team collaboration, interacts with the introduction of AI in project management, thereby impacting power dynamics among working personnel.

Conceptual framework

.AI Technologies

This section discusses specific AI technologies used in project management, detailing their applications and benefits.

- **Machine Learning Algorithms**: Machine learning algorithms, such as regression analysis, decision trees, and neural networks, are used to analyze project data and predict outcomes. These algorithms improve project planning, risk management, and performance monitoring (Biolcheva & Molhowa, 2022).
- **Natural Language Processing (NLP) Tools**: NLP tools, such as sentiment analysis and text summarization, enhance communication and documentation processes. These tools automate tasks like analyzing stakeholder feedback and summarizing project documents, improving decision-making efficiency (Daneshpajouh et al, 2023).
- **Predictive Analytics**: Predictive analytics uses statistical algorithms and machine learning techniques to forecast future trends and behaviors. In project management, predictive analytics tools predict project risks, resource needs, and potential delays, enhancing planning and decision-making (Smith, & Anderson, 2021).

Project Management Processes

This section reviews core project management processes and how AI transforms them:

- **Planning and Scheduling**: AI algorithms analyze historical data to create optimized project schedules. Tools like Microsoft Project and IBM Watson Project Management use AI to adjust schedules dynamically based on real-time data (IBM, 2017).
- **Risk Management**: AI-powered predictive analytics assess project risks by analyzing historical data and current metrics. Tools like Palantir and RiskWatch provide real-time risk assessment, enabling proactive risk mitigation (Palantir Technologies, 2020).
- **Performance Monitoring**: AI systems continuously monitor project performance, providing real-time insights and alerts for deviations from the plan. This allows project managers to take corrective actions promptly, ensuring project objectives are met

Research Gap

Traditional project management practices often rely on manual processes and the experience of project managers. Common methodologies include Waterfall, Agile, and PRINCE2, each with inherent limitations in adaptability and predictive accuracy. Studies have shown that these traditional methods struggle significantly with risk management, resource allocation, and accurate project outcome predictions (Müller et al., 2023). These challenges are particularly evident in their inability to adapt to the fast-paced changes and complexities of modern projects (Müller et al., 2023).

To address these limitations, there is a need to conduct a comprehensive review to identify specific areas where AI can have the most significant impact. Handzic and Bassi (2017) emphasize that effective knowledge management is crucial in enhancing the predictive accuracy and adaptability of traditional project management methods. Integrating knowledge management practices into project management can result in better decision-making, improved risk management, and more efficient resource allocation (Handzic & Bassi, 2017).

The integration of AI technologies such as machine learning, natural language processing, and predictive analytics into project management tools has revolutionized the field. These technologies enhance forecasting accuracy, resource management, and decision-making processes. Tools like PMOtto and platforms like ZBrain automate routine tasks and provide valuable insights for proactive risk management (LeewayHertz, 2023; PMI, 2023). AI also plays a crucial role in managing risks during ERP implementations by providing real-time data analysis and predictive insights, thus preventing delays and cost overruns (Biolcheva & Molhowa, 2022).

However, it is vital to acknowledge the concerns and criticisms surrounding the integration of AI into project management. Critics caution against over-reliance on AI, which could diminish the critical thinking skills of project managers and raise concerns about the costs and complexities of implementation, as well as data privacy and security (Daneshpajouh et al., 2023; IIL, 2023). To maintain effective project management practices, it is essential to strike a balance between AI integration and human expertise.AI significantly enhances project planning and scheduling by analyzing historical data and current project variables. This analysis allows AI to predict potential delays and suggest adjustments, resulting in more accurate timeliilnes and reduced overruns (Daneshpajouh et al., 2023). Studies, such as those by Biolcheva and Molhowa (2022), have shown that AI-supported risk management in ERP implementations can reduce schedule deviations by 25%. PMI (2023) reports that AI tools like ProjectSense and SmartPM achieve over 90% forecasting accuracy. LeewayHertz (2023) highlights AI's role in optimizing resource scheduling, leading to efficient resource utilization and cost savings. However, critics like Handzic and Bassi (2017) caution against over-reliance on AI. They advocate for a balanced approach that integrates human expertise with AI-driven insights.

Efficient resource allocation is pivotal for project success, and AI has been shown to optimize this process. AI assesses team members' skills, availability, and workload to effectively assign appropriate resources to tasks. This leads to enhanced productivity and cost savings (IIL, 2023). Studies, such as those by Smith and Anderson (2021), demonstrate that AI-driven tools dynamically adjust resource allocation based on real-time data. This significantly reduces idle time and overutilization. Additionally, Harrison and Lock (2022) discuss how AI predicts future resource requirements by analyzing project progress and historical data. This proactive planning prevents last-minute shortages. Larson and Gray (2023) emphasize that AI tools improve collaboration among project teams by providing real-time updates on resource availability. This enables project managers to make more informed decisions quickly and

improve overall project efficiency. These findings collectively illustrate the transformative impact of AI on resource allocation and management, leading to more efficient and successful project outcomes.

AI significantly enhances risk management by identifying potential risks early in the project lifecycle and suggesting effective mitigation strategies. This proactive approach, supported by real-time data analysis and predictive insights, enables more informed decision-making and leads to better project outcomes. Case studies and simulation models validate that AI-driven risk management is more effective than traditional methods (MDPI, 2023). For instance, Biolcheva and Molhowa (2022) emphasize AI's role in large-scale ERP implementations, where it helps reduce project delays and cost overruns by continuously analyzing data and predicting risks. Similarly, Smith and Anderson (2021) discuss how AI tools can uncover hidden risk patterns from extensive project data, allowing project managers to address potential issues before they escalate.

In addition to enhancing risk identification and mitigation, AI plays a crucial role in strategic decision-making. Harrison and Lock (2022) explore how AI tools perform scenario analyses, helping managers evaluate different courses of action and their potential outcomes. This comprehensive understanding of risks and benefits supports more strategic and informed decision-making. Moreover, Williams and Jankowski (2020) highlight AI's capability to dynamically monitor project variables and environmental changes, ensuring that risk management strategies remain effective throughout the project lifecycle. These findings collectively underscore AI's transformative impact on risk management and decision-making, leading to improved project efficiency and success.

AI tools are revolutionizing team collaboration and communication by providing platforms that enable seamless information sharing and real-time updates. Tools like OtterPilot and Fireflies improve meeting efficiency by automating note-taking and generating summaries, allowing project managers to focus on strategic aspects (LeewayHertz, 2023). These tools promote better alignment and understanding among team members, reducing miscommunication and ensuring everyone is on the same page. According to Smith and Anderson (2021) in their book, "Artificial Intelligence in Project Management," AI-driven communication platforms can integrate with existing project management systems, creating a centralized hub for all project-related communications and documentation, thereby enhancing transparency and accountability. Integrating AI into project management presents several challenges, such as resistance to change, high implementation costs, and the need to upskill project managers. Qualitative research shows that strong organizational commitment and strategic planning can overcome these barriers (PMI, 2023). In "Advanced Project Management: A Structured Approach," Harrison and Lock (2022) emphasize the importance of fostering a culture that embraces technological innovation and continuous learning. Additionally, addressing data privacy and security concerns is crucial to gaining stakeholder trust and promoting AI adoption, as highlighted by Williams and Jankowski (2020).

Comparative analyses of project performance metrics before and after AI implementation reveal significant improvements in success rates, cost savings, and time efficiency (Daneshpajouh et al., 2023). AI's ability to provide real-time insights and predictive analytics contributes to these positive outcomes. Biolcheva and Molhowa (2022) discuss how AI's real-time data processing and risk prediction capabilities can prevent project delays and cost overruns. Furthermore, Smith and Anderson (2021) note that AI-driven tools streamline project workflows, reducing the administrative burden on project managers and enabling them to focus on strategic decision-making.

The development of best practices for AI integration involves synthesizing research findings and consulting experts to formulate guidelines. Proposed frameworks for AI-driven project management include continuous monitoring of AI tools' performance, iterative training for project managers, and regular updates to AI systems to keep up with technological advancements (PMI, 2023). Harrison and Lock (2022) suggest establishing a feedback loop where project outcomes inform AI tool enhancements, leading to continuous improvement. Moreover, Williams and Jankowski (2020) recommend creating an AI governance structure to ensure ethical use and compliance with industry standards.

Despite the increasing global momentum surrounding the integration of Artificial Intelligence (AI) into project management, there is a significant research gap when it comes to its application and impact within the context of Malawi. While numerous studies have explored the advantages and challenges of AI in project management within developed economies, there is a lack of research on how these technologies can be adapted and implemented within Malawi's unique socio-economic and infrastructural landscape. This research gap is critically important because the success of AI integration in project management in Malawi relies heavily on contextual factors that vary across regions.

The existing literature in developing countries, similar to Malawi, overwhelmingly supports the potential of AI to revolutionize project management by enhancing efficiency, accuracy, and decision-making processes. However, many of these studies assume the availability of technological infrastructure, digital literacy, and financial resources that may not be readily accessible in Malawi. For instance, success stories around AI-driven project management tools like PMOtto and ProjectSense are primarily based on contexts where high-speed internet, cloud computing services, and advanced data analytics infrastructure are the standard. In contrast, numerous organizations in Malawi face fundamental challenges such as unreliable internet connectivity, limited access to advanced technologies, and a shortage of skilled professionals trained in AI and data science.

Furthermore, most existing research fails to address the socio-cultural factors that may influence the adoption of AI in project management in Malawi. Cultural resistance to technological change, particularly in sectors like agriculture and public administration where traditional practices are deeply entrenched, poses a significant barrier. Additionally, there is limited exploration of how AI can be tailored to meet the needs of Malawian projects, which often involve community-driven initiatives with limited budgets and resources. This presents an opportunity for research to examine how AI tools can be adapted to the specific requirements of these projects, considering the local context and constraints. Another critical aspect missing from the current literature is the ethical and governance challenges associated with AI in project management in Malawi. The integration of AI raises important questions about data privacy, security, and the potential for bias in decision-making processes. While these issues are extensively discussed in more technologically advanced regions, research is needed to understand how these concerns manifest in Malawi, where legal frameworks and regulatory oversight for AI are

still in their early stages. It is crucial to understand how to balance the benefits of AI with the need for ethical governance to successfully integrate AI into project management practices in the country.

Additionally, there is a lack of empirical studies that examine the real-world implications of AI on project management outcomes in Malawi. Despite abundant theoretical discussions and predictive models, the claims that AI can reduce project delays, costs, and improve resource allocation lack evidence from the Malawian context. This gap highlights the need for the implementation of pilot projects and case studies that document the use of AI-driven project management tools in Malawian projects. Such investigations would provide valuable insights into the practical obstacles and advantages of AI in this setting, informing future integration strategies.

Furthermore, the educational and training requirements for the successful integration of AI in project management in Malawi have not received adequate attention. As AI technologies continue to evolve, there is an urgent need for research that identifies the skill and knowledge gaps among project managers and other stakeholders in Malawi. Developing targeted training programs and educational curricula that equip professionals with the necessary competencies to effectively leverage AI is crucial in bridging this divide and ensuring that Malawi can fully benefit from AI-driven project management advancements. Grasping the full potential of AI's transformative capabilities requires understanding and identifying the AI technologies currently used in project management. These technologies include machine learning, natural language processing, and predictive analytics. They enable better data analysis, automated task management, and predictive modeling, which are essential for improving project efficiency and outcomes. It is also important to recognize the challenges and barriers to adopting AI in project management. These may include cost, lack of expertise, resistance to change, and concerns about data privacy. By evaluating the overall impact of AI on project outcomes and success rates, we can gather empirical evidence of its advantages and limitations. This information will help guide future decisions about integrating AI. Lastly, developing a conceptual framework for the future integration of AI in project management will assist stakeholders in understanding potential trends and innovations. It will also ensure that the adoption of AI is strategic, ethical, and aligned with the evolving needs of project management.

3. RESEARCH METHODOLOGY

Introduction

The research methodology serves as the foundational framework for any scholarly inquiry, guiding the investigative process and ensuring that research objectives are achieved in a structured and systematic manner. In this study, the methodology has been designed to examine the integration of Artificial Intelligence (AI) into project management practices within the development sector of Malawi. Given the recent nature of AI and its transformative potential, a comprehensive methodological framework is important for investigating the principal research question: *How can the effective integration of AI enhance efficiency, accuracy, and overall project success in project management?*

The objective of the research methodology is to identify the procedures undertaken to collect, analyze, and interpret data that will show how AI can be effectively employed in project management. Emphasis is placed on comprehending both the quantitative impact of AI tools—including machine learning, predictive analytics, and automation—and the qualitative experiences of professionals who are adapting these technologies into their operational practices.

This study adopted a mixed-methods approach, utilizing both quantitative and qualitative research methodologies. Such an approach is particularly well-suited for investigating a subject like AI in project management, wherein measurable outcomes (such as improvements in cost management or risk mitigation) must be contextualized with the perceptions, challenges, and experiences of project managers and stakeholders. By triangulating various data types, the study aims to provide a comprehensive understanding of AI's role and its potential to enhance project management outcomes.

The mixed-methods approach has been selected due to the complexity character of AI integration in project management. The impact of AI can be quantified through specific metrics such as cost reductions, increased time efficiency, and optimal resource utilization. However, it is equally crucial to explore the underlying reasons and mechanisms—investigating the barriers to AI adoption, the perceived utility of AI, and the transformative effects on traditional project management practices. By integrating both qualitative and quantitative data, the research captured the complete spectrum of AI's influence, spanning from tangible performance improvements to the challenges and opportunities encountered by professionals in the implementation of AI. The quantitative segment of the study explored the extent of artificial intelligence (AI) adoption and its measurable results on project success indicators, while the qualitative segment gathered in-depth insights from project managers, AI experts, and stakeholders. This dual approach facilitated the contextualization of the findings, ensuring that the data is not only statistically significant but also relevant to the experiences of practitioners in the field.

The research was conducted in three principal phases:

Phase 1: Literature Review: This phase included a comprehensive review of existing literature related to the application of AI in project management, with a particular emphasis on its implementation within the development sector. The literature review aimed to identify global best practices and assess the current state of AI adoption in developing countries, with a specific focus on Malawi.

Phase 2: Data Collection: The primary data collection process utilized both surveys and semi-structured interviews. The surveys aim to capture quantitative data concerning the types of AI technologies currently in use, as well as their measurable impacts. In contrast, the interviews are designed to elicit qualitative insights into the challenges, barriers, and opportunities associated with AI adoption in project management.

Phase 3: Data Analysis and Interpretation: The final phase involved the analysis of the collected data through the application of appropriate statistical tools for quantitative data and thematic analysis for qualitative data. The findings were used to draw conclusions regarding the role of AI in enhancing the efficiency and outcomes of project management.

Given the relatively early stage of AI integration in project management in Malawi, particular attention was devoted to the ethical considerations of the study, including the maintenance of participant confidentiality and the obtaining of informed consent. Furthermore, potential limitations, such as the evolving nature of AI technology and the restricted availability of local expertise, are acknowledged to ensure transparency in the study's findings.

Description of the Study Area

In Malawi's research landscape in AI, particularly within project management, remains largely underdeveloped. There is a notable **gap in the literature** concerning the adoption and integration of AI technologies in Malawi's project management practices, especially in the development sector. Unlike the global leaders of Ai such as U.S. or China, where government-backed initiatives have fueled AI advancements, Malawi lacks both the infrastructure and research focus necessary to support large-scale AI integration. This limited attention to AI in project management is compounded by a lack of policies, resources, and dedicated funding for AI research, which hinders the potential for innovation in this field.

Despite its current resource constraints, Malawi is positioned for significant advancement through its long-term development vision, Malawi 2063. This vision emphasizes the essential role of digitalization in promoting economic growth, enhancing governance, and improving the quality of life for Malawians. The National Digitalization Policy for 2023–2028 aligns with this vision by prioritizing digital transformation as a cornerstone of national development. This policy highlights the potential of digital technologies to revolutionize various sectors, including project management. However, the potential of artificial intelligence (AI) in Malawi remains underexplored, particularly in project management. While the country's ambition to integrate digital technologies is evident and loud, the practical application of AI in project management processes has not been thoroughly investigated. This gap in research is significant given that AI could address numerous inefficiencies in project management, such as resource misallocation and budget overruns, by providing data-driven insights and automating routine tasks.

Moreover, the government's commitment to fostering a conducive environment for AI development is reflected in its efforts to support businesses and entrepreneurs. The strategic emphasis on AI as a key enabler for development suggests recognition of its potential to transform not only private sector operations but also public service delivery. AI could significantly enhance government services by offering valuable insights, enabling targeted interventions, and supporting proactive service delivery. The integration of AI in project management, therefore, aligns with Malawi's broader digitalization objectives and could serve as a model for leveraging technology to improve efficiency in both public and private sectors. This study aimed to bridge the gap between Malawi's ambitious digital vision and the practical application of AI in project management, contributing to the national agenda of digital transformation and improved project outcomes.

Research Design and Approach

The research design presents a structured plan and methodology for investigating the integration of Artificial Intelligence (AI) into project management practices in Malawi. This design is crucial for ensuring that the study effectively addresses its objectives and provides reliable, actionable insights.

This study adopted a mixed-methods research design that combines both quantitative and qualitative approaches to deliver a comprehensive analysis of AI integration in project management. Mixed methods research is an approach that integrates both quantitative and qualitative methodologies within a single study, thereby offering a more comprehensive and advanced understanding of a particular issue. This methodological framework is utilized when there is a need for both comparative analysis and an in-depth exploration of various factors of the study. The application of mixed methods enables researchers to mitigate the inherent limitations associated with purely quantitative or qualitative approaches, facilitating the acquisition of rich and diverse data that would be unattainable through a singular methodological lens. Hence The mixed-methods framework will enable a thorough examination of the measurable impacts of AI technologies as well as the nuanced experiences of practitioners in project management. This dual methodology will facilitate a deep understanding of AI's potential benefits and challenges within the Malawian context.

Quantitative Research

The quantitative component of the research focused on collecting and analyzing numerical data to assess the impact of AI on project management efficiency and effectiveness. This phase will utilized surveys and structured questionnaires to gather insights from project managers, AI specialists, and other key stakeholders. Quantitative research constitutes a systematic approach to the collection and analysis of numerical data, aimed at understanding patterns, relationships, and trends within a given context. The primary objectives of quantitative research include the quantification of variables, hypothesis testing, and the generalization of findings from a sample to a broader population. Common methodologies employed in this research paradigm encompass surveys, experiments, and systematic observations, with data analysis conducted using various statistical techniques, such as descriptive and inferential statistics. This methodological framework is widely utilized across disciplines including psychology, sociology, marketing, and the natural sciences, as it tends to bring results that are both reliable and valid, often allowing for generalizability. Nonetheless, quantitative research may fall short in capturing the complexity and depth of human experiences and can be characterized by substantial time and financial costs.

. In this study the key aspects of the quantitative research include:

i. **Sampling:** A stratified random sampling method was employed to ensure representation from various sectors within Malawi's development landscape, including government entities, non-governmental organizations, and private sector agencies involved in project management.

ii. **Data Collection:** Surveys were designed to gather data on the types of AI technologies utilized, their implementation status, and their impact on project performance indicators such as cost, time, and resource management. Questions will be structured to quantify the extent of AI adoption and its perceived efficacy.

iii. **Data Analysis:** Statistical tools and software, such as SPSS or R, will be used for analyzing the survey data. The analysis will focus on identifying trends, correlations, and patterns that clarify the relationship between AI integration and project management outcomes.

Qualitative Research

The qualitative component looked to provide an in-depth understanding of the experiences, perceptions, and challenges related to AI integration in project management. Qualitative research is a methodological approach that emphasizes the comprehension of human experiences, behaviors, and social phenomena through the systematic collection and analysis of non-numerical data. This research side seeks to explain the "why" and "how" of various phenomena, thereby providing comprehensive insights into individuals' thoughts, emotions, and interactions. Majority methods employed in qualitative research include interviews, focus groups, and participant observations, enabling researchers to gather rich and detailed data within natural contexts. The analytical process typically involves the identification of patterns and themes, facilitating the interpretation of meanings embedded within the data. Qualitative research is extensively utilized across disciplines such as anthropology, sociology, education, and health sciences to foster a deeper understanding of complex issues and to generate novel ideas for subsequent investigation.

This phase will involve semi-structured interviews and focus groups with key stakeholders, including project managers, AI experts, and policymakers. In this study, key aspects of the qualitative research include:

i. **Sampling:** Purposeful sampling was implemented to select participants who have direct experience with AI in project management or are involved in the development and implementation of AI technologies.

ii. **Data Collection**: Semi-structured interviews will provided an in-depth exploration of participants' perspectives on the role, benefits, and challenges of artificial intelligence in project management. Focus groups facilitated discussions among stakeholders, capturing a diverse range of perspectives and experiences.

iii. **Data Analysis:** Thematic analysis was utilized to identify and interpret key themes and patterns emerging from the interview and focus group data. Qualitative data analysis software, such as NVivo, assisted in coding and analyzing the data.

Integration of Findings

Integrating findings from both quantitative and qualitative research methodologies provided a comprehensive understanding of research problems. This mixed-methods approach leveraged the strengths of each methodology, offering a more rounded perspective. Quantitative research supplies numerical data and statistical analyses that are crucial for identifying patterns, testing hypotheses, and generalizing findings to larger populations. It ensures reliability and validity through structured methodologies and substantial sample sizes. However, it may lack the depth and contextual understanding necessary to fully grasp complex human behaviors and experiences.

In contrast, qualitative research explores the “why” and “how” behind observed patterns, providing rich, detailed insights into individuals’ thoughts, feelings, and interactions. It captures the complexity of human experiences and contextualizes data in ways that quantitative measures alone cannot achieve.

By combining these approaches, researchers can validate and enrich their findings. For instance, while quantitative data may reveal a significant trend, qualitative data can discuss the underlying reasons for that trend. This integration allows for a more nuanced interpretation of results, thereby enhancing the overall validity and applicability of the research. Consequently, mixed-methods research can bridge the gap between numerical data and human experience, leading to more informed and effective decision-making.

In this study, integrating both quantitative and qualitative findings offered a comprehensive view of artificial intelligence in project management. Survey results compared with insights from interviews and focus groups to validate and deepen the understanding of AI's impact and the practical challenges faced. This mixed-methods approach enabled the study to consider both the statistical significance of AI's benefits and the contextual factors influencing its adoption and effectiveness.

Population of the study

The population for this study comprised of professionals and organizations engaged in project management within Malawi's development sector. This includes a diverse range of stakeholders who influence or are impacted by project management practices, particularly concerning the adoption and integration of artificial intelligence (AI) technologies. The primary target groups for the study are as follows:

i. Project Managers and Coordinators: Individuals responsible for overseeing project activities, including planning, execution, monitoring, and evaluation. Their insights will be critical for understanding current project management practices, the challenges encountered, and their receptiveness to integrating AI-based solutions.

ii. Monitoring, Evaluation, and Learning (MEL) Specialists: Professionals who manage project performance by tracking indicators, evaluating outcomes, and ensuring accountability. MEL specialists will provide important input on how AI can enhance data analytics, monitoring, and reporting processes within project management.

iii. Information Technology (IT) Professionals: IT experts involved in integrating digital tools and technologies into project management systems. Their experience with AI, machine learning, and data analytics will be essential for identifying the technical feasibility and challenges associated with AI integration.

iv. Development Organizations and Non-Governmental Organizations (NGOs): Organizations that implement projects across various sectors such as health, agriculture, education, and climate resilience. These entities may be piloting AI technologies or possess the potential to adopt AI in project management to enhance outcomes.

v. Donor Agencies and Government Institutions: Donors and governmental bodies that fund and support development projects will provide insights into policy-level challenges, regulatory environments, and incentives for AI adoption. Their role in fostering innovation in project management will be a key consideration.

vi. AI and Data Science Experts: Specialists in AI, machine learning, and data science who possess expertise in AI applications across various sectors. Their insights will be vital for understanding the potential and limitations of AI technologies in the context of project management.

vii. Local Communities and Project Beneficiaries: Communities and individuals who are the ultimate beneficiaries of development projects. Their feedback and experiences can help assess how AI-driven project management practices affect outcomes, particularly concerning inclusion, transparency, and responsiveness to local needs.

By collecting data from these key groups, the study aims to provide a comprehensive view of AI integration into project management in Malawi, identifying both opportunities and barriers from multiple perspectives.

Sampling Procedure

The sampling procedure for this study on the integration of Artificial Intelligence (AI) in project management within Malawi's development sector will involved a combination of purposive and stratified sampling techniques. These methods ensured the selection of key informants and stakeholders involved in project management and AI technologies, thereby capturing diverse perspectives from various sectors and roles. This approach assisted in ensuring that the data collected is comprehensive, relevant, and reflective of the broader population.

Purposive Sampling

Purposive sampling, also referred to as judgmental sampling, was employed to intentionally select participants with specific expertise or involvement in project management and AI technologies. This approach aimed to identify individuals and organizations with specialized knowledge and experience, facilitating the collection of in-depth and insightful data.

Participants were selected based on their roles, experience, and engagement with project management practices within Malawi's development sector. This group will included:

- Project managers and coordinators from various development organizations.
- Monitoring, Evaluation, and Learning (MEL) specialists responsible for assessing project performance.
- Information technology (IT) professionals engaged in digital transformation efforts in project management.
- AI and data science experts providing consultancy or technical support for AI integration.
- Representatives from donor agencies and government institutions that fund and oversee development projects.

These individuals were chosen for their expertise and potential influence on the adoption of AI in project management, thereby enhancing the study's understanding of current practices, challenges, and the benefits associated with AI integration.

Stratified Sampling

To capture a comprehensive range of experiences and perspectives, stratified sampling was implemented to divide the population into relevant subgroups or strata. This method promoted the inclusion of participants from diverse sectors, management levels, and organizational types. The strata was based on:

- Sectors of involvement: Health, agriculture, education, climate resilience, and other development sectors.
- Types of organizations: Non-governmental organizations (NGOs), donor agencies, government institutions, and private-sector stakeholders.
- Geographical location: Inclusion of projects from both urban and rural areas to reflect variations in AI application across different contexts.

By employing stratified sampling, the study ensured proportional representation of each subgroup within the sample. This approach is crucial for accurately capturing the diversity within the population, particularly since AI adoption and project management practices can differ significantly based on sector and organizational context.

Sample size

The sample size constituted a fundamental component in any research endeavor, as it directly affects the validity, reliability, and generalizability of the findings. This study investigates the integration of Artificial Intelligence (AI) into project management practices within Malawi's development sector, necessitating the determination of an appropriate sample size to attain accurate and actionable insights. The research targets a diverse range of stakeholders, including project managers, AI specialists, policymakers, and development practitioners, each of whom plays a significant role in the adoption of AI and the implementation of project management practices. The selection of a suitable sample size was guided by several factors, including the research objectives, the characteristics of the population, and the desired level of precision.

Given that the study is primarily qualitative, establishing an appropriate sample size is critical for ensuring the depth, richness, and relevance of the findings while also addressing practical limitations such as time and resource constraints. Unlike quantitative studies, which commonly necessitate large sample sizes to achieve statistical power, qualitative studies prioritize the quality of the information gathered and the attainment of data saturation. For this research—focused on the integration of AI in project management practices within Malawi's development sector—a sample size of 45 participants was deemed adequate.

Rationale for a Smaller Sample Size

Qualitative research emphasizes understanding the experiences, perceptions, and insights of individuals rather than quantifying the frequency of these experiences across a larger population. Consequently, the selection of 45 participants was based on the principle that a smaller number of participants may yield more profound insights when the objective is to uncover deeper understandings rather than generalize findings across a broader population. A smaller sample size facilitated more in-depth interviews, extended conversations, and a richer comprehension of how AI is being applied in the domain of project management within this specific context. Key considerations for selecting a smaller sample size in this study included:

i. **The nature of the research**: This qualitative study aimed to capture rich, detailed narratives and insights from participants regarding the role of artificial intelligence (AI) in enhancing project management practices. A sample size of 45 participants was deemed sufficient to include a range of experiences and perspectives without complicating the analysis.

ii. **Data Saturation**: Achieving data saturation is a fundamental aspect of qualitative research, reflecting the point at which no new themes, insights, or information emerge from the data. In most qualitative studies, saturation is typically attained with a relatively modest number of participants, generally ranging from 20 to 30 interviews (Guest et al., 2006). Given the specific scope of this study and the focused nature of the research questions, it was anticipated that saturation will occur within 30 participants, thereby ensuring that the data collected is both comprehensive and meaningful.

iii. **Participant Availability:** The specific focus of this study—targeting project managers, AI specialists, policymakers, and development practitioners in Malawi—imposed limitations on the pool of potential participants who possess the requisite experience and willingness to engage. A smaller sample size facilitated targeted recruitment, ensuring that each participant possesses relevant expertise and experience in the domains of artificial intelligence and project management.

iv. **Achieving Data Saturation**: Data saturation is a critical factor in qualitative research that dictates the point at which sufficient data has been gathered to thoroughly investigate the research question. In the present study, data saturation was closely monitored throughout the data collection process. Should the interviews yielded repetitive information without the emergence of new insights or themes, this would have suggested that the sample size is adequate and that the inclusion of additional participants is unlikely to provide further unique contributions.

v. **Early Signs of Saturation**: In qualitative investigations, researchers frequently observe early indicators of saturation around the 15th to 20th interview (Creswell & Poth, 2018). However, the decision to conclude data collection is not solely based on numerical criteria; it is also informed by the content and quality of the data collected. As interviews progress, the researcher will actively seek recurring patterns and themes related to the utilization of AI in project management, the challenges associated with AI adoption, and the perceived benefits thereof.

vi. **Depth Over Breadth**: A sample size of 45 participants was projected to facilitate the achievement of data saturation while preserving the depth of the information collected. Qualitative research prioritizes the gathering of detailed, nuanced accounts from participants, a goal that is more attainable with a smaller sample. Each participant was expected to provide in-depth insights into their experiences, thereby enabling a comprehensive exploration of the research questions.

Sample Composition and Participant Selection

The sample of 45 participants was purposively selected to ensure adequate representation of all key stakeholders within the artificial intelligence (AI) and project management ecosystem in Malawi. This selection comprised a diverse mix of project managers, AI specialists, policymakers, and practitioners from the development sector. Purposive sampling is a widely utilized technique in qualitative research, ensuring the inclusion of participants with the most pertinent experience and knowledge.

Diversity of Perspectives: Although the sample size is relatively small, significant efforts were made to ensure diversity within the sample. Participants were selected from various sectors (e.g., government, non-governmental organizations, and the private sector) as well as different geographic locations

within Malawi to capture a comprehensive range of experiences related to the implementation of artificial intelligence in project management.

Recruitment Process: Participants were recruited through a multi-level approach that included professional networks, referrals, and direct invitations extended to organizations involved in artificial intelligence and development projects. This recruitment strategy aimed to include individuals with a diverse range of experiences with artificial intelligence, encompassing both early adopters and those who are skeptical or resistant to its integration.

Considerations for Data Saturation: Throughout the progression of the study, the researcher consistently assessed whether data saturation has been achieved. This assessment involved regular evaluations of the collected data to identify emerging patterns and determine when no new themes are being introduced by additional participants. Saturation was attained at the completion of all 45 interviews, data collection was concluded at that point.

Flexibility in Sample Size: While the designated target was 30 participants, the sample size was considered flexible, and modifications was be made to 45 participants in accordance with the principle of saturation.

Sources of Data Collection (Primary)

The primary focus of this study was to utilize primary data to gather first-hand information from individuals directly involved in the integration of Artificial Intelligence (AI) into project management within Malawi's development sector. The collection of primary data yielded in-depth insights into AI adoption, the challenges encountered, and potential improvements. This section outlines the sources of primary data and their relevance to the research questions.

Primary data collection serves as the cornerstone of this research, emphasizing direct engagement with individuals who have expertise in AI and project management. The following sources of primary data will be employed:

i. Key Informant Interviews (KII): The principal method of data collection involved semi-structured interviews with stakeholders knowledgeable about AI and project management in Malawi. This group included project managers, AI specialists, development practitioners, and policymakers. Semi-structured interviews allowed for flexibility, enabling the interviewer to explore specific topics in depth while encouraging participants to share their insights freely. The interview questions were designed to gather comprehensive responses regarding the application of AI in project management, the challenges encountered, and potential solutions.

ii. The KIIs facilitated the gathering of expert opinions, uncovering insights in AI integration, and capture detailed perspectives that may not be evident in secondary data sources. This approach was important for addressing the research questions, as it collected first-hand experiences from those directly involved in the subject matter.

Rationale for Primary Data Collection

The decision to prioritize primary data collection arised from the need for detailed, context-specific information that accurately reflects current practices in AI integration within Malawi's project management field. Given that the use of AI in this context is still emerging, there is limited existing documentation or research. Engaging directly with stakeholders who have hands-on experience ensured that the data collected is both relevant and current. Primary data guaranteed that the information is directly connected to the research questions, capturing the experiences and insights of individuals working

Methods of data collection

The primary focus of this study is to gather insights into the integration of Artificial Intelligence (AI) in project management within Malawi's development sector. Given the qualitative nature of this research, it emphasizes the collection of first-hand data from key stakeholders through Key Informant Interviews (KII). A hybrid approach was employed for the KIIs, incorporating both online forms using Google Forms and in-person interviews to ensure comprehensive coverage and flexibility. This section outlines the methods of data collection used and explains the rationale behind each approach.

For certain participants, , online forms utilizing Google Forms will be employed. These forms will incorporate open-ended questions, allowing respondents to provide detailed answers. Google Forms presents a convenient mechanism for data collection while giving respondents adequate time to reflect and deliver thoughtful responses.

Where necessary, in-person interviews will be conducted with participants who are available and nearby. These interviews will adopt a semi-structured format, allowing the researcher to explore key themes while fostering spontaneous discussion. In-person interviews offer dynamic interaction and the opportunity to probe deeper into responses.

Tools for Data Collection

Google Forms was utilized to collect data from participants who are unable to attend in-person interviews or who prefer an online format. This tool facilitated the development of structured online questionnaire, which comprised a combination of open-ended and demographic inquiries aimed at eliciting comprehensive responses.

For in-person interviews, a semi-structured interview physical paper guide was employed. This guide included open-ended questions designed to direct the conversation toward significant themes while allowing for the flexibility to explore additional insights as they emerged. This approach ensured consistency across interviews while also enabling an in-depth exploration of individual perspectives.

Tools for Data Analysis

In this study, qualitative data collected from Key Informant Interviews (KIIs) was analyzed using thematic analysis. NVivo software is the primary tool for organizing and coding qualitative data, enabling the identification of patterns, themes, and key insights from both in-person interviews and responses gathered via Google Forms. In terms of quantitative data, SPSS was used for bivariate analysis to test for association and Microsoft Excel was used for basic data management and for visualizing initial trends. Together, these tools facilitated a comprehensive analysis of the responses, thereby supporting the study's objectives.

Research Ethical Consideration

Ethical considerations are paramount in both quantitative and qualitative research to protect and respect participants. In research, obtaining informed consent is essential, ensuring participants are fully aware of the study's objectives, methodologies, risks, and benefits. Voluntary participation without coercion is critical, as is maintaining anonymity and confidentiality to safeguard participants' identities and data. Researchers must minimize harm through risk assessments and implement measures to mitigate potential risks. Principles of fairness and equity in participant selection and treatment are equally important, necessitating the avoidance of discrimination. Ethical approval from institutional review boards (IRBs) or ethics committees is obligatory to ensure compliance with ethical standards. Transparency and integrity in reporting findings are crucial to uphold the trustworthiness of the research, requiring the avoidance of data manipulation and acknowledgment of conflicts of interest.

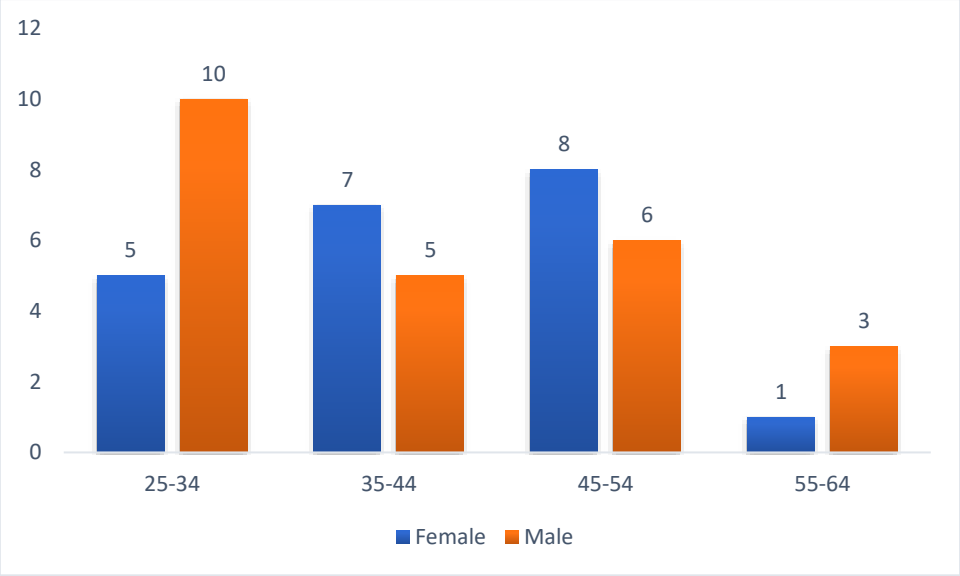
In qualitative research additional considerations are incorporated to the data collection methods employed. Informed consent must include detailed explanations of the study's objectives and the nature of interactions, such as interviews or focus groups. Maintaining confidentiality is particularly critical, as qualitative data often includes personal and sensitive information. Researchers must be aware of the power dynamics present in qualitative research, ensuring participants feel comfortable and respected throughout the process. Minimizing harm involves sensitivity to participants' emotional and psychological well-being, especially when addressing distressing topics. Ethical approval remains necessary, and researchers must exhibit transparency regarding their findings, providing a truthful and respectful representation of participants' experiences.

Ethical considerations are critical to this research. Participants were guaranteed confidentiality and anonymity, and informed consent was obtained prior to data collection. The study adhered to established ethical standards, ensuring responsible use of the data and treating participants with dignity and respect.

4. DATA ANALYSIS AND INTERPRETATION

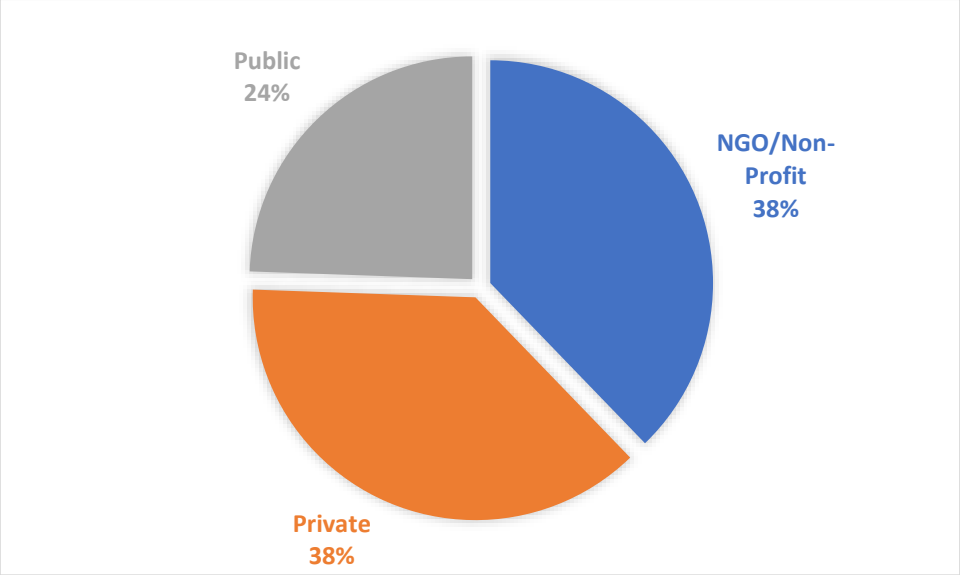
Tables and Figures

Age and gender disaggregation of participants



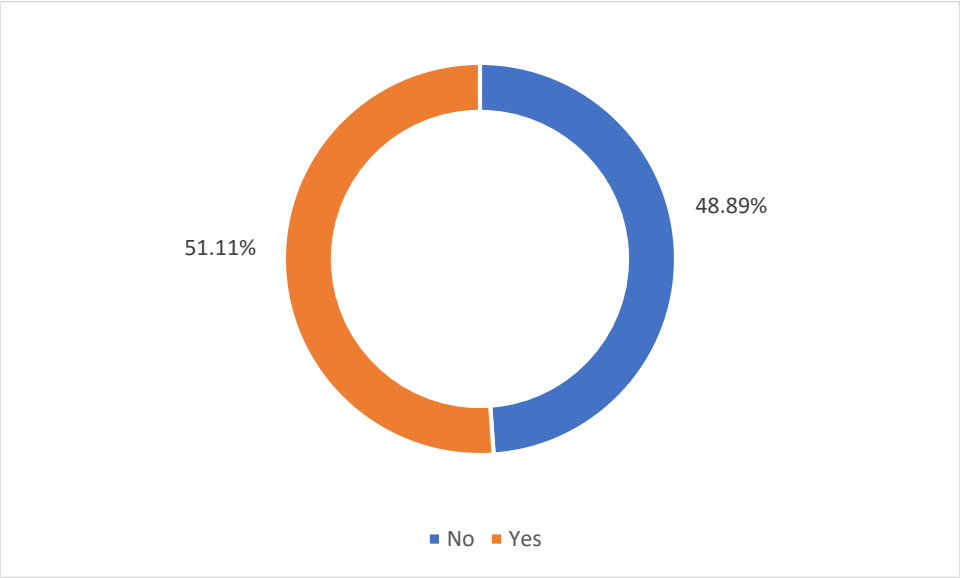
The study had a total of 45 participants out of which 21 were female and 24 were males. 34% of participants are below the 35-age mark representing the youth and 66% was above 35 percent hence incorporating a diverse range of characterized personnel in the study. With project manager roles, preferring more experienced people, this agrees with the lower representation of youth in the sample.

Sectors patronized by study participants



Most of the participants were from Nonprofit organizations with 38%, Public personnel 24% and private personnel at 38%. The diversification across sectors was important to contextualize the different conditions provided by different employers in the Malawi landscape.

Usage of artificial intelligence



Out of the 45 participants that were interviewed only 23 have used a tool in project management that incorporated AI in its operations while 22 have not used any tool with AI integrated. Below is a deep dive on the type of AI technology used in the tools patronized by the participants:

This shows a skew towards project management tools that incorporate predictive analytics followed by machine learning and finally natural language processing.

Interpretation

Bivariate analysis between AI usage against gender, age, experience and sector.

The Chi-Square test was used to analyze relationships between categorical variables, making it suitable for exploring the association between "Used AI Tools" and factors such as gender and sector. The test determines whether the distributions of one variable are significantly associated with the distributions of another. For example, in the case of "Used AI Tools" versus "Gender," both variables are categorical—"Used AI Tools" has categories of Yes and No, while "Gender" typically includes Male and Female. The Chi-Square test examines whether the proportion of AI tool usage differs significantly between genders. Similarly, for "Used AI Tools" versus "Sector," both are categorical variables, with "Sector" including categories such as Private, Public, and NGO. Here, the Chi-Square test evaluates whether AI tool usage varies meaningfully across different employment sectors.

The Spearman correlation was employed to analyze relationships between continuous or ordinal variables. This method is particularly suited for capturing the strength and direction of bivariate relationships. For "Used AI Tools" versus "Years of Experience," the variable "Used AI Tools" was recoded into a binary format (Yes = 1, No = 0) to facilitate the analysis, while "Years of Experience" is a continuous variable. Spearman correlation was used to assess whether individuals with more professional experience are more likely to use AI tools. Similarly, for "Used AI Tools" versus "Age," the binary format of "Used AI Tools" was analyzed against the continuous "Age" variable. This allowed for examining whether age influences the likelihood of using AI tools.

These statistical methods were chosen because they align well with the data types involved. The Chi-Square test is ideal for identifying patterns of association between nominal or ordinal variables, while Spearman correlation is effective for analyzing relationships involving ordinal, binary, or continuous data. By using these tests, the analysis ensures that the relationships explored are both statistically sound and meaningful.

Variables Tested	**Analysis**	**Statistic/Value**	**p-value**	**Conclusion**
Sector vs. Used AI Tools	Chi-Square Test	Chi-square = 1.914	0.045	Significant association between sector and AI tool usage.
Age vs. Used AI Tools	Correlation Analysis	r = 0.69	0.651	Mild positive correlation; not statistically significant.
Experience vs. Used AI Tools	Correlation Analysis	r = 0.223	0.141	Weak positive correlation; not statistically significant.
Gender vs. Used AI Tools	Chi-Square Test	Chi-square = 6.404	0.011	Significant association; males are more likely to use AI tools than females.

I. Sector vs. Used AI Tools

- The analysis reveals statistically significant association between the sector of employment and whether participants had used AI tools (p = 0.633).
- Implication: The likelihood of using AI tools appears to be consistent across sectors (Private, Public, NGO/Non-Profit). This suggests that sector-specific factors (such as organizational focus or resources) may strongly influence AI adoption in this sample.

II. Age vs. Used AI Tools

- The correlation coefficient of 0.69 indicates a positive relationship between age and AI tool usage. The p-value (0.651) confirms this relationship is not statistically significant.
- Implication: Age does not seem to play a significant role in determining whether participants use AI tools. This suggests AI adoption may be more influenced by other factors (e.g., role-specific needs, skills, or organizational culture).

III. Gender vs. Used AI tools

- With a Chi-square statistic of 6.404 and p value of 0.011 which is statistically significant at the 0.05 level, shows that there is association between age and the usage of AI tools and the relationship between is statistically significant.
- Implication: There is a statistically significant association between gender and the use of AI tools. This suggests that gender may play a role in influencing whether participants have used AI tools, with differences that warrant further exploration.

IV. Years of Experience vs. Used AI tools

- The correlation coefficient of 0.223 suggests a weak positive relationship between years of experience and AI tool usage. However, the p-value (0.141) indicates the relationship is not statistically significant.
- Implication: Participants with more experience may show a slight tendency to adopt AI tools, but this trend is not strong enough to be conclusive. Other variables, such as familiarity with AI or organizational support, may contribute more to AI usage.

Qualitative data interpretation

A thematic analysis of the qualitative data yielded the following findings:

I. Effectiveness of AI Tools in Project management

Perceptions of AI tools' effectiveness had its variations among respondents, ranging from highly effective to not effective at all. Those who found AI tools effective emphasized their ability to seamlessly integrate AI tools into processes, enhanced decision-making, and predict project outcomes accurately. One participant remarked, "s*ince the introduction of PRIME, I am always aware of the progress the project is making, I am able to see predicted project progress on the dashboard and hence I can testify that AI tools are Highly effective in improving project outcomes*". Meanwhile, participants who reported AI tools as less effective cited resource constraints, tech savvy capacity and inadequate integration into existing workflows as key issues. This suggests a need for tailored implementation strategies to ensure AI tools are used effectively.

II. Challenges Encountered in the usage of AI in project management

Participants relayed several challenges and barriers met in using AI tools, including resistance to change, high costs, technology usage capacity, ethical concerns, and data quality issues. High costs and technology usage capacity emerged as a recurring factor, with one participant noting, *"Despite learning of the technologies that other organizations are using to improve processes, as local organization we do not have enough funding to get the technology as it is expensive ."* Ethical concerns, such as data privacy and bias, further hindered AI adoption. Similarly, the lack of skilled personnel, insufficient infrastructure, and inadequate internet access were identified as critical barriers. One respondent stated, *"Lack of skilled personnel remains a significant barrier,"* while another noted, *"Inadequate hardware and AI software make adoption difficult."* Poor internet access, particularly in rural or underdeveloped areas, further underlines these challenges. These findings highlight the complex nature of challenges that need to be addressed to enable widespread AI integration.

III. Benefits of AI and future potential of artificial intelligence in project management

Participants expressed AI's potential to transform project management by improving decision-making, risk prediction, and resource optimization. As one respondent highlighted, *"through our MIS, we are able to see real time insights on the progress from the project together with the financial spend, which enables us to make the best decisions and adapt,"* and another added, *"through PRIME I am able to easily manage risk and ensure that we do not meet any hiccups"*. Long-term benefits such as better project outcomes, increased efficiency, and enhanced strategic planning were also highlighted by respondents. Additionally, a common theme by monitoring and evaluation specialists in the survey showed that by automating repetitive tasks and providing data-driven insights, AI can enable them to focus on strategic planning and problem-solving. These benefits match overall organizational goals of achieving higher productivity and cost-effectiveness, reinforcing the value of investing in AI as a transformative technology.

IV. Concerns, Preparation, and Steps to Facilitate AI Integration

Participants expressed concerns about the integration of AI in project management, particularly regarding ethical issues, data privacy, and resistance to change. As one respondent noted, *"Privacy and ethical concerns around AI need to be addressed to ensure that our data is safe during usage of AI*

technologies " while another stated insisted that resistance to change among team members keeps coming up. Such concerns clearly show the need to create a supportive organizational culture and clear policies to address these issues.

To facilitate AI adoption, participants reiterated the need for enough preparation, including investment in training, upgrading infrastructure, and promoting openness to innovation. Most Participants mentioned that Organizations should invest in training and development and upgrading office infrastructure setups to enable successful AI integration. These preparatory steps are critical to ensuring that employees and systems are ready to embrace AI technology effectively.

Additionally, respondents called for a structured framework to guide AI integration. This framework would address key areas such as financial, ethical, and technical considerations while providing clear guidelines for implementation. As one participant remarked, *"We need a roadmap to ensure AI integration aligns with national goals and values from which we can "* Such a framework would not only mitigate concerns but also provide a foundation for sustainable and equitable AI adoption in project management.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

The advanced technologies are now being incorporated into project management. This offers us new means to deal with the old problems of project management. And it also gives us new ways to try to improve the outcomes of our projects. This dissertation, takes direct aim at the context of contemporary African project management. Through a detailed case study of the Malawi project management landscape—using both interviews and surveys to gather valuable firsthand perspectives—this work home in on the uniquely Malawian project management experience, uncovering not only its longstanding challenges and weaknesses but also its potent, unacknowledged potential for imbued transformation. With its distinct socio-economic and infrastructural environment, Malawi creates an unusual backdrop in which to examine these innovations: their application, value, and potential impact in the local context. The operations of the projects that we study happen here. We are in a decision-making and resource allocation process with them, right here, right now, in Malawi. The study looks at three things: the adoption of these tools, their advantages, and the obstacles associated with them. By looking at these three things, the study hopes to say something useful about the conversation that is going on about the role of contemporary technology in advancing project management practices. The discoveries presented here spotlight the potential of these innovations to completely change how project management is done in Malawi, alongside addressing the challenges and opportunities that come with such a makeover.

Discussions of findings

The study reveals that while Malawi has embarked on a journey toward integrating Artificial Intelligence into project management, significant gaps remain compared to global and regional statistics. In line with findings from similar studies in developing countries, our research confirms that the potential benefits of AI in project management, such as enhanced decision-making, improved efficiency, and better risk management, are well recognized by stakeholders. However, these benefits are yet to be fully realized in Malawi due to persistent challenges:

Infrastructure Limitations and the Digital Divide

Evidenced by only 51% percent of this studies participants reporting to have used AI in their project management practice, the digital divide is clear. It shows that Malawi's internet penetration and broadband quality are considerably lower than in neighboring countries. This is consistent with data from the World Bank (2022), which indicates that countries such as Kenya have made: substantial investments in digital infrastructure, reflected in their higher connectivity indices, while Malawi lags. Such graphical comparisons underscore the critical need for Malawi to improve its network infrastructure to support resource-intensive AI applications. Additionally, the more worrying insight from the data is the significant relationship between differences in gender and usage of AI which underlines the need for further investigations on how cultural factors are influencing usage of AI within a project management sector with a well-educated base.

High Implementation Costs and Financial Constraints

Participants from the public sector and local nonprofits in the qualitative aspect of the study explicitly indicate that their organizations allocate a minimal percentage of their budget to technology innovations compared to counterparts in the private and international NGO sector. This observation aligns with the African Development Bank's (2023) report, which reveals that many development organizations and SMEs across Africa face similar financial barriers. Countries like Rwanda have successfully reduced costs through government subsidies and targeted financial mechanisms, as illustrated in comparative expenditure graphs (African Development Bank, 2023). These graphs incentives the recommendation that Malawi should establish dedicated funding schemes to lower the financial barriers for AI adoption.

Skill Shortages and Limited Local Expertise

Despite a statistically non-significant relationship between AI usage and years of project management experience, the narratives in the qualitative aspect depict a stark deficit in AI-skilled professionals in Malawi compared to regional benchmarks such as South Africa, Zambia and Kenya. This finding is corroborated by OECD (2021) data, which shows that nations investing in specialized educational programs produce a higher percentage of tech savvy graduates. The evidence from the not only validates our observation regarding the skills gap but also reinforces the need for strategic investments in education and training initiatives. Countries like South Africa have effectively mitigated similar challenges by launching targeted AI training programs, a model that Malawi should emulate (OECD, 2021).

Regulatory Uncertainty, Governance Issues and organization Resistance

Malawi's policy framework for AI regulation is underdeveloped relative to international standards. Comparisons with European Commission data(2021) on AI governance highlight that clear ethical guidelines and robust data protection laws are essential for fostering innovation. The visual disparity between Malawi's current regulatory status and that of more advanced regions reinforces our argument for the urgent development of comprehensive AI policies tailored to local needs. The absence of clear ethical guidelines and robust data protection laws creates uncertainty for project management stakeholders, including government, researchers, and policymakers.

This is evident in the participants narrative in the survey that highlights a major concern towards ethical consideration of AI integration project management on issues such as data privacy and protection which has in turn led to resistance to change in innovative AI solutions to project management. This is consistent with global studies, such as those conducted in India (McKinsey & Company, 2020), which show that cultural resistance is a common barrier in emerging economies without proper AI regulatory frameworks. Comparing public perception data across regions illustrates that nations investing in awareness and retraining programs (e.g., Singapore) have mitigated these concerns more effectively (Singapore Economic Development Board, 2021).

Furthermore, a good example of a successful case study is the European Union which has established comprehensive frameworks such as the *AI Act*, which emphasizes risk-based regulation, ethical AI development, and stringent data protection measures under the *General Data Protection Regulation (GDPR)*. These frameworks provide clear guidelines for transparency, accountability, and fairness in AI systems, fostering an environment conducive to innovation while safeguarding public trust.

Comparison with Regional and Global Benchmarks

In relation to regional leaders such as Kenya and South Africa, Malawi remains in the early stages of adopting artificial intelligence, as shown through graphical data and innovation indexes. Kenya's National AI Strategy (2023–2028), backed by a solid digital infrastructure and innovation ecosystems, has set a high bar that Malawi has yet to reach (Paradigm Initiative, 2022). Likewise, South Africa's advanced regulatory frameworks and investments in AI research starkly contrast Malawi's current situation and further highlight Malawi's apparent lack of leadership in the regional AI race. On the other hand, Malawi's current national situation marked by an underdeveloped digital infrastructure, a lack of cohesive policy, and a limited pool of AI talent is an apparent drag on the national strategy that needs to be addressed if AI is going to play a meaningful role in transforming the Malawian economy.

Conclusion

. The incorporation of Artificial Intelligence (AI) into project management in Malawi has been studied, with a specific focus on its possible effects and impacts. The potential effect is seen as being very positive, with possible enhancements in efficiency, decision-making, and risk management. The results point out that although AI adoption in Malawi is still quite new, there is an increased acknowledgment of the possible paybacks. Challenges persist, such as insufficient digital infrastructure, shortage of funds, and dearth of know-how in AI, which are major obstacles. The research contributes to the ongoing discourse by providing a structured analysis of these challenges and offering a framework for AI integration that is tailored to Malawi's project management landscape.

The findings make clear that investment in digital infrastructure, capacity building, and policy development is absolutely essential for both the nurturing and the speeding up of AI adoption. The study proposes a partnership model among government, private sector, and academic institutions. This is necessary to set up the kinds of environments that enable the kinds of projects AI excels in working with to also excel in working with it. The study ends with a few suggestions for further research into the (as yet poorly understood) socio-ethical implications of AI. "Malawi has the potential to be a forerunner," the study states, "in the application of AI for project success."

Suggestions and Recommendations

Based on the findings and insights drawn from the study's document review, data analysis and interpretation, the following strategic recommendations are proposed to accelerate AI integration in Malawi's project management landscape:

1. **Invest in Digital Infrastructure**

To harness the full potential of AI in project management, Malawi must prioritize investments in digital infrastructure. Graphs depicting current connectivity gaps (World Bank, 2022) indicate that countries that are thriving in the adoption of AI and its use have a sufficient network in broadband access and reliable electricity supply. Malawi should emulate Kenya's fiber-optic expansion projects by leveraging public funding and international partnerships to bridge the digital divide which would enable the integration of AI in project management on a large scale.

2. **Establish Financial Support Mechanisms**

Harrison, F., & Lock, D. (2022) in their study on advanced project management conclude that financial constraints have played a big role in derailing the full integration of technologies such as AI in project management in developing. Hence countries like Malawi need to borrow a leaf from the global leaders in AI, by introducing tax incentives, grant schemes, and low-interest loans targeted at SMEs and organization that use, provide services and expertise in AI. A conducive environment for such businesses will lead to patronization of their AI powered services in a wide range of field as successfully implemented in Rwanda (African Development Bank, 2023) and hence could lower the financial barriers to AI adoption.

3. Enhance Educational Programs and Skill Development

In comparison, the output of graduates in developing countries like Malawi with those in more advanced economies reveal a significant skills gap when it comes to technology (OECD, 2021). Incorporating AI, machine learning, and data analytics courses into schools curricula, cultivating a technology savvy approach, and establishing specialized training centers, as demonstrated by South Africa's initiatives on advanced technologies , will be critical to ensure that AI integration is sustainable. This recommendation is further supported by visual data indicating improved workforce readiness in countries that have invested in such programs by GSMA's 2024 report.

4. Promote Public-Private Partnerships (PPPs)

The widespread integration of AI in Malawi's vast sectors cannot be achieved through lone efforts by relevant stakeholder. Partnerships that leverage stakeholder strengths and weaknesses should be put in motion encouraging collaboration between government, academia, and the private sector can pool resources and expertise to pilot AI projects in Malawi's critical sectors that rare open to integration and in dire need of such. Such partnerships should be visually tracked over time to ensure measurable improvements in AI uptake. Enabling government policies should be put in place to allow such partnerships to thrive and bear fruit.

5. Launch Awareness and Retraining Programs

To overcome cultural resistance, as shown in the perception of participants in the key informant interviews on the ethics around the coming in of AI, there is a need for comprehensive educational and awareness programs to be implemented on the benefits of AI, function and technical capacity of AI. These initiatives should highlight the critical issues of AI while providing evidence from international case studies for more contexts. Retraining programs can be designed to mitigate fears of job displacement and help workers transition to AI-enhanced roles, as visualized in successful transition models from other countries (McKinsey & Company, 2020).

6. Foster Regional and International Collaboration

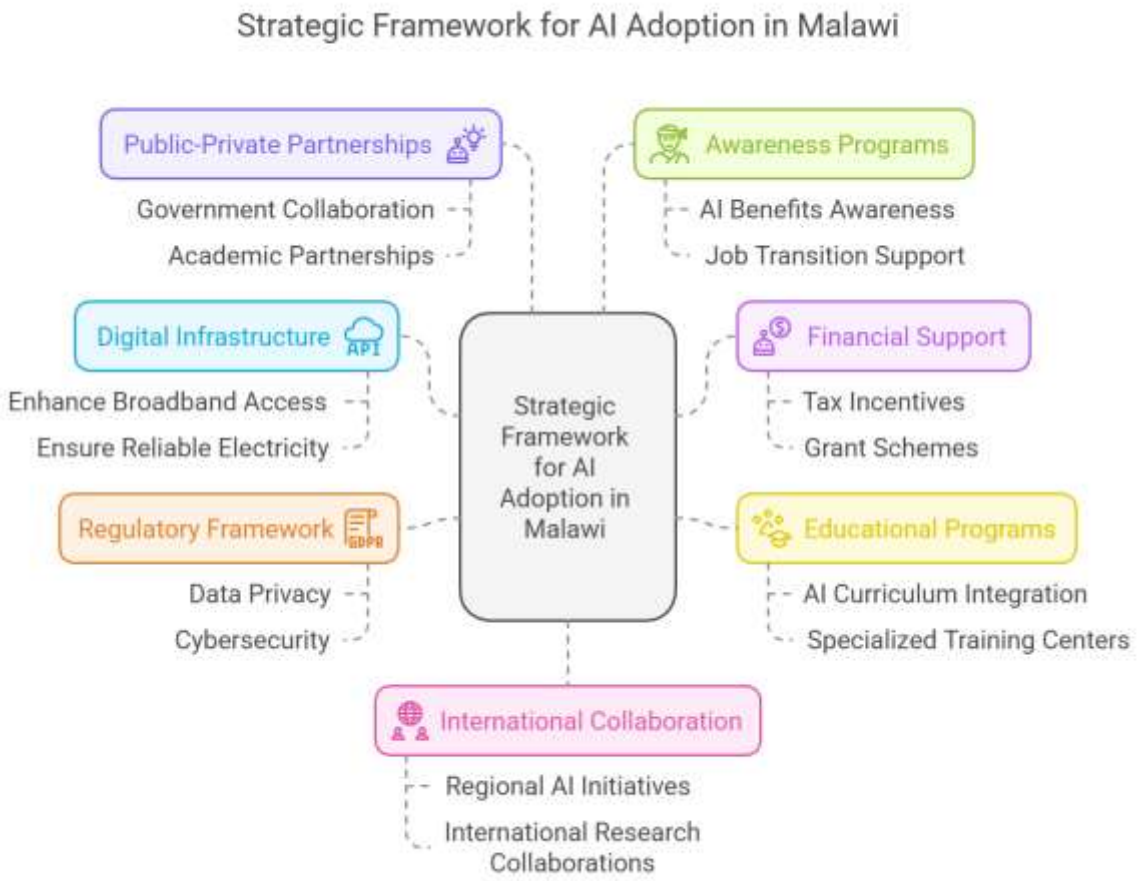
Finally, Malawi should engage in regional AI initiatives and international research collaborations. Participation in platforms like the African Union's AI strategy (African Union, 2021) and partnerships with organizations such as the UNDP can provide access to technical expertise and funding. Evidence has shown that the benefits of cross-border collaborations underscore the value of this approach, showing that nations engaged in such partnerships often achieve higher innovation indices

7. Proposed strategic framework for AI integration in project management

To facilitate the effective adoption of Artificial Intelligence (AI) in project management in Malawi, this thesis outlines a Strategic Framework for AI Integration in project management across all sectors in Malawi. The framework aims to provide structured guidance on AI adoption, addressing key challenges while fostering an environment conducive to AI-driven project success. It is built upon four core pillars: Infrastructure Development, Capacity Building, Policy and Governance, and Ethical AI Deployment.

This framework prioritizes the enhancement of digital infrastructure, with specific attention to reliable data storage, high-speed internet connectivity, and accessibility to cloud-based AI tools for project management. We propose capacity-building initiatives that will serve to equip project managers and teams with AI literacy, technical know-how, and change management skills. Moreover, the framework suggests formulating AI policies and governance structures that align with the National Digitalization Policy (2023–2028) of Malawi to ensure responsible and effective implementation of AI. In addition, the focus will be on the ethical deployment of AI to deal with worries about transparency, data privacy, and fairness. This strategic framework provides the project management sector in Malawi with a way to use AI for its services. It focuses on (1) improving overall project efficiency; (2) optimizing resources, including staff, money, and time; and (3) enhancing risk management. These three areas largely determine the success or failure of a project and therefore are key to achieving national development outcomes

The image displayed below provides a visual representation of the proposed framework, highlighting the key components and their interconnections:



Limitations of the study

This study had several limitations. First, although a sample size of 45 participants is adequate for qualitative research, it may limit the generalizability of the findings to a broader population for the quantitative data. Additionally, data collection methods, such as Key Informant Interviews (KIIs) conducted via Google Forms or other online platforms, encountered challenges, such as limited internet access, technical difficulties and inclusive disability needs of respondents, which could affect the quality, diversity and depth of the responses.

Furthermore, participant bias may have arisen if respondents feel pressured to provide socially desirable answers, particularly during in-person interviews. Lastly, the time constraint to adhere to college submission timelines associated with conducting. and analyzing qualitative data hindered a comprehensive exploration of all emerging themes. Despite these limitations, measures were implemented to minimize their impact through comprehensive planning and data cross-verification.

Areas for Further Research

The ethical and socio-technical dimensions of AI-driven decision-making in project management, especially as they relate to the Malawian context, should be the main focus of future research. While the key potentials of AI—optimizing resource allocation, preemptively addressing comprehensible and understandable risks, and automating the sorts of routine tasks that allow project managers to focus on the tasks for which they are better suited—are not in doubt, they also raise issues. Concerns about bias in AI, data privacy, and transparency versus inscrutability can and should be addressed head-on. We should also look to the future to better understand the human roles that will remain in project management post-AI: leadership in a project context, stakeholder engagement, etc. And finally: How ready are Malawian organizations, in terms of infrastructure, financial resources, and technical expertise, to adopt AI in a project management context?

A tailored AI integration framework for Malawi's project management landscape is urgently needed and must be developed through critical research. This research could use comparative methods to study Kenya and Zambia. Best practices from these countries could illuminate policy strategies that not only deepen AI integration but also address local challenges. Another area for urgent research concerns M&E processes. The degree to which AI can or cannot improve these processes will be felt immediately by the people and projects that use M&E. The economic impact of AI will also be felt immediately. Decision-makers need to know the costs, probable savings, and other economic metrics that could guide them in either supporting or

shelving AI initiatives. More broadly, research should look at the impact on project success rates. If AI really can assist in hitting a bull's-eye, that places Malawi ahead of the economic curve.

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ACRONYMS AND ABBREVIATION

AI – Artificial Intelligence

ICT – Information and Communication Technology

PM – Project Management

PPP – Public-Private Partnership

M&E – Monitoring and Evaluation

SDGs – Sustainable Development Goals

R&D – Research and Development

GDP – Gross Domestic Product

IoT – Internet of Things

ML – Machine Learning

NDP – National Digitalization Policy

IT – Information Technology

SMEs – Small and Medium Enterprises

GDPR – General Data Protection Regulation

FOSS – Free and Open-Source Software

API – Application Programming Interface

DPP – Data Privacy Protection

NCC – National Communication Commission

UNDP – United Nations Development Programme

AI4PM – Artificial Intelligence for Project Management