ISLAMIC UNIVERSITY JOURNAL OF SOCIAL SCIENCES VOL 1, NO 2, MARCH 2025 ISSN: 2709-2429(Print), 2709-2437(Online)-Published 03rd March2025

Analysis Of The Role Of Technology And Its Impact On Refugee Management In Uganda

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ABSTRACT

Uganda, renowned as Africa's most refugee-friendly nation and third globally, hosts over 1.5 million refugees, primarily from Congo, South Sudan, and Somalia. Its inclusive policies grant access to land, healthcare, and education, yet managing this influx remains challenging amid limited technological integration. While ICT tools like biometric identification, KoBoToolbox, and UNHCR's PRIME system enhance registration and resource allocation, Uganda lags in leveraging advanced technologies for holistic refugee management. Pre-arrival, refugees rely on ICT for navigation and communication, but post-arrival challenges such as high internet costs, data privacy concerns, and interoperability gaps impede effective service delivery. Digital literacy deficits and infrastructure limitations further hinder equitable access. This study identifies critical gaps in the role of ICT Uganda's refugee management, emphasizing the need for scalable ICT solutions to improve decision-making and integration. Recommendations include expanding digital literacy programs, enhancing network coverage, and fostering partnerships to deploy AI, blockchain, and IoT for predictive analytics and secure identity management. Future advancements, such as AI-driven chatbots, VR for relocation planning, and smart camps with IoT-enabled resource optimization, promise transformative potential. By prioritizing ICT infrastructure, Uganda can model sustainable refugee integration, shifting from crisis response to empowerment. Collaborative efforts among governments, NGOs, and the private sector are vital to harness emerging technologies, ensuring refugees' access to education, healthcare, and socioeconomic opportunities, ultimately fostering a more humane and efficient global migration framework.

Keywords: Biometric identification, Blockchain technology, ICT in refugee management, Refugee-friendly policies, Refugees migration.

1 Introduction

Uganda in the Eastern part of Africa is currently considered the most refugee-friendly country in Africa and ranked third across the globe due to its "Open border" policy it is investing over 28 trillion shillings in caring for the host and displaced communities (Titz & Feck, 2017) with over with 1,595,405 displaced people and asylum seekers as of February 2022 (Reliefweb, 2022) . According to the United Nations (UN), Uganda is currently hosting 1.3 million refugees, Pakistan has 1.4 million, and Turkey has 2.9 million. To achieve the UN's sustainable goals, technology is directly integrated into these goals, most notably in sustainable cities and communities, responsible consumption and production, peace, justice, and strong institutions (https://sdgs.un.org/goals/).

According to the report presented by the United Nations High Commission for Refugees (UNHCR) in conjunction with the Republic of Uganda, the total population of Refugees as of September 2022 is over 1,518,570, which constitutes a total of 385,398 households, and

making the total asylum Seekers to be 36,611. 92% live in settlements, 81% are women and children, and 3% are elderly. The three top countries with increased refugees to Uganda are Congo, South Sudan, and Somalia with 32.4 %, 63.3%, and 4.3%, respectively. These people are managed within the settlement camps that include Adjumani, Bidibidi, Nakivale, Rhino, Kyangwali, Kampala, Palorinya, Kyaka II, Rwamwanja, Palabek, Kiryandongo, Imvepi, Oruchinga and Lobule (Reliefweb, 2022). The first five of these refugee camps are the largest in the country with populations of 220,592, 210,102, 152,733 and 143,200 refugees respectively.

The government and non-governmental organizations are looking for innovative solutions to manage the increased influx of asylum seekers. For instance, several reasons in Uganda's bordering nations, particularly the conflict and bloodshed in South Sudan and the Congo, as well as the ensuing economic crises and political unrest in the area, are to blame for the massive influx of refugees. Uganda has comparatively "friendly" regulations that give refugees access to human rights like those to private property, good healthcare, formal education, and other fundamental social services and rights (Brown et al., 2022; Matlin et al., 2025; Okumu et al., 2023) . According to recent studies, innovative technologies are used more in the field of migration to manage refugees better and streamline procedures. Refugees in developing nations are more susceptible to several challenges in the host countries, especially in the Covid19 and post pandemic's socioeconomic effects (Daily Monitor, 2021).

Technology utilization in migration management is at its genesis in developed and developing nations. However, in Uganda, limited research has been done to analyze the technological role in refugee management at three levels, i.e., user, settlement in charge, and governmental level (Nalbandian & Dreher, 2023). The prospective and actual applications of technologies in migration management processes have presented an advanced benefit in developed nations, but Uganda is not yet certain about the cutting-edge technology application in migration management. Therefore, this research strictly focuses on the technology usage perspective and its impact on physically and electronically managing refugees.

As the refugee numbers increase, their data management becomes critically difficult resulting in poor planning and decision-making for them in mainly basic needs of life. Thus, this study will present these gaps for the government and non-governmental implementors and decision-makers on refugee migration to enhance them for refugees to better stay in Uganda, which can be tested and implemented in other migrant-friendly and developing nations as well.

Study Goal and Objectives

To effectively manage refugee affairs, a standardized process should be established, especially in developing countries like Uganda. Given Uganda's high ranking as a refugee-hosting nation in Africa, its technological capabilities must be assessed to evaluate its strengths, weaknesses, opportunities, and threats. This assessment will support informed decision-making and enhance resource utilization efficiency. The objectives of this study are to:

a) Investigate key aspects of information and communication technologies utilized in managing refugee affairs within settlement camps in Uganda
b) Establish the limitations and challenges of the existing technology in refugee and data management within the Ugandan system.
c) Determine the role of ICTs in refugee management before and after displacement.
d) Assess the infrastructure and technological streams for refugee management.

Guiding research questions to study are

a) What are the key aspects of ICT used in managing refuges affairs during their displacement and settlement?
b) What are the limitation and challenges of using the existing technologies?
c) What are the present and future roles of ICT in refugee management before and after displacement?
d) What are infrastructure and technological streams used for refuge welfare in refuge camps?

2 Related works

The global crisis of forced displacement has reached unprecedented levels, necessitating innovative approaches to address the challenges of social inclusion for refugees. Emerging technologies, particularly information and communication technologies (ICTs), have shown significant potential in mitigating these challenges, both in the immediate and long term. This section reviews existing literature on the role of technology in refugee management, focusing on its impact on social inclusion, communication, and integration in host countries, with particular relevance to Uganda.

2.1 Challenges Faced by Refugees and the role of ICTs in Bridging Gaps

Upon arrival in host countries, refugees encounter numerous obstacles, including language barriers, disrupted education, shifts in family dynamics, and discrimination (Correa-Velez et al., 2010; S. Gifford et al., 2009; S. M. Gifford & Wilding, 2013). Additionally, they must navigate the dual challenge of maintaining connections with family and friends in their home countries while building new social networks in their host countries (Damian & Van Ingen, 2014; Merdi, 2019). These challenges highlight the critical need for tools and resources that facilitate adaptation and integration. Research by (Abujarour et al., 2021; Navarrete & Huerta, 2006) underscores the transformative role of the Internet in refugee interactions, bridging temporal and spatial gaps. Emerging ICTs, with their multimedia capabilities, combining text, images, audio, and video, not only address refugees' communication needs but also foster a sense of community. For instance, mobile apps and social media platforms enable refugees to maintain connections with loved ones, which enhances their sense of belonging in host countries (S. M. Gifford & Wilding, 2013). Social media also empowers refugees by providing platforms to share their experiences, present their identities, and engage with both their communities and host societies, thereby strengthening their integration (S. M. Gifford & Wilding, 2013).

Studies have demonstrated that social media use, particularly platforms like Facebook, correlates with improved quality of social relationships for migrants, both online and offline. These platforms facilitate connections across home and host countries, enabling refugees to build and maintain relationships that are crucial for their social, cultural, and psychological adaptation (Bock et al., 2020; Damian & Van Ingen, 2014; Lee, 2016). Furthermore, refugees who engage more frequently with locals online tend to achieve greater success in their adaptation processes (Chen, 2010). A study by (Andrade & Doolin, 2016) employs the capability approach to examine how ICTs facilitate social inclusion among refugees in New Zealand. The authors conceptualize technology as a resource that enables refugees to develop five key capabilities: (1) involvement in an information society, (2) effective communication, (3) understanding of a new society, (4) social connectedness, and (5) cultural expression. These capabilities empower refugees to function effectively in their new environments, regain control over their lives, and enhance their sense of agency and well-being—critical components of social inclusion in the refugee context.

2.2 ICTs as Tools for Information Access and Cultural Expression

ICT use by refugees presents a unique opportunity to explore how technology-mediated activities contribute to social inclusion. Forced migrants in unfamiliar environments require

access to information to solve everyday problems, understand laws and regulations, and navigate cultural and societal norms. The inability to access and utilize relevant information resources can marginalize refugees, making social inclusion an information challenge (Caidi et al., 2010; Lloyd et al., 2013) . Beyond information access, the Internet and social media facilitate communication, expression, and participation in ICT-enabled social and support systems (Caidi et al., 2010) . Digital media production and virtual spaces, such as websites, also provide platforms for refugees to develop and express their cultural identities (Caidi et al., 2010; Panagakos & Horst, 2006).

Focusing solely on refugees' integration within host countries overlooks the importance of geographical mobility and transnational connections in contemporary life. Refugees increasingly participate in extensive, overlapping social networks that form "a more global, deterritorialized world" (S. M. Gifford & Wilding, 2013). ICTs enable information flows and network connections across borders, allowing community membership to transcend physical colocation (Wilding, 2009) . Refugees inhabit transnational spaces where ICTs facilitate global information exchange, communication with distant family and friends, and continued engagement with their countries of origin through monitoring events and participating in political life (Benítez, 2012; Wilding, 2012).

In summary, the above studies highlight the transformative potential of ICTs in addressing the multifaceted challenges faced by refugees. From enhancing communication and fostering a sense of belonging to enabling information access and cultural expression, technology plays a pivotal role in promoting social inclusion. In the context of Uganda, where refugee populations are significant, leveraging these technological tools could offer innovative solutions to improve refugee management and integration (Madon & Schoemaker, 2021).

2.4 Conceptual Framework

The conceptual framework presented here in provides four dimensions of the role of ICT in management of refugees in the East Africa context specifically Uganda. In this respect we present the a) the host society dimension b) the source society dimension c) pre-migration and d) post-dimension. In this study the roles of ICT based refugee management towards adoption, bonding, opportunity and bridging models not underscoring the pivotal roles of government, non-government organization and telecommunication infrastructure established in both the source and host countries is explored.

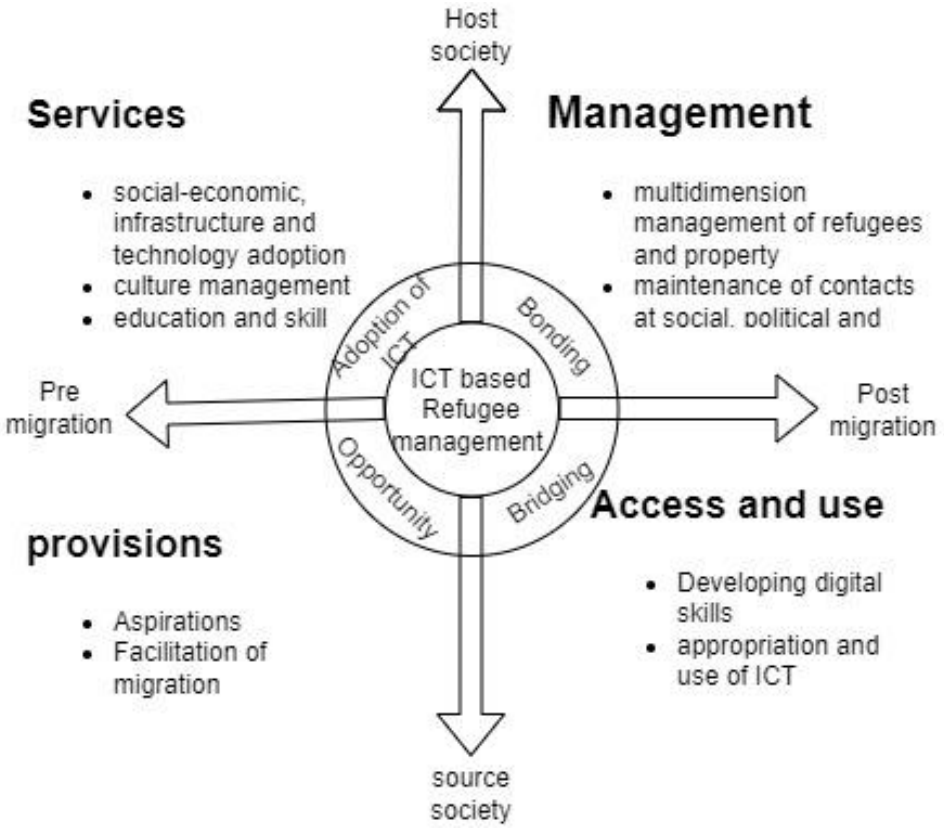

Fig. 1. Conceptual Framework

3 Methods

3.1 Research Methodology

This study adopted a **cross-sectional survey design** to gather responses from a targeted group of respondents, addressing specific research questions as outlined by Creswell & Creswell (2022) . The cross-sectional design was selected due to its efficiency in collecting data within a short timeframe, making it suitable for capturing a snapshot of the current state of technology usage in refugee management. Descriptive statistics were utilized to answer the research questions and generate conclusive findings for each research objective.

3.2 Study Area, Period, and Population

The research was conducted in refugee camps across Uganda. The study spanned a period of 12 months (February 2024-February 2025), ensuring sufficient time for data collection, analysis, and validation. The source population for this study includes the 13 refugee camps located within Uganda, and their respective supervisors. These camps and offices represent the primary stakeholders involved in refugee management and the use of

information technologies for management and administration of refugees' welfare. From the 13 refugee camps, 5 camps were selected for this study. In each selected camp, the top managers were identified and included in the study. Additionally, three (3) individuals were selected from United Nations High Commissioner for Refugees (UNHCR) verify the insights from a policy and administrative perspective.

3.3 Sample Size and Sampling Technique

The sample size for quantitative data collection consisted of 20 respondents. This number was determined to ensure a manageable yet representative sample for statistical analysis. A purposeful sampling technique was employed to select the 5 refugee camps with the highest number of refugees. The rationale behind this approach is the assumption that technology diffusion and infusion are more prevalent in larger camps compared to smaller ones. By focusing on larger camps, the study aims to capture a more comprehensive understanding of technology usage in refugee management.

3.4 Data Collection

Primary data for the quantitative component of the study was collected through structured questionnaires administered to the selected respondents. The questionnaires were designed to gather information on technology usage, challenges, and effectiveness in refugee management. In the study google form survey questionnaire was used to gather feedback from respondents, while safeguarding their privacy.

3.5 Data Management and Analysis

Data analysis commenced after identifying and addressing any missing values in the quantitative dataset. The Statistical Package for Social Sciences (SPSS) version 23. The study organized the data through a systematic process of editing, coding, tabulation, and categorization. Data was correlated with the respective research variables to ensure valid findings, conclusions, and recommendations regarding technology usage in refugee management. Descriptive statistics were used to summarize the responses to specific items on the research instrument.

4 Presentation of Results and Discussions

4.1 The Role of ICT in Refugee Integration into Host Communities

From the study's findings, the provisional government regulates refugee registration and settlement through a computerized system that integrates various databases and technologies. From a global perspective, the registration System relies on digital data management, with refugee information stored in computers and shared across platforms. Office applications are

typical, including analysis software like KoBoToolbox and RefAid for connecting the displaced people with NGOs for assistance like shelter and food. The UNHCR's PRIME database and the Displacement Tracking Matrix (DTM) are crucial in tracking displaced individuals. Refugees are issued identification cards linked to digital records, ensuring accurate data management. Internet access is essential for database operations and information sharing, facilitating coordination among agencies involved in refugee support and resettlement. The use of ICTs in managing the affairs of refugees and displaced individuals serves as a vital lifeline, not only for delivering services, information, and opportunities but also as a crucial tool for addressing emerging challenges. This aligns with findings the authors present the impact of ICT, the information that is accessed by the refugees and displaces people, maintenance of social connectivity and challenges

ICT tools play a crucial role in refugee settlement and integration. Mobile phones, used by up to 90.9% of individuals in settlements, and internet access, available to 54.5% of refugees, are key in enhancing connectivity. Biometric technologies, widely employed for refugee identification, support service provision and welfare management. The majority of officers, 63.5%, are equipped with both desktops and laptops, enabling them to perform their duties effectively. The existence of dedicated ICT programs, such as digital literacy training and access to online services, is acknowledged by approximately 72% of respondents, demonstrating the proactive measures taken to aid refugee integration. Over 70% agree on the critical role of ICT in enhancing refugees' access to legal aid and protection services. Finally, there is broad acceptance of government, NGO, and private sector partnerships in improving refugee ICT accessibility through grants and ICT development programs.

Key improvements to enhance refugee integration through ICT include expanding digital literacy programs and ensuring accessibility to digital tools. Online education and skills development opportunities can empower refugees with knowledge and professional expertise, while ICT-driven employment initiatives support economic independence. Digital solutions should also enhance healthcare and psychological support, ensuring refugees receive necessary medical and mental health services. Additionally, secure digital identity systems can facilitate legal assistance and service access. Strengthening telecommunications infrastructure, providing reliable network coverage, and improving access to electricity are crucial for sustained ICT use. Equipping refugees with smartphones, free internet, and computers can further bridge the digital divide. Lastly, establishing a sustainable ICT refugee

integration system will ensure long-term access to essential services, fostering self-reliance and smoother adaptation into host communities.

4.2 ICT's role in linking refugees with their country of origin

Refugees frequently use ICT to maintain connections with their countries of origin, with up to 63% relying on digital communication. This not only helps them stay in touch with their loved ones but also provides a sense of belonging and reduces feelings of isolation. Popular applications include WhatsApp (90%), Facebook (over 80%), email (36%), and SMS (63%). Smartphones and related applications are the primary tools for fulfilling communication needs, enabling refugees to stay in touch with individuals back home, access news updates, and use entertainment services. However, several barriers hinder the full utilization of ICT, including the high cost of data and the internet, limited access to personal ICT equipment, government restrictions, and lack of digital skills. Additionally, mobile money services are crucial in enabling refugees to send financial assistance to relatives, though unfavorable policies in their home countries often pose challenges.

The study also reveals Additional ICT services that could help refugees maintain connections with their country of origin, including the provision of free internet, reduced ICT costs, affordable data bundles, and free airtime. Video conferencing tools and email communication can further enhance connectivity. Additionally, subsidies and promotional offers can make ICT services more accessible. Raising awareness about diseases and security threats through digital platforms can also help refugees stay informed about conditions in their home countries. Improving and expanding these ICT programs would significantly enhance refugee communication and connectivity.

4.3 ICT's Role Before Refugees Arrive in Uganda

Approximately 63% of individuals seeking refuge plan their journey using social media, GPS, and messaging apps. The most sought-after online information includes refugees' rights and legal procedures (82%), travel routes and safety details (73%), asylum application procedures (46%), and online maps and GPS services. Additionally, about 70% of refugees consider the information they access reliable, while nearly 55% acknowledge instances of misinformation that may mislead them during migration. Respondents also highlight the availability of emergency hotlines (73%), legal aid apps and websites (64%), online refugee support services (64%), and assistance from supportive relatives (9%) as key resources before arriving in host

countries. Overall, ICT-based services are widely regarded as effective in making migration processes safer and more informed.

ICT is crucial in facilitating cross-border coordination for refugee tracking and assistance. It is widely regarded as good and very useful in enhancing refugee registration and tracking, ensuring accurate identification and monitoring of displaced individuals. Additionally, ICT significantly improves humanitarian assistance and resource allocation, enabling organizations to distribute aid efficiently. However, some challenges exist, particularly in monitoring conflict zones and mobilizing responsible agencies, where ICT tools have proven to be poorly utilized in some cases. Despite this, digital mapping and GPS services assist in navigation, providing refugees and aid workers with essential directions. Furthermore, ICT plays a vital role in smoothing coordination between countries, ensuring better communication and cooperation in refugee management. Overall, ICT remains highly effective in cross-border efforts, though improvements in conflict zone monitoring and inter-agency mobilization are needed.

In this study, respondents highlighted how humanitarian agencies face significant ICT-related challenges that hinder refugee assistance and coordination before they arrive in in the host country. These include; limited digital infrastructure and poor connectivity, especially in remote areas, result in frequent network breakdowns, inadequate power supply, and restricted ICT use. High internet costs and accessibility issues further exacerbate these problems, while government restrictions and data-sharing barriers complicate inter-agency coordination. Data security and privacy risks, including cyber threats and scams, pose serious concerns. The lack of digital literacy among refugees and aid workers, coupled with misinformation, reduces the effectiveness of ICT tools. Addressing these challenges is crucial to enhancing digital solutions for humanitarian efforts and improving refugee service delivery.

Respondents agree that several technological solutions can be implemented to improve and support pre-migration information. Free Internet and data access enable refugees to obtain crucial migration details. Establishing multidirectional digital identity and biometric registration systems can streamline refugee tracking and legal processing. Developing online platforms in local languages and offering websites and mobile apps with critical migration and legal information would enhance accessibility. Strengthening network coverage and ICT infrastructure, ensuring the affordability of digital devices, and addressing limited access to phones and the Internet are also essential. Additionally, collaborating with ICT professionals to provide technical support can enhance the effectiveness of these digital solutions, ensuring

refugees receive accurate and timely pre-travel information. Lastly, emerging technologies cutting across bright things, big data analytics, and Artificial intelligence can create a different dimension in managing migration.

4.4 The Role of ICT After Refugees Arrive in Uganda

Upon arrival in the host country, refugees are registered using biometric systems, with their information recorded in a refugee information system. In cases where biometric systems are unavailable due to infrastructure challenges, registration is conducted manually using forms. Additionally, mobile apps are sometimes utilized to capture refugee data upon arrival. Once registered, refugees undergo further management processes, including documentation and verification, until their settlement is complete. During this process, officers face several challenges in using ICT for refugee management, including data security and privacy risks, as some refugees may attempt to hide information. Interoperability and integration issues further complicate data sharing between systems. Language barriers and inadequate technical skills among officers limit the effective use of advanced ICT tools for data collection and analysis. Poor computer literacy, slow internet connections, network breakdowns, and limited coverage hinder communication and information processing. The high cost of internet services and misinformation pose significant obstacles, making ICT utilization less effective in refugee management.

In the study, several gaps hinder the effective use of ICT in managing refugees in host countries. Poor or inadequate internet access and limited network coverage prevent refugees and humanitarian workers from accessing essential digital services. The insufficient availability of computers, smartphones, and tablets further restricts digital engagement, making it challenging to streamline refugee management processes. Additionally, low levels of ICT literacy among refugees and aid workers limit their ability to utilize digital tools effectively. The high cost of devices and data makes technology inaccessible to many, particularly vulnerable groups such as older people, women, and people with disabilities, leading to unequal access. Financial constraints and lack of funding for ICT infrastructure, training, and device distribution further exacerbate these challenges. Addressing these gaps is crucial for improving refugee management through digital solutions.

To enhance post-migration refugee management respondents proposed several ICT improvements that should be implemented. Among them are strengthening digital identity and registration systems will ensure accurate refugee data collection and streamline service

delivery. Expanding Internet and mobile network access by establishing access infrastructure, providing free Internet services, and reducing data costs will improve connectivity. Enhancing data security and privacy protections is crucial for safeguarding refugee information. Developing more apps and websites to provide information on legal, healthcare, and assistance programs can also improve accessibility. Capacity-building initiatives should focus on ICT literacy training to empower refugees and humanitarian workers. Telecommunications companies must enhance network coverage, while financial support from donors such as the U.S. and Europe can help fund digital infrastructure, training programs, and device distribution. These improvements will significantly enhance refugee management and integration efforts.

5. Discussion

On the role of ICT refugee integration in the host community, the study highlights the critical role of ICT in managing refugee registration, settlement, and integration. Governments and agencies use computerized systems, such as the UNHCR's PRIME database and the Displacement Tracking Matrix (DTM), to track displaced populations digitally. Refugee identification cards linked to centralized databases ensure accurate data management, while internet access enables stakeholder coordination. Tools such as biometric technologies streamline service delivery and welfare management. Mobile phones (used by 90.9% of refugees) and internet access (available to 54.5%) enhance connectivity, while 72% of respondents acknowledge ICT programs like digital literacy training. Over 70% agree ICT improves access to legal aid and protection. Other emerging technologies such as internet of things, cloud computing, artificial intelligence are visualized to have significant impact of refugee management in many dimensions cutting across education provision, healthcare provision and enabling innovation and self-reliance artificial intelligence are seen to have significant impact of refugee management in many dimensions cutting across education provision, healthcare provision and enabling innovation and self-reliance. (Alli et al., 2021; Alli & Alam, 2019; Kalinaki et al., 2024). These finding are in line with studies (ANM, 2024; Gupta et al., 2022; Ritchie, 2023) in ICT was found to play a crucial role in enhancing the implementation of curricula in refugee settlement places boosting engagements and motivation up to 76% enabling skills development and societal inclusion. This enhances engagement and empowerment. The same studies noted that ICT provided interdisciplinary transitions from temporary to permanent settlement.

On the role of ICT in linking refugees with their home country this study highlights refugees' reliance on ICT, with 63% using digital tools to connect with their countries of origin. Apps like WhatsApp (90%), Facebook (80%), SMS (63%), and email (36%) help maintain social ties, reduce isolation, and access news/entertainment. However, barriers like high data costs, limited device access, restrictive policies, and digital illiteracy hinder full ICT utilization. Mobile money services are vital for sending financial aid but face regulatory challenges. Similar finding has been highlighted in (AbuJarour et al., 2019; Marchetti-Mercer, 2022) where the role of ICT is seen to be multifaceted providing both communication and services which are important for reducing isolation, maintaining emotional connection, addresses issues of mobility let alone preserving cultural ties.

On the use of ICT before they head to the destination countries of refuge this study highlights that 63% of refugees use ICT tools like social media, GPS, and messaging apps to plan migration, seeking information on rights (82%), routes (73%), and asylum procedures (46%). While 70% trust this information, 55% encounter misinformation. Key resources include emergency hotlines (73%), legal aid apps (64%), and online services. ICT enhances cross-border coordination for registration, tracking, and aid distribution but struggles in conflict zones and inter-agency mobilization. Challenges for humanitarian agencies include poor infrastructure, high costs, data security risks, and low digital literacy. Solutions propose free internet, biometric systems, local-language platforms, affordable devices, and ICT partnerships. Emerging technologies like AI and big data could revolutionize migration management, underscoring the need for robust, inclusive ICT frameworks to ensure safer, informed migration. Our finding ream with those in (Diaz Andrade & Doolin, 2019; Frouws et al., 2016; Martin-Shields & Munir-Asen, 2024) where refugees in transit use ICT tools for self-reliance and examining daily practices in the host communities, they also use them to examine their routes, foster connections with smugglers in cases of illegal migration and keeping them well-informed their new society they intent to move to. These activities solicited from ICT's available enable them to take rational decisions on where to see refuge.

On arrival in Uganda ICTs play a significant role this study outlines refugee registration via biometric systems or manual methods when infrastructure is lacking, ICTs have been management of refugees in terms of provisions of aid, tracing their movements and managing integrations programs. It is noted that post-registration challenges include data security risks, interoperability issues, language barriers, and limited staff technical skills, alongside poor connectivity, high costs, and misinformation. Critical gaps hinder ICT effectiveness include

inadequate internet access, scarce devices, low digital literacy, and financial constraints, disproportionately affecting vulnerable groups like women and the elderly. Unlike our study where advanced ICTs have not been adopted in many of the settlement locations because of their remoteness, studies in (Gaspard-Chickoree, 2020; Jadaan & Hasan, 2024; Sharma & Kaur, 2024) have revealed advanced ICTs including platforms for stakeholder collaboration and management, geo-localized support for security and migration pattern management, entrepreneurial platforms for training and job-matching. All these ICTs help in settling and mitigation of settlement challenges in the host countries

6. The Future Information Technologies For Refugee Management

In the near future, advances in information technology will revolutionize refugee camp management worldwide, creating a more humane and efficient ecosystem amidst the political, social, environmental, and philosophical conditions that drive migration. Emerging technologies will enhance refugee identification and resource distribution and bridge communication, security, and overall well-being gaps (Marchetti-Mercer, 2022; Martin-Shields & Munir-Asen, 2024) . In addition, education will be digitally transformed through future EdTech solutions tailored to refugee needs. AI-driven e-learning platforms will provide displaced children customized curriculums, while virtual classrooms will connect learners with teachers worldwide (Kerneža et al., 2024) . Communication technologies will further enhance social integration, allowing refugees to maintain family connections, receive legal guidance, and access mental health support services(Frouws et al., 2016).

One of the most transformative technologies in this space is artificial intelligence (AI). In the future, AI-powered chatbots and virtual assistants will support help desk managers by providing real-time, multilingual assistance to refugees, ensuring safer migration journeys from their countries of origin to host nations. AI-driven predictive analytics will enable governments, humanitarian organizations, and refugee agencies to anticipate migration patterns, allocate resources effectively, and make informed policy decisions on controls(Kabir et al., 2023; Krasić, 2024). AI technologies will yield privacy and security concerns that will encourage the adoption of blockchain that will redefine the way refugees manage their identities and access essential services(Khekare et al., 2025). Beyond its current applications, such as the World Food Programme's *Building Blocks* for distributing aid, blockchain will evolve into a comprehensive digital ecosystem where refugees can securely store and access personal records, including medical history, education certificates, and financial

transactions (Kabir et al., 2023; Khekare et al., 2025) . This seamless and fraud-resistant system will empower displaced individuals to rebuild their lives with greater autonomy and dignity.

Advanced web applications, virtual reality (VR), and augmented reality (AR) will give refugees a real-time snapshot of potential host countries, offering insights into settlement locations, infrastructure, healthcare facilities, climate conditions, and available livelihood opportunities. These technologies will enhance pre-migration decision-making, allowing individuals to visualize their future environments and make informed choices about relocation(Kirya et al., 2023; Sharma & Kaur, 2024). Additionally, the future refugee camps will be smartly managed through the Internet of Things (IoT), integrating connected devices to monitor and optimize water, food, energy, and medical resources. For example, sensor-equipped health devices will continuously track refugees' vital signs, alerting medical personnel to potential health risks and enabling timely interventions. Automated systems will improve shelter conditions, ensuring climate control, sanitation, and structural safety. In addition, using drones and autonomous robotic systems will become standard for delivering emergency supplies, conducting aerial surveillance, and assessing risks in disaster-prone areas. Real-time imagery from drones will assist aid organizations in tracking refugee movements, detecting security threats, and ensuring the safety of displaced populations (Alli et al., 2024; Tong et al., 2023).

In general, as technology continues to evolve, the role of ICT in refugee welfare will go beyond crisis response, but it will empower, protect, and integrate displaced populations into new societies. These advancements will enhance identification systems, optimize health and aid management, and provide educational opportunities, all contributing to creating a more humane, efficient, and sustainable refugee management system.

7. Conclusion, recommendations and future research directions

This study highlights the critical role of technology in refugee management, particularly in Uganda, which hosts one of the largest refugee populations globally. By examining the use of Information and Communication Technologies (ICTs) across pre-migration, post-migration, and integration phases, the research reveals both the transformative potential and challenges of leveraging technology in this context. ICTs, such as biometric systems, mobile applications, and digital databases like the UNHCR’s PRIME and the Displacement Tracking Matrix (DTM), have streamlined refugee registration, data management, and service delivery. Mobile phones and internet access have empowered refugees by facilitating communication,

access to information, and social connectivity, both within host communities and with their countries of origin. These tools have also supported economic independence through mobile money services and online education platforms, while reducing isolation and fostering cultural expression. However, significant barriers hinder the full potential of ICTs in refugee management. Limited digital infrastructure, high costs of internet and devices, data security risks, and low digital literacy among refugees and humanitarian workers pose major challenges. Vulnerable groups, including women, the elderly, and people with disabilities, are disproportionately affected, exacerbating inequalities in access to digital resources.

To address these challenges, key recommendations include expanding digital literacy programs, improving ICT infrastructure (e.g., reliable networks, electricity access), and providing refugees with smartphones, free internet, and computers to bridge the digital divide. ICT-driven education and employment initiatives can empower refugees economically, while secure digital identity systems facilitate access to healthcare, legal aid, and social services. Partnerships between governments, NGOs, and the private sector are vital for funding ICT development programs. Strengthening telecommunications infrastructure and establishing sustainable ICT frameworks will ensure long-term access to essential services, fostering refugee self-reliance and smoother integration into host communities. Overall, ICT serves as a lifeline, addressing challenges in displacement while promoting social connectivity and resilience. Secondly, to improve connectivity, proposed solutions include free internet, subsidized data/airtime, video conferencing tools, and awareness campaigns on health/security via digital platforms. Expanding affordable ICT access, promoting digital skills, and enhancing subsidies could strengthen refugees' social and economic resilience while keeping them informed about their home countries. Lastly, proposed solutions to better use of ICT in refugee management include strengthening digital identity systems, expanding free/low-cost internet access, enhancing data security, developing legal/healthcare apps, and ICT literacy training. Funding from international donors and telecom infrastructure upgrades are vital for device distribution and network coverage. Addressing these gaps can improve refugee management, service delivery, and integration through inclusive, secure, and accessible digital solutions that include emerging technologies such as internet of things, cloud computing, artificial intelligence among many other upcoming information communication solutions.

In future, we intend to conduct longitudinal studies to assess the long-term impact of ICTs on refugee integration, economic independence, and social inclusion. This would provide deeper insights into how sustained access to technology influences refugees' adaptation and

well-being over time. Additionally, we shall explore the potential of emerging technologies such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT) in enhancing refugee data management, service delivery, and security. Investigate their ethical implications and scalability in resource-constrained settings.

"This research was funded by the Islamic University in Uganda (IUIU) under the Islamic Development Bank (IDB) Research Fund. The support provided by IUIU and IDB is gratefully acknowledged"

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