The Potential Impact of Artificial Intelligence (AI) and Big Data on Philanthropy in Sub-Saharan Africa

Abstract

This study examines the potential impact of Artificial Intelligence (AI) and big data on philanthropy in Sub-Saharan Africa, considering the diverse political, economic, and socio-cultural landscapes of the region, which significantly influence data availability and quality. The study investigates the types and quality of data accessible to philanthropic organisations, aiming to identify how data can enhance decision making and improve effectiveness by exploring the current and future usability of various data sources. AI and big data have become critical tools for resource mobilisation, measuring impact, and strategic planning in philanthropy. Over the past decade, the relevance of data-driven decision making has increased, necessitating a shift from qualitative to quantitative impact metrics. This study emphasises the importance of combining numerical data with qualitative insights to provide a comprehensive understanding of philanthropic impact and the benefits of this integrated approach. The growing importance of data analytics underscores its role in shaping philanthropic activities, socio-economic policy formulation, and advocacy across Sub-Saharan Africa. Furthermore, the research identifies the need for reliable data sources to support informed decision making, moving beyond situational crises and anecdotal evidence. Ethical implications and challenges of implementing AI and big data technologies are also addressed. Our findings provide actionable insights for philanthropic organisations to compare key performance indicators over time, measure actual versus planned impact, and enhance the sustainability of their initiatives. Additionally, the study suggests that collecting data on operational challenges, impact measurement, and targeted issues can improve the efficacy of philanthropic efforts. This research offers a structured analysis of how AI and big data tools and techniques will transform philanthropy in Sub-Saharan Africa, ensuring that technological advancements contribute meaningfully and ethically to sustainable development. The findings of the research also point to current gaps, such as the integration of traditional knowledge systems into AI and big data, that require further investigation.

Keywords

Philanthropy, Big data, Artificial Intelligence (AI), Data-Driven Decision Making, Impact, Sustainability, Governance.

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1. Introduction and background

Philanthropic organisations globally are navigating a transformative era marked by the emergence of AI and big data as pivotal tools in their operations (Junge et al., 2018). The potential impact of these technologies on philanthropy in Sub-Saharan Africa is substantial, yet current research in this area remains sparse. This study aims to bridge this gap by exploring how AI and big data can enhance the effectiveness of philanthropic activities within this region, characterised by its diverse political, economic, and socio-cultural landscapes.

Over the past five to ten years, AI and big data have rapidly evolved, influencing the business approaches used by organisations worldwide, including those in the philanthropic sector (King, 2023). These technologies offer innovative tools and techniques that can transform philanthropic organisations by improving efficiency, effectiveness, and transparency (Ooro et al., 2023). For instance, AI and big data tools and techniques can process vast amounts of data to identify patterns and insights that would be impossible for humans to discern. At the same time, big data analytics can provide real-time monitoring and evaluation of philanthropic projects. Despite these promising capabilities, the adoption of AI and big data in Sub-Saharan African philanthropy is still nascent, and organisations must overcome significant hurdles related to data availability, accessibility, quality, integration, and data security. Addressing these challenges requires a comprehensive understanding of the local data landscape and the development of robust data governance frameworks.

The varied socio-political environments of the region have created distinct data ecosystems that require tailored approaches to data collection, processing, and application (Mzuku & Van Belle, 2018). Understanding these dynamics is crucial for leveraging AI and big data to drive meaningful social change and support governments in addressing socio-economic challenges. However, despite their potential benefits, there remains a significant research gap regarding the effective implementation of these technologies in philanthropy across Sub-Saharan Africa.

One major problem facing philanthropic organisations in Sub-Saharan Africa is the fragmented nature of data ecosystems. Data is often incomplete, inconsistent, and inaccessible, posing significant challenges for organisations attempting to leverage AI and big data (Mzuku & Van Belle, 2018). Additionally, the region's infrastructure which is often underdeveloped, limits the capacity for large-scale data collection and analysis. These issues are compounded by the shortage of skilled personnel capable of managing and interpreting complex data sets, further hindering the effective use of AI and big data technologies (King, 2023).

The political and socio-cultural diversity of Sub-Saharan Africa also impacts the effectiveness of AI and big data in philanthropy. Countries and regions have varying levels of technological adoption, regulatory frameworks, and cultural attitudes towards data privacy and usage (Mzuku & Van Belle, 2018). This diversity necessitates a context-specific approach to implementing AI and big data solutions, often lacking in current philanthropic strategies. Moreover, ethical considerations such as data privacy, bias in AI algorithms, and equitable access to technology are critical issues that must be addressed to ensure that these technologies do not inadvertently exacerbate existing inequalities (Manning et al., 2020).

Despite these challenges, philanthropic organisations have significant opportunities to harness AI and big data tools and techniques to enhance their impact in Sub-Saharan Africa. By developing robust data governance frameworks, investing in infrastructure, and building local capacity, organisations can overcome the barriers to effective data utilisation. For example, the use of predictive algorithms for wildlife conservation in Uganda has demonstrated how data can drive strategic interventions and improve outcomes (Junge et al., 2018). Similarly, the Magic Box platform by UNICEF in Central Africa, which utilises AI and machine learning to respond to humanitarian crises, highlights the potential of real-time data analysis to improve philanthropic initiatives (Muhr, 2024).

Based on the introduction, the identified challenges were classified by thematic area as shown in Table 1.

Thematic Area	Identified Challenges
Availability of Data	• Fragmented nature of data ecosystems • Quality – Incomplete and/or Outdated • Accessibility • Integrated data sets
Adoption of AI & Big Data	• Adoption of AI & Big Data tools and techniques is just coming into existence SSA
Data Governance	• Lack of localised, uniform, and/or sufficient policy frameworks • Data ownership & usage • Data colonisation • Data security
Infrastructure	• Access to internet is varied across the continent • Digital divide
Technical Skills & Capacity	• Limited availability of skilled personnel – Management & Interpretation of complex data sets
Political & Socio-Cultural	• Need for context-specific approaches – Complicates creation of integrated data sets • Approach to data collection, processing, & application • Integration of traditional knowledge systems into AI & Big Data frameworks

Table 1: Identified Challenges by Thematic Area

The identified challenges were then used to define the problem statement and research question as follows:

1.1 Problem statement

The adoption of AI and big data tools and techniques within the philanthropy sector is still lagging behind in Sub-Saharan Africa. This can be attributed to the fragmented nature of data ecosystems, where data is often incomplete, inconsistent, inaccessible, and sometimes insecure. The situation is

further exacerbated by the lack of infrastructure in some instances, the varied political and socio-cultural environments, and lack of skilled personnel.

1.2 Research question

In order to propose solutions that address the identified challenges, the research aims to answer the following question: Is there evidence from literature, and case studies suggesting that AI and big data tools and techniques can have a positive impact on philanthropic activities in Sub-Saharan Africa?

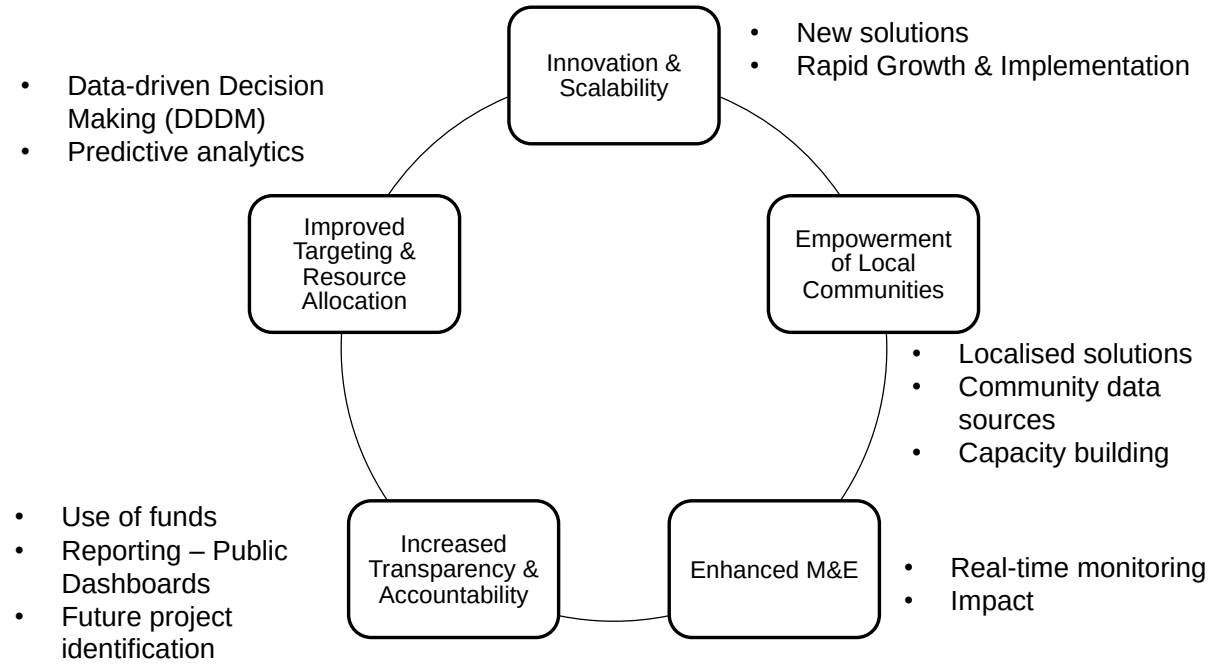
2. Literature review

This section is divided into three main parts to facilitate a robust literature review. These include the theory and empirical review, the theoretical framework, and the conceptual framework. Each part is discussed in detail to enable a deeper conceptualisation and understanding of the existing research and theoretical foundations relevant to philanthropy, AI, and big data.

2.1 Theoretical and empirical review

The potential impact of AI and big data on philanthropy in Sub-Saharan Africa is substantial, offering solutions that can enhance efficiency, effectiveness, and transparency in philanthropic activities (Mzuku & Van Belle, 2018). This paper discusses five (5) key areas where AI and big data have an impact on philanthropic activities: Innovation and Scalability, Empowerment of Local Communities, Enhanced Monitoring and Evaluation, Increased Transparency and Accountability, and Improved Targeting and Resource Allocation (Melles et al., 2015). Figure 2 summarises the theoretical and empirical review.

Figure 1: Theoretical and Empirical Review Aspects



Innovation and scalability are pivotal in developing new solutions within the philanthropic sector. AI and big data drive innovation by identifying novel approaches to solving contextual problems, enabling more effective interventions (Verhulst, 2024). These innovations facilitate the creation of methods for addressing challenges such as; disease detection and control, improving agricultural practices, and promoting community-driven education tailored to local contexts (Osili, 2022). For example, AI algorithms have been used to analyse health data to predict disease outbreaks, allowing timely interventions that save lives. In agriculture, big data has been used to optimise resource allocation and crop management, increasing yields and food security. Additionally, community-driven education programmes have been enhanced using data to tailor curricula and teaching methods to specific local needs.

Scalability is another critical aspect, as AI-driven projects rapidly expand across regions with similar political, cultural, and socio-economic contexts, maximising their impact (Nahar, 2024). Scalable models enable philanthropic activities to grow from pilot projects into large-scale interventions in a shorter timeframe. Case studies further validate this concept, demonstrating how successful AI-based initiatives in one country can be adapted and implemented in others with similar socio-economic contexts. For example, an AI-driven health initiative successfully implemented in Kenya could be scaled to neighbouring countries across East Africa with similar health challenges and infrastructure, amplifying its impact.

Empowering local communities is crucial for the inclusivity of philanthropic initiatives (Pasic et al., 2020). Localised solutions that utilise data sourced from communities are more appropriate and empowering. AI and big data provide communities with the tools and information needed to address their specific challenges. Localised data analysis helps communities better understand their unique contextual challenges and develop tailored solutions in collaboration with other stakeholders in the philanthropic space. This participatory approach ensures that interventions are culturally relevant and more likely to succeed.

Capacity building is an integral part of empowering local communities. Training local organisations and individuals in AI and big data builds local capacity, ensuring knowledge and skills transfer and the development of sustainable solutions from within the community (Community Tool Box, 2023). This approach enhances the effectiveness of philanthropic initiatives and fosters local ownership and long-term sustainability. By equipping community members with the necessary skills, they develop the ability to continuously adapt and improve solutions to meet evolving challenges.

Monitoring and evaluation (M&E) are critical aspects of philanthropic activities. AI and big data provide real-time monitoring tools that track the progress and impact of projects (Muhr, 2024). These tools offer immediate feedback, allowing for quick adjustments to strategic objectives and ensuring projects stay on track to deliver intended outcomes (Omura & Forster, 2014). Real-time data collection and analysis enhance the ability to accurately measure project effectiveness and make prompt adjustments. This dynamic approach to M&E ensures that resources are used efficiently and that projects achieve their goals.

An effective M&E process provides insights for impact assessment. Big data tools aggregate and analyse data from various projects and programmes, enabling comprehensive impact assessments (Verhulst, 2024). This holistic view helps organisations understand the broader impact of their activities and identify areas for improvement. For example, analysing data from multiple education initiatives allows organisations to identify common success factors and challenges, refine strategies, and increase overall impact.

Transparency and accountability in fund use are essential for maintaining donor trust and ensuring the effectiveness of philanthropic activities. The outputs of the M&E process, along with other project reports, are used to develop transparent reports that outline the accountability levels of all stakeholders (Nonprofit Tech for Good, n.d.). This transparency builds and maintains trust with donors, beneficiaries, and other stakeholders. It ensures that funds are used effectively and ethically and that all parties are held accountable for their actions. The potential of integrating blockchain and AI to enhance transparency and accountability in the philanthropic sector is significant (Jayasinghe et al., 2018). Combining AI with blockchain technology improves transparency in project identification, fund distribution, and utilisation (Swati et al., 2022). The immutable ledger provided by blockchain creates a transparent and verifiable record of transactions, reducing the risk of mismanagement and corruption, especially within Sub-Saharan Africa (Adeleye et al., 2020). For instance, using blockchain to track the flow of funds from donors to beneficiaries, ensuring that every transaction is recorded and auditable, thereby increasing trust and confidence in the philanthropic process.

One of the solutions that has successfully worked is the creation of public dashboards. AI and big data are used to create public dashboards that display data on the use of funds, project progress, outcomes, and impact (Sivio Institute, 2023). This level of transparency and accountability builds trust with donors and other key stakeholders.

Lastly, AI and big data improve targeting and resource allocation in philanthropic activities. This is because community driven data enhances decision making by providing relevant and impactful insights (Omura & Forster, 2014). AI and big data support philanthropic organisations to identify the most pressing needs by analysing vast amounts of data from various sources, such as country economic indicators, community data, and the success or failure of previous philanthropic interventions. This allows for more precise targeting of resources to areas and populations that need them most and align with donor areas of focus.

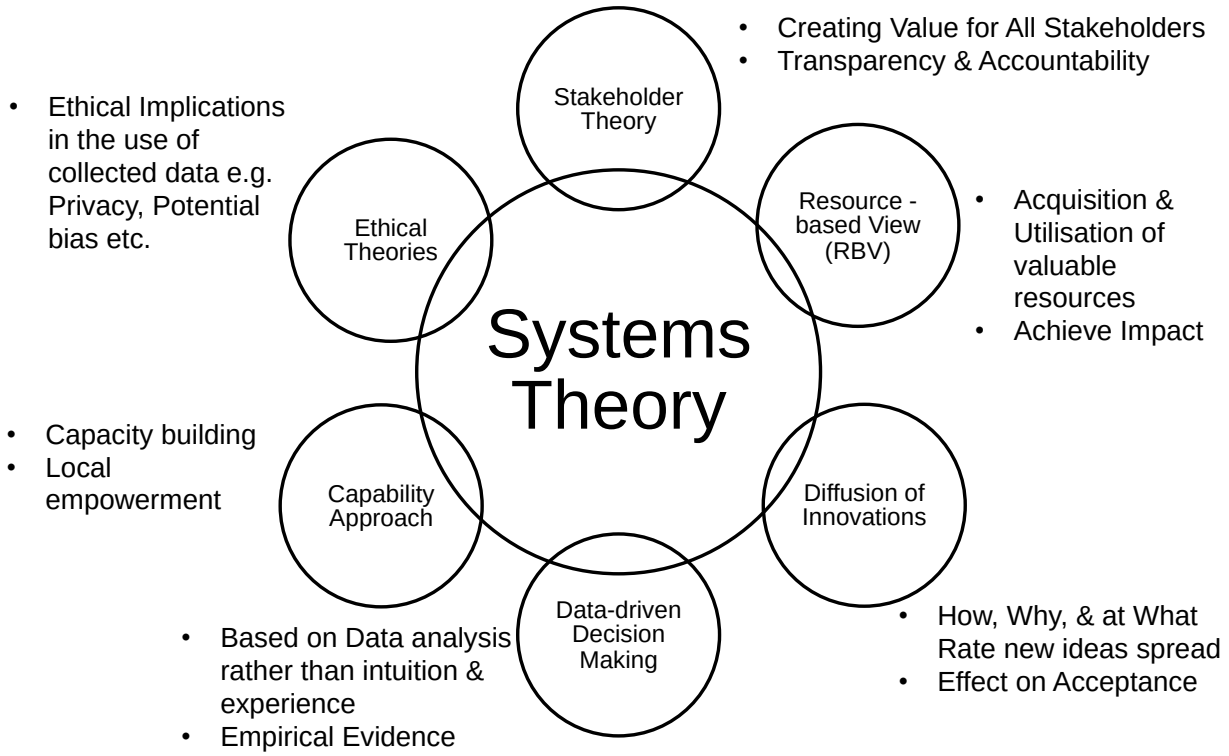
Predictive analytics, as part of the AI and big data ecosystem, benefits both the donors and recipients in the philanthropic space. By using predictive models based on historical data, organisations can forecast future needs and trends, enabling proactive rather than reactive approaches to philanthropy. For example, predicting potential flooding, food shortages, and disease outbreaks allows for timely interventions, complementing traditional knowledge systems (Magni, 2017).

2.2 Theoretical framework

This section focuses on the theoretical framework applied and how it supports the impact of AI and big data in transforming philanthropy in Sub-Saharan Africa. The theoretical framework was anchored

in the systems theory and also interrogated other theories and concepts that feed into the systems theory from a philanthropic perspective such as information and technology systems, community and development studies, and socio-economic contexts. As such, a multi-layered theoretical framework, based on the systems theory, was applied in this research and included the following supporting theories: Stakeholder theory, Resource-Based View, Diffusion of Innovations, Data-Driven Decision Making, Capability Approach, and Ethical Theories. The theoretical framework is summarised in Figure 3.

Figure 2: Theoretical Framework



Systems theory can be summarised as the view that philanthropic organisations, and related ecosystems, have a complex set of interrelated and interdependent parts that work together to achieve a common goal (Klier et al., 2022). This theory therefore includes elements of different actors, and how they behave both interdependently and independently. As the overarching framework for this research, systems theory encompasses various supporting theories. Implementing AI and big data in philanthropy is an integration of new technological subsystems into the existing philanthropic ecosystem. The interaction between technological subsystems (AI and data analytics) and human subsystems (staff and stakeholders) is crucial for success (Pomeroy et al., 2023). As such, systems theory provides an overarching theoretical framework that interrogates how different parts of the philanthropic ecosystem must adapt and align when new technologies are introduced.

Firstly, as a contributor to systems theory, the stakeholder theory proposes a paradigm shift within the philanthropic sector in that organisations should create value for all stakeholders, not just

shareholders (Peddada & Abdalla Adam, 2019). In philanthropy, stakeholders include; donors, beneficiaries, employees, and the broader community. AI and big data enhance transparency and accountability, which build trust and create value for all stakeholders. Stakeholder theory helps assess how the interests of all relevant parties are incorporated in the development, testing, and implementation of new technologies that support philanthropic activities. In addition, it addresses how stakeholders interact within the ecosystem.

The Resource-Based View (RBV) contributes to the theoretical framework by suggesting that organisations gain a competitive advantage through the acquisition and utilisation of valuable, rare, inimitable, and non-substitutable resources (Madhani, 2010). In this research, RBV also considered the aspect of power resources such as financial, human and others which are critical in adopting AI and big data within philanthropic organisations. AI and big data are viewed as strategic resources that philanthropic organisations leverage to enhance their effectiveness and impact. For example, predictive analytics, a function of both AI and big data, provides insights that are not easily replicable by organisations without similar technological capabilities. This perspective highlights how technological resources support the philanthropic ecosystem by improving resource allocation and achieving desired outcomes.

Following from RBV, the diffusion of innovations theory explains how, why, and at what rate new ideas and technology spread through cultures (Makovhololo et al., 2017). The adoption of AI and big data in philanthropy can be studied through the lens of diffusion of innovations, focusing on factors such as the innovation's relative advantage, compatibility with existing values and practices, complexity, trialability, and observability (Makovhololo et al., 2017). Therefore, understanding these factors can help facilitate the development and acceptance of AI and big data solutions in philanthropic organisations and communities. The theory addresses the challenges of poor decision making often caused by lack of relevant data and information. This data deficiency is generally attributed to insufficient monitoring efforts in the region, fragmented data storage, and the ineffective conversion of data into actionable information to support decision making (Pietersen & Beekman, 2016).

The fourth theory that contributed to the theoretical framework is Data-Driven Decision Making (DDDM). DDDM posits that organisations, and indeed ecosystems, make better decisions when they base their actions on data analysis rather than on intuition or experience alone (Makovhololo et al., 2017). In the context of philanthropy, DDDM helps organisations allocate resources more effectively by analysing data on socio-economic conditions and other relevant indicators (Lane et al., 2024). This approach is grounded in the broader theory of evidence-based management, which emphasises the importance of empirical evidence in decision-making processes (Greenhalgh & Montgomery, 2020). Furthermore, integrating traditional knowledge systems with DDDM is crucial, as these systems are rich in information and contribute to improved decision making (Magni, 2017).

The capability approach focuses on enhancing individuals' abilities to lead the kind of lives they value (Garcés Velástegui, 2020). Access to AI and big data tools and technology empowers communities by

providing them with relevant information and tools to improve their well-being (Kazim, 2021). This approach emphasises capacity building and local empowerment, integrating traditional knowledge systems and prioritising human-cantered development, which is essential for effective philanthropy.

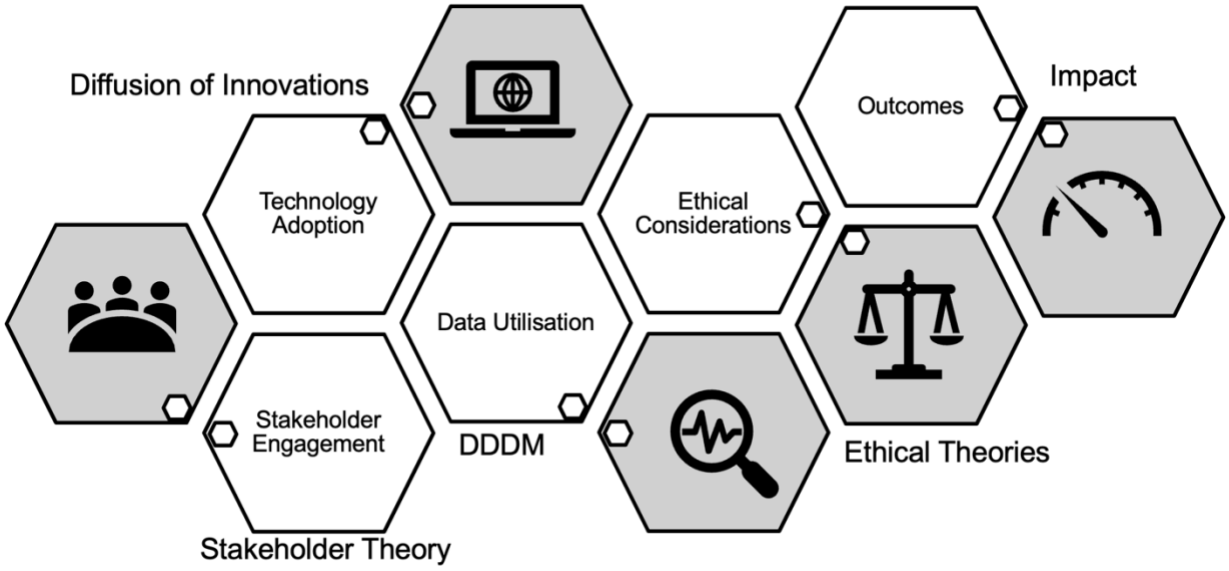
Finally, ethical theories provide a framework for evaluating the moral implications of decisions and actions (Adeleye et al., 2020). The use of AI and big data in philanthropy must be guided by ethical principles such as fairness, transparency, and respect for privacy. This involves addressing issues like; data ownership, data privacy, potential biases in AI algorithms, and the digital divide (Manning et al., 2020). Ethical considerations are essential to ensure that the deployment of technology does not inadvertently harm the very populations it aims to help.

In conclusion, adopting systems theory as a foundation for the theoretical framework offers a multi-dimensional approach to analysing, and leveraging, the potential of AI and big data for philanthropy in Sub-Saharan Africa, and ensures that technological advancements contribute meaningfully and ethically to sustainable development through philanthropic activities.

2.3 Conceptual Framework

The conceptual framework applied outlines the relationships between key concepts and variables that affect how AI and big data impact philanthropy in Sub-Saharan Africa (Kamaludin et al., 2024). It consists of five (5) dimensions linked to the theoretical framework: stakeholder engagement, data utilisation, technology adoption, ethical considerations, and outcomes, as shown in Figure 4.

Figure 3: Conceptual Framework Overview



The first dimension, stakeholder engagement aligns with the stakeholder theory. In the philanthropy sector, this includes the engagement of all stakeholders with a specific focus on donor engagement, by using data to demonstrate impact and build trust with donors through transparency and accountability (Sweetkind-Singer, 2013). Secondly, there is beneficiary involvement, empowering local communities through capacity building; this could include participation in data collection, basic interpretation, and contributions to contextually relevant solutions (Kazim, 2021). Finally, it involves developing partnerships through collaboration with local NGOs, governments, and private sector partners to leverage their strengths and networks (Sweetkind-Singer, 2013).

The next dimension of the conceptual framework, data utilisation, aligns with the data-driven decision-making theory outlined in the theoretical framework. Communities and other philanthropic actors possess a wealth of data which is not always fully utilised (Lane et al., 2024). As such the conceptual framework considers three key elements that enhance data utilisation. Firstly, data collection in order to aggregate diverse sources and forms of data such as demographics, socio-economic indicators, and the impact of past philanthropic activities (Davies, 2018) collected at the community level. Secondly, conducting data analysis to interpret the data through solutions such as AI and big data techniques (machine learning, predictive analytics, and natural language processing) (King, 2023). Research indicates that decision making utilising big data analytics within organisations ultimately drives innovation (Pillay & Van der Merwe, 2021). Finally, as discussed in the theoretical framework, utilising data derives actionable insights to guide philanthropic strategies, and resource allocation to achieve desired impact and sustainability (Melles et al., 2015).

Technology adoption, which is the third dimension of the conceptual framework, is aligned with the diffusion of innovations theory from the theoretical framework. In order for AI and big data to positively impact the philanthropic sector, their solutions must be adapted. The conceptual

framework identifies three key aspects to be considered in relation to technology adoption. Firstly, infrastructure readiness which evaluates the availability of technology enabling infrastructure such as internet connectivity, data storage and governance, and computing power (Makovhololo et al., 2017). Secondly, there is a need for skills development through relevant training and capacity building for local staff, communities, and stakeholders to effectively use AI and big data tools (Vorobiova, 2022). Finally, innovation diffusion that would lead to the adoption of AI and big data technologies is facilitated through the perceived advantages, compatibility with current systems, ease of implementation, and ease of use (Kazim, 2021).

The fourth dimension, ethical considerations, is aligned to the application of ethical theories within the theoretical framework. The conceptual framework focuses on three key aspects: data privacy, bias mitigation, and equitable access (Manning et al., 2020). Firstly, data privacy is meant to ensure the confidentiality and security of personal data collected from individuals and communities. This requires philanthropic organisations to implement robust data governance policies (Aaronson, 2021). Secondly, bias mitigation addresses and mitigates biases in AI algorithms to prevent perpetuation of existing inequalities (Haven & Boyd, 2020). Finally, equitable access to data ensures that all communities, particularly marginalised ones, benefit equally from AI and big data technologies (Lane et al., 2024).

The fifth and final dimension is the outcomes of applying the conceptual framework in combination with the theoretical framework. This dimension considers the following factors: efficiency, effectiveness, transparency, and community empowerment and capacity building. In considering the outcomes, the stated factors should be enhanced through application of AI and big data technologies in philanthropy. Firstly, enhanced efficiency as an outcome is measured through improved allocation of resources and streamlined operations leading to cost savings and greater impact (Verhulst, 2024). Secondly, effective interventions are measured through the ability to implement more targeted and timely interventions based on predictive analytics and real-time data monitoring (Davies, 2018). Thirdly, increased transparency, is measured by the ability of philanthropic organisations to show greater transparency in their activities, fostering trust among donors and beneficiaries (Omura & Forster, 2014). Finally, community empowerment and capacity building are critical outcome measures. As such, for AI and big data to be effective in delivering positive outcomes, empowering

local communities with data and technological skills is essential for fostering self-reliance and sustainable development (Kazim, 2021).

Having discussed the dimensions in the conceptual framework, and their relationship to the theoretical framework, the following section discusses the inter-relationships between the five dimensions within the conceptual framework and is summarised in Table 2.

Relationship	Summary
Stakeholder Engagement & Outcomes	• Engaging all stakeholders • Alignment – Beneficiary needs vs. Stakeholder expectations • Engaging traditional knowledge frameworks
Data Utilisation & Technology Adoption	• Effective Data collection and analysis • Appropriate solutions • Skills and capacity development
Technology Adoption & Stakeholder Engagement	• Awareness of proposed solutions • Demonstrate Value of Technology use
Ethical Considerations & Outcomes	• Data Privacy • Bias Mitigation • Equitable Access • Data Ownership
Feedback Loops	• Linked to all dimensions • M&E

Table 2: Conceptual Framework Relationships

The first relationship is between stakeholder engagement and outcomes. Engaging all identified stakeholders ensures that philanthropic activities and efforts are aligned with beneficiary needs and expectations of all stakeholders, leading to effective, successful, and impactful outcomes.

The second relationship is between data utilisation and technology adoption. Applying robust and effective data collection and analysis approaches and technologies informs the need for appropriate technological solutions and highlights the importance of building the necessary infrastructure and skills. This, in turn, leads to the adoption of AI and big data tools and techniques.

The third relationship is between technology adoption and stakeholder engagement. All stakeholders should be aware of the proposed technological solutions proposed. When combined with robust technological infrastructure and trained personnel, this enables philanthropic organisations to engage

stakeholders more effectively, demonstrating the value and potential impact of AI and big data initiatives to beneficiaries and their communities.

The fourth relationship is between ethical considerations and outcomes. By addressing ethical issues such as data ownership, data privacy, bias mitigation, and equitable access, philanthropic organisations ensure that the benefits of AI and big data are distributed fairly, and that interventions are inclusive in nature without inadvertently causing harm.

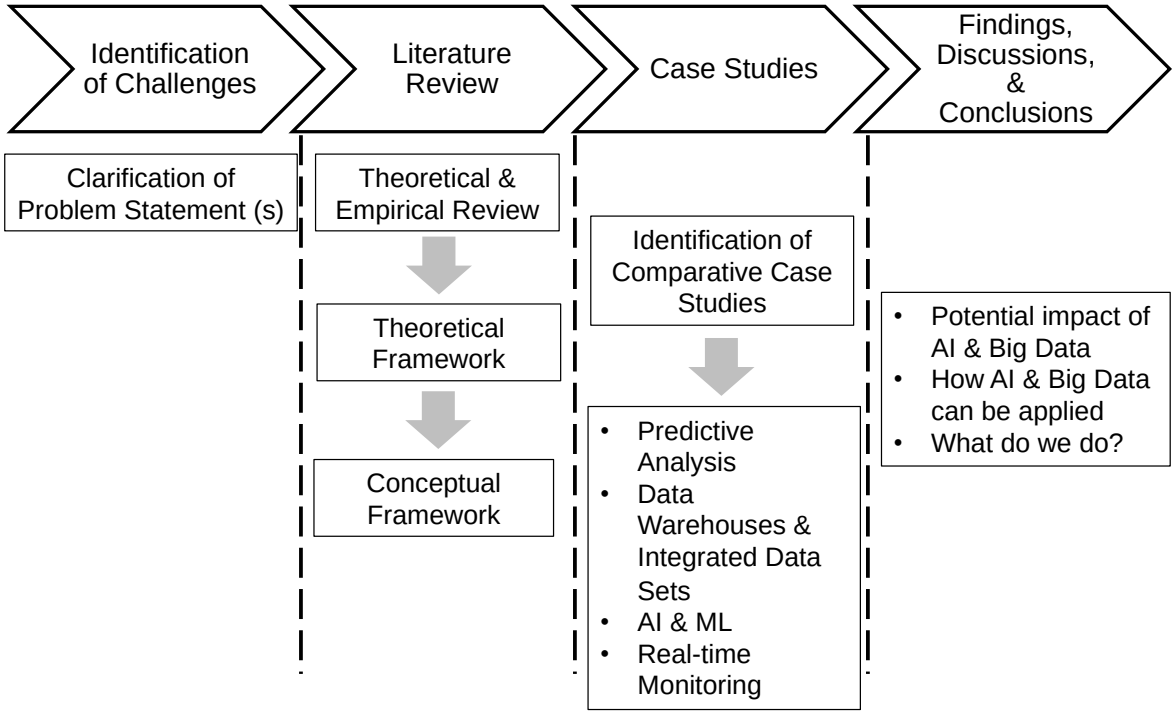
Finally, feedback loops are essential in connecting all the other dimensions of the conceptual framework. By establishing feedback loops, organisations can improve how outcomes feed back into data utilisation and technology adoption. Enhanced efficiency and effective interventions generate more data and better insights; this in turn drives further improvements in technology, stakeholder engagement strategies, implementation, and capacity building.

In conclusion, the conceptual framework provides a holistic view of how the theoretical framework on AI and big data can be applied conceptually to transform philanthropy in Sub-Saharan Africa. It highlights the interconnectedness of stakeholder engagement, data utilisation, technological adoption, ethical considerations, and achieving desired outcomes.

3. Methodology

A qualitative approach was applied to address the research question. The paper starts by outlining the challenges identified from currently available research, followed by a literature review covering three (3) aspects: theory and empirical review, theoretical framework and the conceptual framework. This is complemented by a section on relevant case studies. The final sections present the findings and discussion, ending with the conclusions. The methodology is outlined in Figure 1.

Figure 4: Research Methodology



4. Case Studies

Research on AI and big data in philanthropy is still limited, particularly in Sub-Saharan Africa. This section of the paper focuses on case studies from around the world that have shown the impact of AI and big data on various philanthropic and related activities. According to Junge et al. (2018), data is used by philanthropies across the world in several ways: performing predictive analysis using algorithms, creating data warehouses and integrated data sets, applying AI and machine learning (ML) tools and techniques, and real-time monitoring. The case studies reviewed explore each of these aspects and relate them to the Sub-Saharan African context. A summary of the case studies reviewed is provided in Table 3.

Country	Overview	Focus Area & Applications
Uganda – Uganda Wildlife Authority	• Predictive analysis – Poaching data, GPS, & ML	• Environment & Conservation • Extrapolation: • Predicting spread of disease

	• Likelihood of poaching activity – Patrol effectiveness	• Predicting adverse weather conditions
Indonesia – VAMPIRE	• Data warehouses & Integrated data sets – Holistic EWS for climate impact	• Impact of climate on vulnerable populations – Identify priority areas • Relatable to disasters in SSA – Impact on women, youth, & children
Central Africa – UNICEF Magic Box	• AI & ML tools and techniques – Outbreak of Zika and Ebola virus crises	• Insights to inform humanitarian responses – emergencies & epidemics
Indonesia – UN Global Pulse Lab	• Real-time monitoring – Social media tracking	• Food price changes to understand potential humanitarian crises

Table 3: Summary of selected Case Studies

The use of predictive analysis using algorithms has grown significantly and is becoming a key application of AI and big data (Muhr, 2024). The first case study cited by Junge et al. (2018), on the use of predictive algorithms focuses on environment and conservation in Uganda. In this study, poaching data, GPS, and ML are used by the Ugandan Wildlife Authority to predict patrol routes where poaching activity is most likely to occur, thereby improving the effectiveness of their patrols. Based on this case study, the use of predictive algorithms can be extrapolated to other philanthropic areas such as; predicting the spread of a disease outbreaks to plan resource allocation or forecasting adverse weather conditions to coordinate proactive relief efforts, rather than rely on reactive models.

The creation of data warehouses and integrated data sets enables philanthropic actors to consolidate large amounts of data from different sources to enable quicker analysis through joint efforts. A second case study cited by Junge et al. (2018) focuses on the Vulnerability Analysis Monitoring Platform for Impact of Regional Events (VAMPIRE) system in Indonesia. This system integrates different data sets in order to visually present a holistic early warning system for climate impacts, using baseline data that includes population and socio-economic indicators, with additional layers such as meteorological data. The primary purpose of the system is to understand the impact of climate on vulnerable populations and to identify priority areas for intervention. Thus, data warehouses and integrated data sets, can provide the source data for predictive algorithms. This case study is relevant to the Sub-Saharan African context, given the region's recent climatic changes, such as floods and droughts, which have severely impacted vulnerable communities. Furthermore, the limited availability of advanced data storage solutions in sub-Saharan Africa limits the capacity for data analysis, particularly

in sectors like healthcare and education, which are major beneficiaries of philanthropy (Moyo et al., 2022).

The next case study focuses on the application of AI and ML tools and techniques. These tools and techniques involve the input of large amounts of data and allowing the algorithms previously developed to adjust and improve themselves for better outputs (Nost & Colven, 2022). The third case study cited by Junge et al. (2018) examines the application of AI and ML tools and techniques in Central Africa during the Zika outbreak in 2015 and the Ebola crisis in 2017 and the case is based on the Magic Box platform developed by UNICEF as an open source tool designed to share information that informs humanitarian responses. Magic Box collects data from both public and private sector partners and applies ML techniques to generate insights on emerging emergencies and epidemics (Junge et al., 2018). The platform uses ML to analyse data, understand how communities recover from disasters, and assess the impact on vulnerable communities.

This case study is relevant to Sub-Saharan Africa because firstly, the platform was tested and implemented in the region, and secondly, regular disease outbreaks in the region require humanitarian responses, which are predominantly philanthropic in nature. In addition, the use of big data has been extraordinarily beneficial in monitoring and predicting the transmission of ailments such as influenza, Ebola and more recently, the coronavirus disease 2019 (COVID-19) pandemic (Agbehadji et al., 2020).

The final case study focuses on real-time monitoring to improve the effectiveness of philanthropic activities. One technique that is becoming increasingly popular for collecting real-time data for monitoring purposes, is social media tracking (Junge et al., 2018). In recent years, access to social media has provided real-time data that can be analysed and used to inform humanitarian responses. The fourth case study cited by Junge et al. (2018) looks at how the UN Global Pulse Lab in Indonesia uses social media to understand food price changes and their potential impact on food insecurity, which could lead to a humanitarian crisis. Similarly, philanthropic actors across Sub-Saharan Africa could use social media to collect real-time data to identify areas of focus and resource allocation. This data could also assist philanthropic organisations better understand their contextual environment and how to effectively intervene.

In conclusion, the case studies presented are not exhaustive and were intentionally selected based on their relatability to the Sub-Saharan African context. They show the potential for AI and big data to positively impact philanthropy in the region based on previous applications and their relevance to the Sub-Saharan African context.

5. Findings and discussions

This section summarises and discusses the research findings based on; the challenges identified, the literature review findings, and insights from the case studies reviewed, in relation to the impact of AI and big data tools and techniques within the philanthropic ecosystem in Sub-Saharan Africa.

5.1 Challenges identified

The key challenge identified is the incompleteness, inconsistency, and inaccessibility of the data that is currently available. In order to realise the potential impacts of AI and big data within the philanthropic ecosystem across Sub-Saharan Africa, it is imperative to establish strategic avenues through which data is collected, shared, stored, and analysed. This requires engaging in political and socio-economic dialogue across the region to determine how data resources can be shared to enable the full impact of AI and big data in the philanthropy ecosystem.

There is currently no clear framework for integrating existing traditional knowledge systems, that have played important roles in communities, with AI and big data tools and techniques. The information, and data, in these knowledge systems is predominantly anecdotal and undocumented, yet it can support predictive analysis in areas such as climate change.

5.2 Literature review findings

The literature review indicates that the philanthropic sector in Sub-Saharan Africa has been slow to adopt the use of AI and big data tools and techniques, despite the availability of data sources amongst philanthropic organisations and the existence of traditional knowledge systems. This gap presents an opportunity for further research on the use of AI and big data within the philanthropy ecosystem across Sub-Saharan Africa.

Furthermore, the existing data needs to be curated in order to realise the benefits of AI and big data tools and techniques. This process would inherently involve policy interventions on data collection, use, and management.

5.3 Theoretical and empirical review findings

Based on the theoretical and empirical review, and the philanthropic data value chain, there is a lack of clarity amongst stakeholders regarding the potential of AI and big data to positively impact philanthropy across Sub-Saharan Africa. In order for AI and big data to have the desired positive impact within Africa, there needs to be investment in stakeholder involvement, community capacity building, skills development, and infrastructure development.

Additionally, there must be a shift from pilot projects to a more deliberate and continuous use of AI and big data in order to fully realise the potential positive impacts of these technologies in

philanthropy. This can only be achieved through shared goals and long term commitment from all stakeholders.

5.4 Findings from case studies

The case studies reviewed identify opportunities for the use of AI and big data within the philanthropy ecosystem in Sub-Saharan Africa and highlight the need for developing localised solutions. A key area for consideration is the integration of philanthropic activities to national development plans and agendas. The case studies show how AI and big data have been used to support national interventions and further suggest how these can be extrapolated to other philanthropic activities.

6. Conclusions and Recommendations

While the potential benefits of AI and big data are clearly significant, there are also challenges that arise and must be addressed. The key challenges identified are as follows:

Current research: There is limited research and case studies that focus on the use of AI and big data within the philanthropic ecosystem in Sub-Saharan Africa. This gap presents an area for further research, particularly concerning the impact of integrating traditional knowledge systems.

Data Privacy and Security: This involves developing data governance policies that ensure that collected data is stored and used in ways that protect the privacy and security of individuals and organisations.

Digital Divide: In Sub-Saharan Africa, the digital divide remains a barrier. To ensure that all communities benefit from AI and big data technologies, it is essential to invest in infrastructure and education.

Comparative Case Studies: Over and above investment in infrastructure and education, the philanthropy sector in Sub-Saharan Africa should learn from best practices in other parts of the world through existing case studies. In specific, the application of AI and big data technologies to inform national development plans (NDPs) and agendas relating to philanthropy. This is as a means of shifting philanthropic activities from the point of being reactive to that of being proactive.

Ethical Considerations: Advances in technology and its application in the philanthropic space carry ethical implications. Therefore, the use of AI, and big data in philanthropy must be cognisant of issues such as bias in data and decision making. These biases must be carefully managed to avoid unintended negative consequences.

Areas for future research: Traditional knowledge systems are an integral part of communities across Sub-Saharan Africa. Therefore, further research needs to be conducted on the integration of these systems with AI and big data tools and techniques.

In conclusion, AI and big data have the potential to revolutionise philanthropy in Sub-Saharan Africa by improving the efficiency and effectiveness of interventions, enhancing transparency, and empowering local communities. However, realising this potential requires addressing the identified challenges, including conducting further research on the integration of traditional knowledge systems, improving access to quality data sets, ensuring data privacy and security, bridging the digital divide, and promoting the ethical use of data.

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