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Application of Information and Communication Technology in Traditional Medicine and Healing Knowledge Management: Stakeholders' Perspectives from Tanzania

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Abstract

This study examined the application of information and communication technology (ICT) in managing traditional medicine across four districts of Njombe, Masasi, Singida, and Magu, and the Institute of Traditional Medicine in Dar es Salaam, Tanzania. Specifically, the study explored how Tanzanian stakeholders use ICT to manage traditional medicine and healing knowledge, the effects of ICT on the ecosystem of traditional medicine and healing knowledge, their readiness to adopt ICT applications, and the obstacles they face when integrating ICT. Using a mixed-methods approach informed by the Technology Acceptance Model and the Information System Success Model, the study deployed a questionnaire survey, semi-structured interviews, focus group discussions, and observations to collect data from 71 respondents including traditional healers, prospective users, researchers, and district coordinators. The data were subjected to thematic and descriptive statistical analyses facilitated by the Statistical Package for Service Solutions. The study found severely limited use of modern technologies, such as computers, in managing traditional medicine and healing knowledge. Although stakeholders owned smartphones, their use was constrained by financial limitations, inadequate ICT skills, and insufficient technological infrastructure. Despite these challenges, participants acknowledged the importance of using ICT in managing traditional medicine and healing knowledge and expressed readiness to use it. However, ICT was not fully utilised in managing such knowledge in Tanzania. Enhancing ICT infrastructure, implementing targeted training programmes for stakeholders, and establishing clear policies and guidelines for ICT use in managing traditional knowledge are recommended.

Keywords: Indigenous knowledge, Information and Communication Technology, Knowledge management, Traditional healers, Traditional medicine, Healing knowledge.

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Introduction

The global proliferation of Information and Communication Technology (ICT) and the widespread use of the Internet since the early 2000s have significantly influenced various aspects of life, including socioeconomic and political developments (Iwata & Hoskins, 2017; Adam 2012). ICT, which encompasses telecommunication technologies such as telephones, cable, satellite, and radio, along with digital technologies such as computers, information networks, and software, has advanced information processing, sharing, and communication, overcoming geographical constraints and enabling real-time interaction (Mwiinga, 2023; Ogbomo & Ogbomo, 2008). This transformative influence extends to the management of

traditional medicine and healing knowledge, facilitating the interactive sharing of information about such knowledge through Web 2.0 and Web 3.0 channels, including telephones, emails, social media, and video conferencing (Iwata, 2024).

In today's rapidly evolving world, the extensive use of ICT across various spheres of life is imperative (Iwata 2015; Maponya, 2005). Therefore, managing traditional medicine and healing knowledge for the restoration of human health requires leveraging ICT for collecting, organising, categorising, and disseminating such knowledge, including digitising important metadata for traditional medicine and healing knowledge (Iwata, 2023; Dlamini, 2009; Davenport & Prusak, 2000). Digitising such knowledge also serves to avoid duplication, advances research, and accelerates scientific and technological development (Xie et al., 2010). In other words, integrating ICT in managing traditional medicine and healing knowledge provides timely information access to prospective users and facilitates the management of such knowledge for contemporary generations and posterity.

ICT usage has expanded over the past decades notably since the 2000s in various domains, including e-governance, agriculture, business, education, and knowledge management (Baako & Abroampa, 2023). In Tanzania, the widespread adoption highlights the huge potential of ICT in managing indigenous knowledge systems including traditional medicine and healing knowledge which hold significant cultural, social, and economic value in the country. Despite this acknowledgment, the nation's ICT integration with traditional medical and healing knowledge represents a crucial turning point for the evolution, transmission, storage, accessibility, and preservation of indigenous knowledge traditions. Information fragmentation, a lack of systematic methodologies, and inadequate documentation are some of the issues facing the administration and preservation of such knowledge.

Historically, traditional medicine and healing knowledge practices have profoundly influenced human health restoration in many African societies since time immemorial. The Ulwazi Programme in South Africa, for example, documents and preserves indigenous culture and history using online media; yet it is only since the 1980s that scholarly debate on managing indigenous knowledge has acquired importance. A renaissance of traditional medicine and healing traditions has resulted from countries like Tanzania, China, Nigeria, India, South Africa, Kenya, Ghana, Zambia, and Zimbabwe realising the importance of indigenous knowledge in healthcare (Iwata, 2015). Nevertheless, the management and preservation of Tanzania's traditional medicine and healing knowledge lack a systematic approach, with scattered information dispersed throughout communities without proper organisation. This situation persists even with the emphasis on the interconnectedness between ICT and knowledge management. The absence of a structured framework for utilising ICT raises questions about the effectiveness and appropriateness of such technologies in managing traditional medicine and healing knowledge.

In Tanzania, there exists a paucity of understanding regarding how stakeholders (including traditional healers, healthcare practitioners, policymakers, and community members) perceive and engage with modern technologies. The extent to which these stakeholders have embraced or rejected ICT, and their perceptions of whether these technologies are beneficial or detrimental, especially to the traditional healers and prospective users, remains unknown. Nonetheless, notable studies have examined managing indigenous knowledge in Tanzania, including the studies by Iwata (2015), Chirangi (2013), and Lwoga (2009), which have extensively explored the application and value analysis of managing indigenous knowledge with ICT focus. Iwata (2015) and Lwoga (2009) strongly advocate for the use of ICT in managing indigenous knowledge, aligning with Haralambos and Holborn's

(2004) assertion that knowledge not adaptable to technological formats risks loss or neglect. Despite the global acknowledgment of the positive impacts of technology on managing indigenous knowledge, the underutilisation of ICT by stakeholders in managing Tanzania's traditional medicine and healing knowledge highlights critical challenges and limitations including a lack of skills and infrastructure. Additionally, the integration of such technologies within the country's traditional medicine and healing practices remains largely unexplored, and accessing metadata for such knowledge remains a challenge.

The gap between the global acknowledgment of the positive impacts of technology in managing indigenous knowledge and the underutilisation of ICT by stakeholders in managing traditional medicine and healing knowledge in Tanzania raises critical questions regarding the extent to which the stakeholders have embraced or rejected ICT in managing traditional medicine and healing knowledge. And why ICT has not been properly applied in managing Tanzania's traditional medicine and healing knowledge despite being viewed as a beneficial tool for that purpose. Therefore, this study examined these issues and the challenges traditional healers face in integrating such technologies into their practices of managing knowledge in their possession. The specific objectives of this study were to examine how Tanzanian stakeholders use ICT to manage traditional medicine and healing knowledge. Moreover, it also looks at how they use ICT, how it affects the ecosystem of traditional medicine and healing knowledge, how ready they are to adopt ICT applications, and what obstacles they face when integrating ICT into these fields.

Literature Review

This article has thematically structured the literature review to align with the study's objectives, focusing on stakeholders' ICT use and methodologies in adopting and use of ICT for managing traditional medicine and healing knowledge, the impact of ICT on the ecosystem of traditional medicine, ICT adoption readiness, and the challenges encountered to effective ICT integration for this purpose.

Stakeholders' ICT use in managing traditional medicine and healing knowledge

Stakeholders' ICT use in managing traditional medicine and healing knowledge in Tanzania entails familiarity with the technology and acceptance of ICT applications. After all, ICT facilitates the capture, storage, preservation, and dissemination of information on services and products from indigenous knowledge, specifically for the restoration of human health. According to Iwata (2023), Adam (2012), and Jain (2006) the successful ICT application depends on ensuring accessibility and integration into educational frameworks. Proper ICT application fosters the flow of indigenous knowledge and facilitates the blending of traditional knowledge with modern scientific understandings. However, significant challenges persist. Iwata (2015) notes that much of traditional medicine and healing knowledge is retained in the minds of practitioners, hence making comprehensive digitisation and sharing complex. This critical gap between the potential and actual engagement of stakeholders with ICT suggests that practical challenges to knowledge transfer and technology adaptation need addressing for effective ICT utilisation to materialise.

Utilisation of ICT in managing traditional medicine and healing knowledge

Stakeholders utilise ICT in managing traditional medicine and healing knowledge in diverse and specific contexts. Stakeholders' familiarity with technology and its perceived benefits heavily influence their perceptions of ICT use. Mwiinga (2023) and Lwoga (2009) posit that effective use of ICT requires specific competencies, which many stakeholders currently lack.

This problem highlights the necessity of comprehensive training and capacity-building programmes for enhancing ICT competencies among stakeholders. Additionally, Iwata (2015) emphasises that stakeholders' willingness to adopt these technologies is crucial; without proper understanding and acceptance, the integration of ICT remains superficial. Therefore, targeted interventions are necessary to improve stakeholders' ICT competencies and willingness to adopt new technologies.

Impact of ICT on traditional medicine and healing knowledge management ecosystem

The impact of ICT on the ecosystem for managing traditional medicine and healing knowledge can be assessed through its effects on preservation, accessibility, and dissemination. Studies by Nikonova and Biryukova (2017), Iwata (2015), Chirangi (2013), Adam (2012), and Lwoga (2009) demonstrate that ICT can significantly enhance the preservation of indigenous knowledge by creating digital archives. The usefulness of these systems in terms of information quality, relevance, and completeness is still up for question, though. How well ICT systems satisfy stakeholders' demands has a direct impact on how satisfied stakeholders are with them. ICT facility accessibility remains a major concern, particularly for stakeholders in rural regions with poor infrastructure and connections. Although ICT has the potential to be revolutionary, this discussion implies that guaranteeing successful fulfilment of the stakeholders' demands and being free from data insecurity requires adaptation of its deployment to overcome unique contextual limitations (Jawad, 2024; Mwiinga, 2023).

Readiness for ICT adoption

Evaluating the stakeholders' readiness to adopt ICT applications for managing traditional medicine and healing knowledge involves assessing the availability of necessary resources and their capacity to utilise these technologies. Lwoga (2011) underscores the importance of addressing digital illiteracy and building capacity among stakeholders to harness ICT's potential. Without adequate skills and knowledge, communities may struggle to utilise effectively available technologies, perpetuating the underutilisation observed in many contexts (Muriithi et al., 2016). In this regard, the literature reveals a significant gap in understanding the stakeholders' readiness for ICT use in this specific domain. Studies also indicate a general recognition of ICT's potential benefits, but actual readiness varies significantly across different stakeholder groups. This variation necessitates further research to develop tailored strategies for enhancing ICT readiness among these groups.

Challenges to Effective ICT utilisation

Challenges that impede the effective utilisation of ICT in managing traditional medicine and healing knowledge include the digital divide, which is a primary barrier exacerbating inequalities in accessing ICT tools (Benmansour, 2019; Nikonova and Biryukova, 2017; Lwoga et al., 2010). Other significant obstacles include prohibitive ICT equipment costs and inadequate infrastructure (Jain, 2006; Mutula, 2002). Moreover, government policies, lack of skilled manpower, digital illiteracy, and cultural resistance further complicate the integration of ICT (Mutula, 2002; Lwoga, 2011). Despite the global increase in ICT utilisation, its use in acquiring and sharing indigenous traditional medicine and healing knowledge in Tanzania remains limited. Studies by Nakata et al. (2020) and Kim et al. (2021) that explored the integration of mobile technologies and digital platforms in indigenous knowledge systems produced promising results in addition to highlighting persistent challenges that need

addressing. The study further emphasised the necessity for ongoing research aimed at identifying and mitigating barriers to effective ICT utilisation in this context.

Theoretical Framework

Davis's (1989 Technology Acceptance Model (TAM), and DeLone and McLean's (1992) Information System Success Model (ISSM) informed the study's evaluation of the effectiveness of information systems. The integration of these models offers a comprehensive framework for understanding stakeholders' perceptions and satisfaction with ICT in managing traditional medicine and healing knowledge.

Technology Acceptance Model

The technology acceptance model (TAM) provides a lens through which the study examines the acceptance and adoption of ICT among stakeholders, specifically focusing on traditional healers. TAM assumes that two key constructs—perceived usefulness and perceived ease of use—induce user acceptance of technology. Perceived usefulness presumes that using a particular technological system will enhance performance, and entails understanding how stakeholders perceive the benefits of ICT in improving the management and dissemination of traditional medicine and healing knowledge, in this case. On the other hand, perceived ease of use has to do with the degree to which stakeholders believe that using a technology can be free of effort. Thus, it is crucial to assess whether stakeholders find ICT applications intuitive and straightforward for use in managing traditional medicine and healing knowledge as part of their practices. Perceived usefulness and perceived ease of use are essential in shaping the attitudes and intentions of stakeholders toward adopting ICT for managing such knowledge. In this case, the TAM helped to identify potential barriers to acceptance in addition to providing insights into how these can be addressed to facilitate effective ICT adoption.

Information System Success Model

The information system success model (ISSM) expands the evaluation criteria by considering the quality of information, system, and service as predictors of user satisfaction. Information quality relates to the value of the system's output. For traditional medicine, it includes the accuracy, relevance, and completeness of the ICT-managed information. System quality covers the reliability, ease of use, support, and accessibility of the ICT system, hence the need to evaluate how well the system performs and meets the needs of traditional healers and other stakeholders. Service quality pertains to the dimensions of online support, including contact, responsiveness, and reliability. It is important to assess the level of support users receive and how it impacts their satisfaction with the ICT system.

The coupling of TAM and ISSM allowed the study to capture a comprehensive set of attributes critical in evaluating ICT adoption and satisfaction in the context of traditional medicine. Both theories complement each other by addressing different aspects of ICT adoption and satisfaction. Whereas the TAM focuses on the initial acceptance and perceived ease-of-use and usefulness of ICT, the ISSM assesses the continual satisfaction with the system's performance and support. This dual approach ensures a thorough evaluation of both the adoption process and the effectiveness of ICT in managing traditional medicine and healing knowledge. In this study, TAM informed the exploration of whether participants perceived ICT to be as beneficial in managing traditional medicine and healing knowledge, focusing on ease of adoption and perceived usefulness of such technology. Concurrently, the ISSM facilitated the investigation of the stakeholders' satisfaction with the accessibility and utilisation of ICT, particularly the quality of information, systems, and services on offer.

Together, both theoretical underpinnings engendered a comprehensive framework for understanding the complex dynamics of ICT adoption in the context of traditional medicine and healing knowledge in Tanzania.

Research Methods

The mixed-methods approach in this study integrated the collection and analysis of both qualitative and quantitative data to generate a comprehensive understanding of the role of ICT in managing traditional medicine and healing knowledge in Tanzania. Whereas the primary focus was to gain in-depth insights into stakeholders' perceptions using qualitative research, the quantitative dimension of the research provided quantifiable data to support and validate the findings. The study was conducted in four districts of Singida, Masasi, Njombe, and Magu in Tanzania. Each of these districts had a relatively substantive number of registered traditional healers listed by the Traditional and Alternative Health Practices Council (TAHPC). Additionally, the Institute of Traditional Medicine (ITM) in Dar es Salaam was included due to its high-value research on traditional medicine, its established ICT infrastructure, and its concerted efforts to make traditional medicine relevant to modern Tanzania.

The study sample of 71 participants comprised traditional healers, prospective users, district coordinators from TAHPC, and ITM researchers. The study used the TAHPC registry to identify traditional healers filtered using systematic sampling to get a representative sample of practitioners. The district coordinators and researchers, on the other hand, were sampled purposively based on their relevant expertise after being contacted via the TAHPC and ITM, respectively. Finally, convenience sampling facilitated the drawing of prospective users, resulting in the inclusion of a diverse range of individuals who interact with traditional medicine and ICT.

Data collection entailed employing the questionnaire, interview, focus group discussion, and observations to capture both subjective and objective insights. The questionnaire helped to gather both quantitative and qualitative data using both closed and open-ended questions for quantitative and qualitative analyses, respectively, hence providing statistically significant results, on the one hand, and maintaining participant privacy, on the other. Face-to-face interview sessions were held with traditional healers, district coordinators, and researchers to obtain detailed personal insights into their experiences and perceptions of ICT use in fostering traditional medicine and healing knowledge. Four focus group discussions involving prospective users, one in each district under review, were organised to facilitate interactive dialogue among prospective users, idea exchange, and collective reflections on the ICT's role in managing traditional medicine and healing knowledge. This method was culturally appropriate and fostered community-based discussions while remaining sensitive to local beliefs and customs. Both obtrusive and unobtrusive observations enabled the generation of contextual data on the actual use and ICT use-related challenges in practice settings.

Qualitative data from open-ended questions, interviews, and focus group discussions (FGDs) were subjected to thematic analysis, which entailed organising data into major categories, breaking down content into meaningful units, systematically coding the data, and identifying patterns and themes. Manual coding was employed to ensure a rigorous and thorough analysis of the qualitative data. On the other hand, the SPSS (Statistical Package for Service Solutions) facilitated the analysis of quantitative data gathered using closed-ended questions, hence the descriptive statistics, including frequencies and percentages, used to summarise and interpret the data.

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Face-to-face interviews, FGDs, and observation enabled the study to obtain rich, detailed information crucial to understanding the stakeholders' experiences in a culturally appropriate manner. These methods were also effective in eliciting in-depth responses and facilitating interactive dialogue. The use of questionnaires, on the other hand, allowed for the collection of both quantitative and qualitative data, hence providing a balanced approach to data collection. To ensure methodological rigour, qualitative data analysis was performed manually to ensure a detailed and clear understanding of the thematic content whereas quantitative data analysis relied on SPSS, which is well-suited for handling large datasets and performing statistical analyses.

Results and interpretations

This section presents a comprehensive analysis of the research results, aligned with the predefined study objectives. Although demographic information was not the primary objective of the study, it was important to examine as it might influence participants' engagement with ICT.

Demographic profile of participants

The article involved 71 participants made up of traditional healers, prospective users, and professionals from the Institute of Traditional Medicine (ITM) and district coordinators of the Traditional and Alternative Health Practices Council (TAHPC) in Dar es Salaam. In terms of gender, 32 percent of the respondents were female, and 68 percent were male; age-wise, the majority (61%) were aged 51 years and above, followed by 33 percent in the 31-50 age group, with the lowest representation (6%) aged 20-30. In terms of professional affiliation, among the 71 participants, seven percent were TAHPC district coordinators, five percent were researchers from ITM, 63 percent were prospective users, and 25 percent were traditional healers. Regarding the educational background of traditional healers, the results show that among the 18 responding traditional healers, 50 percent had primary education, 22 percent had secondary education, and 28 percent had no formal schooling. Their religious affiliation ranged from 56 percent Christians, 39 percent Muslims, and five percent adhered to traditional beliefs. Furthermore, the study found that 78 percent of the traditional healers had over 10 years of practice experience, 17 percent had 4-7 years of such experience, and five percent had 8-10 years of experience. The demographic profile suggests that factors such as age and education levels might influence the integration of ICT use in traditional medicine and healing knowledge dissemination. Incidentally, younger individuals might be deterred from pursuing traditional medicine and healing knowledge due to the long and deep-seated association of such practices with witchcraft.

Stakeholders' Utilisation of ICT in Managing Health-related Indigenous Knowledge

The evaluation of the extent of stakeholders' acceptance and engagement with ICT in managing traditional medicine and healing knowledge in Tanzania helped to address issues relating to awareness, familiarity, factors influencing acceptance, current ICT use, barriers, and the impact of cultural beliefs and practices. In this regard, the study found varied levels of familiarity with ICT applications among participants in this study. Out of 71 respondents, 15 percent were very familiar with ICT applications, 44 percent were somewhat familiar, 30 percent were very unfamiliar, and 11 percent were unfamiliar at all. Notably, those who were very familiar with ICT were primarily ITM researchers and TAHPC district coordinators. Traditional healers and prospective users of traditional medicine, on the other hand, generally

exhibited lower levels of familiarity. This disparity highlights a significant gap in ICT knowledge and application between different stakeholder groups.

Additionally, the respondents state their awareness of ICT-related gadgets. The results show that 39 percent were aware of radios, 41 percent of televisions, 68 percent of computers, and 58 percent of phones. However, 11 percent were unaware of any ICT device. Despite a general awareness of ICT concepts, actual utilisation remained severely curtailed as a respondent from the group of district coordinators explained during one of the interviews when she said: "*I know that currently, people are aware of ICT as a concept, but regarding its applicability in managing traditional medicine and healing knowledge, very little has been done, and it is probably being done by ITM. However, having a plan to use ICT for such purposes in Tanzania is a good thing*" (Participant 1, District Coordinator of TAHPC in Njombe).

Also, the respondents further indicated their use of ICT tools or applications in managing traditional medicine and healing knowledge, 14 percent of respondents reported ICT was used, 32 percent were unsure, and 54 percent believed it was not used. This disparity was particularly evident among traditional healers and prospective users, with 50 percent among their ranks showing a lack of awareness about ICT's role in managing traditional medicine. Those who were aware that ICT engaged with it daily in terms of employing smartphones, computers, or other electronic devices. In terms of satisfaction, 68 percent of the respondents indicated that they were not at all satisfied with the use of ICT for managing traditional medicine, eight percent were slightly satisfied, 13 percent were moderately satisfied, and 11 percent were very satisfied. This widespread dissatisfaction suggests that current ICT infrastructure and application methods particularly in handling traditional medicine and healing knowledge are too inadequate to make ICT applications in this domain effective.

The ownership and use of ICT gadgets, among the 18 traditional healers surveyed in this study yielded the following results: six percent owned computers, 83 percent owned cell phones (including smartphones), and 17 percent did not possess any ICT-related gadgets. Additionally, 28 percent used WhatsApp, and 17 percent Facebook for marketing their products and services. Despite high cellular phone ownership, the use of ICT in managing traditional medicine and healing knowledge remained largely minimal. This gap indicates potential barriers to leveraging technology effectively. A traditional healer in Masasi reported: "*Technology has brought convenience to our lives. However, I do not know how to use my smartphone to simplify the accessibility of information on products (herbs and remedies) and services from my knowledge. There is still a lot to learn if I am to use my phone for that purpose*" (Participant 2, Traditional Healer in Njombe). Conversely, another healer from Magu raised concerns about technology's effect on traditional medicine and healing knowledge, stating, "*Although I do not have a computer or smartphone enabled for managing my knowledge on traditional medicine and healing, I'm worried that such technology may dilute my ancestral knowledge and traditions*" (Participant 3, Traditional Healer in Magu District). To counter such fears, ITM researchers called for targeted capacity-building initiatives aimed at bridging the gap between traditional healers and technological advancements. One ITM researcher said, "*There is a need for targeted capacity-building initiatives to empower traditional healers with the infrastructural availability and skills necessary to harness technology effectively*." (Participant 4, Researcher from ITM)

Methods and practices through which stakeholders employ ICT

To identify ICT tools and applications that are user-friendly to traditional healers and

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prospective users, respondents commented on what tools they frequently used. Results from multiple responses identified various ICT tools and applications utilised in traditional medicine. The most frequently mentioned tools included smartphones, computers, social media platforms (such as WhatsApp and Facebook), and various digital record-keeping systems. Traditional healers reported using smartphones primarily for communication and marketing with computers less commonly employed due to their higher cost and lower portability. Notably, 28 percent of the traditional healers used WhatsApp for communication and marketing, and 17 percent used Facebook for promoting their services and products.

Moreover, study participants responded that ICT was integrated into their daily practices of managing traditional medicine and healing knowledge. Results show that the integration of ICT into daily practices varied significantly among the stakeholders. Researchers and district coordinators systematically incorporated ICT into their workflows, using digital databases for research, electronic communication for collaboration, and online platforms for disseminating findings. In contrast, traditional healers exhibited limited integration of ICT into their daily routines due to a lack of technical skills and understanding of how ICT could enhance their practices as a Magu traditional healer explained (quoted earlier).

Furthermore, the respondents in all categories provided their perceptions on the advantages and disadvantages of using ICT in managing traditional medicine and healing knowledge. The advantages of using ICT in managing traditional medicine and healing knowledge they cited included enhanced access to information, improved record-keeping, and broader dissemination of knowledge. On the basis of multiple responses from 71 respondents, results show that of all the respondents, 54 percent believed that ICT had the potential to boost access and utilisation of traditional medicine products and services, 72 percent perceived ICT as beneficial in improving the organisation and preservation of traditional knowledge, whereas 69 percent observed that ICT use could serve as a means to enhancing dissemination.

In contrast, notable disadvantages and concerns also emerged during the study. Stakeholders expressed worries about the potential loss of cultural authenticity and the ethical implications of digitising traditional knowledge. As one TAHPC District Coordinator in Singida cautioned, *"We must proceed with caution to ensure that technological interventions respect the cultural sensitivity and intellectual property rights associated with traditional medicine"* (Participant 5, District Coordinator of TAHPC in Singida District). This was also the concern of a traditional healer in Magu district who said:

> *Although I do not have computers or smartphones enabled to manage my knowledge of traditional medicine and healing, or I have no skills in using it, I'm worried that such technology may dilute my ancestral knowledge and traditions. Thus, I'm scared if not ready to integrate it into my practices as a means of managing my knowledge*. (Participant 3, Traditional Healer in Magu District)

These responses from the respondents indicate that training and support mechanisms for effective ICT utilisation were found to be insufficient in the study sites. Although there were some initiatives by institutions like ITM to provide training to traditional healers, they were often limited in scope and reach. In truth, most of traditional healers lacked formal training in ICT, hence computer illiterate, which significantly hampered their prospective utilisation of tools available effectively, which an ITM researcher suggested needed targeted capacity-building initiatives to empower traditional healers with the infrastructural availability and essential skills for harnessing technology effectively. This push toward empowering traditional healers with computer literacy and exposure to the ICT they need and their advantages featured across various focus groups and interviews, hence underscoring a clear

need for extending more comprehensive training and support to this often-non-conventional group largely operating outside the comforts of modern technology because of the traditional beliefs associated with traditional medicine and healing knowledge.

Impact of ICT on ecosystem of managing traditional medicine and healing knowledge

Meanwhile, the examination of the impact of ICT in the ecosystem of managing traditional medicine and healing knowledge focused on its role in the preservation, accessibility, and dissemination of such knowledge based on the stakeholders' perceptions and practices related to ICT integration into the management of traditional medicine. The study findings signal that the integration of ICT into the management of traditional medicine has significant potential for preserving this knowledge.

Specifically, of all 18 traditional healers, five percent indicated that they were not likely to use ICT at all. The rest 70 percent were very likely, and 25 percent likely—showed keen interest in adopting and applying ICT. This high level of interest reflects a general acceptance of ICT, as a tool for managing traditional medicine and healing knowledge, which also augurs well with the ongoing changes despite the lingering doubts linked to the old belief system common among traditional healers and practitioners. A respondent from the Njombe district with more than 10 years of practising traditional medicine and healing said, *"It is very important to manage traditional medicine and healing knowledge through ICT because doing that will simplify its preservation for use by future generations and make it easier to refer to"* (Participant 6, Traditional Healer in Njombe District). The study also found that ICT's role in preserving traditional medicine and healing knowledge is largely attributable to its capability for securing data storage and systematic documentation. Indeed, 87 percent of all the study participants perceived that ICT could enhance the management of traditional medicine and healing knowledge. This finding aligns with the literature suggesting that digital tools can significantly improve the preservation of culturally sensitive knowledge (Nikonova and Biryukova, 2017). Figure 1 presents the results:

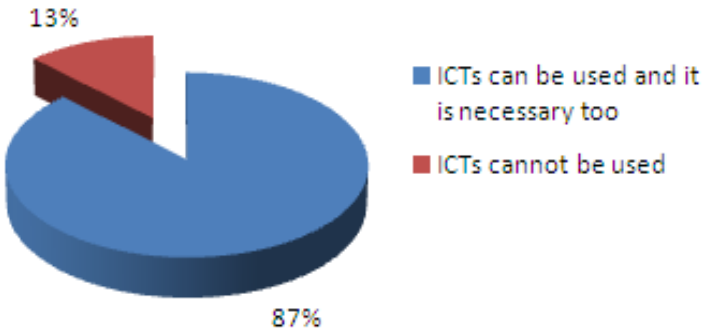

Figure 1: ICT role in managing traditional medicine and healing knowledge (N=71)
Source: Field Data (2023)

Determining the role of ICT in improving accessibility, the study found that ICT has notably improved the accessibility of traditional medicine and healing knowledge. In this regard, the participants identified various ICT tools, including computers and smartphones, as essential for expanding access. Specifically, 83 percent favoured computers and smartphones whereas 63 percent preferred radio and television for managing traditional medicine and healing knowledge. This preference highlights a trend toward using versatile and widely accessible devices. A comparative analysis of traditional oral methods and ICT-based practices revealed

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that ICT offers several advantages, which include enhanced preservation and more cost-effective communication methods. A traditional healer in Njombe district noted, "*ICT can help us reach more people and contribute to better health outcomes for our community*" (Participant 6, Traditional Healer in Njombe District). Evidence shows that ICT can facilitate wider dissemination and accessibility of health information (Iwata, 2015).

Moreover, evidential statements from the study participants hint at the potentiality of ICT roving to be effective in disseminating traditional medicine and healing knowledge. In this regard, the respondents observed that ICT facilitates the widespread distribution of information within and beyond local communities. They highlighted how ICT tools such as social media platforms enable broader outreach and interaction with diverse audiences. This is consistent with Iwata (2015), whose study found that ICT can effectively bridge gaps in traditional healthcare information dissemination. However, the success of these ICT systems is contingent upon the stakeholders' skills and access to technology. Despite the recognition of benefits accruing from ICT, challenges remain in the form of insufficient ICT skills among traditional healers, largely attributable to lower educational levels. This anomaly underscores the need for enhanced targeted training to maximise ICT benefits among members of this group.

During this study, the stakeholders expressed both satisfaction and concerns about the use of ICT in managing traditional medicine and healing knowledge. Even though most of the respondents in this study acknowledged the advantages of ICT in managing traditional medicine and healing knowledge, concerns about data security and technical limitations were prevalent as a traditional healer in Masasi explicated: "*The problem with ICT is that there is a lack of security as we hear every day about cyber theft and fraud. For the time being, ICT is not a safe technique in managing our traditional medicine and healing knowledge*" (Participant 7, Traditional Healer in Masasi District). Such concerns have also been highlighted by empirical literature (see, for example, Jawad, 2024; Mwiinga, 2023) confirming that data security remains a significant barrier to the adoption of digital technologies in traditional medicine and healing practices. Furthermore, reliable electricity and internet access are prerequisite infrastructural support for ICT use, yet they were found to be inadequate in many areas under review. This infrastructural handicap inevitably impeded the effective utilisation of ICT tools and highlights the need for improved infrastructure to support ICT integration.

Readiness to adopt ICT for managing knowledge of traditional medicine and healing

The study also evaluated the readiness of stakeholders to adopt and utilise ICT applications for managing traditional medicine and healing knowledge. Specifically, it examined digital literacy levels, available resources, perceptions of costs and benefits, and key motivators and deterrents for ICT adoption. Examining the current level of digital literacy of the respondents, the study analysed digital literacy among stakeholders, which revealed a varied landscape. Among the 71 respondents, 77 percent indicated a readiness to adopt ICT for managing traditional medicine and healing knowledge, hence primarily driven by motivation. This readiness reflects a high level of enthusiasm towards leveraging ICT in traditional medicine and healing knowledge. However, the remaining 23 percent of the respondents identified significant barriers such as insufficient infrastructure and lack of skills. Also, in the non-mutually exclusive multiple responses from 55 stakeholders who expressed readiness, the results show that 89 percent were motivated to use ICT, and 20 percent cited preparedness in terms of infrastructure. Only seven percent had mentioned training, education, and expertise as contributory factors to their readiness to embrace ICT in harnessing traditional medicine

and healing knowledge. This distribution indicates that even though motivation is a strong driver, there is a notable gap in preparedness regarding infrastructure and training. This finding aligns with literature such as Muriithi et al. (2016) suggesting that though motivation for ICT adoption is high, practical support in terms of training and infrastructure remains insufficient.

Observations on the resources available for ICT adoption revealed that stakeholders faced significant challenges in accessing resources necessary for ICT adoption. Most traditional healers demonstrated enthusiasm for technology but encountered barriers such as inadequate infrastructure and limited digital literacy. This finding is consistent with the existing research highlighting the disparity in resource availability for ICT adoption in rural and underserved communities. Despite some respondents owning modern phones, they lacked the skills to organise and manage traditional medicine and healing knowledge effectively. This gap underscores the necessity for targeted educational interventions and resource allocation to support ICT adoption in traditional medicine management.

In terms of costs and benefits, results show that stakeholders' perceptions of the costs and benefits associated with ICT adoption revealed a complex landscape. A substantial number of traditional healers treated ICT as a valuable tool for managing traditional medicine and healing knowledge, as they recognised its potential benefits in preserving, organising, and promoting their practices locally and abroad. In his regard, a traditional healer in Njombe district noted, "*I am eager to learn and adapt to new technologies for managing my knowledge, but it is challenging without proper training and support, especially the infrastructural support*" (Participant 8, Traditional Healer in Njombe District). Conversely, scepticism about the necessity of new technology persisted among some traditional healers. Another traditional healer from the Singida district stated, "*Our traditional methods of preserving traditional medicine and healing knowledge have served us well for generations. Therefore, I'm not sure if we need another technology. To me, this new foreign technology is not necessary*" (Participant 9, Traditional Healer in Singida District). This sentiment reflects a broad-based reluctance to adopt ICT due to perceived redundancy and a preference for traditional methods (Muriithi et al. 2016).

Even though these results show that key motivators for adopting ICT include the potential for broader outreach and enhanced efficiency in managing traditional medicine and healing knowledge, significant deterrents remain, particularly in relation to infrastructure, digital literacy, and data security. Inevitably, the lack of ICT infrastructure observed in visited communities impeded the full utilisation of ICT tools, hence limiting opportunities for the global promotion of traditional medicine and healing knowledge. Regarding confidence in using ICT, results indicated that only six percent of the traditional healers felt very confident, 33 percent were confident, 28 percent were not very confident, and 33 percent were not confident at all. This distribution highlights a critical need for comprehensive training and support to build confidence and competencies in using ICT. In this regard, all the traditional healers expressed a willingness to undergo such value-adding training, hence suggesting an acknowledgment of ICT's positive potential in managing traditional medicine and healing knowledge.

Challenges in adopting and use of ICT

Furthermore, the study explored infrastructural issues to determine the impact of governmental policies and regulations, common technical problems, and social and cultural barriers. Also, the study set out to determine the ways to address the challenges stakeholders faced in integrating ICT into the management of traditional medicine and healing knowledge.

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To begin with, the study identified several key infrastructural challenges impeding ICT integration. Respondents in this study highlighted a significant lack of awareness and education on technology use, with 68 percent citing this as a major barrier. This barrier covered both a general unawareness of ICT's benefits and inadequate training in its application. The scarcity of essential infrastructure such as reliable internet connectivity and devices further compounded these problems. Another 23 percent of the respondents reported inconsistent investment in ICT infrastructure, which hinders effective technology adoption (Benmansour, 2019; Nikonova and Biryukova, 2017; Muriithi et al. 2016). Despite the availability of some modern devices among stakeholders, many traditional healers during this study lacked the skills necessary to use these technologies effectively, which is corroborated by 79 percent of the respondents, who reported a deficiency in ICT skills. The absence of robust ICT infrastructure and inadequate technical skills contribute to the challenges in managing traditional medicine and healing knowledge using ICT.

It also emerged that governmental policies and regulations also impacted the use of ICT in fostering traditional medicine and healing knowledge, It was noted that governmental policies and regulations play a crucial role in facilitating or hindering ICT integration. The study found that 97 percent of all the respondents believed that the lack of adequate legal frameworks was a significant obstacle. This absence of supportive legal structures affected the protection and management of traditional knowledge, leaving it vulnerable to misuse and exploitation (Kumar and Singh, 2018). Moreover, 41 percent of the respondents indicated insufficient political will as a barrier, affecting the prioritisation of ICT initiatives and budget allocations. The lack of clear policy direction and commitment from government bodies can, indeed, impede progress in ICT integration (Brady et al., 2020; Muriithi, et al. 2016).

Technical issues further emerged as substantial barriers to ICT adoption. Among the 18 traditional healers surveyed in this study, 83 percent cited high costs and time constraints as significant barriers. These issues highlighted the financial and temporal demands associated with adopting and implementing new technologies (Morris et al., 2022). A researcher respondent from the ITM emphasised the importance of budgetary allocation, by stating:

> *Budgetary allocation by the government and other knowledge management stakeholders is very important for improving ICT use in managing traditional medicine and healing knowledge. As without funds, nothing can be done. When we (research fellow) are talking of investments should not involve only purchasing new equipment and software but also developing infrastructures by maintaining the existing equipment and making them used for that purpose.* (Participant 10, Researcher from ITM).

This evidential statement underscores the need for consistent investment not only in acquiring new technologies but also in maintaining and upgrading existing infrastructure. On the other hand, sociocultural factors also played a pivotal role in the integration of ICT into traditional medicine and healing practices. The results show that 83 percent of traditional healers face challenges related to time constraints and the high costs associated with technology adoption. Additionally, cultural resistance to new technologies emerged as a barrier. Some traditional healers were sceptical about embracing ICT, preferring instead to rely on traditional methods that have been passed down through generations. As one traditional healer in Singida district noted, "*Our traditional methods of preserving traditional medicine and healing knowledge have served us well for generations. Therefore, I am not sure if we need another technology. To me, this new foreign technology is not necessary*" (Participant 9, Traditional Healer in Singida District). This sentiment subscribes to a broader reluctance to adopt among

traditionalists who treat modern technology as anathema to their cultural attachment, beliefs, and traditional methods as well as practices (Muriithi, et al. 2016).

Implicitly, addressing these challenges requires a multifaceted approach and strategies, including having in place education and training programmes. Implementing specific training programmes focusing on digital literacy, data management, and the use of digital tools for marketing were suggested as the means for overcoming the challenge of lack of skills. Workshops and ongoing support can help traditional healers acquire the necessary skills (Benmansour, 2019; Nikonova and Biryukova, 2017; Oluic´-Vukovic´, 2001). Also, it is vital to raise awareness of the ICT benefits through community engagement, demonstrations, and sharing success stories to illustrate practical advantages (Muriithi et al. 2016). Also, the government and stakeholders ought to focus investments on ICT infrastructure, especially in rural areas, to overcome the infrastructural problem, including guaranteeing dependable internet access and energy (Benmansour, 2019; Nikonova and Biryukova, 2017; Oluic´-Vukovic´, 2001). Such intervention should also go together with substantive budgetary allocations to maintain and upgrade existing infrastructure and ensure its optimal functionality (Brady et al., 2020).

In terms of legal and policy reforms, there was a call to establish legal frameworks to protect traditional knowledge and intellectual property rights, including data security and protection laws (Kumar and Singh, 2018). Also essential was a need to advocate for policies that support ICT integration in traditional medicine management, including incentives for technology adoption and funding for ICT initiatives and traditional practitioners (Muriithi et al. 2016). In addition, the government, according to the respondents, should boost involvement and commitment to ICT adoption by allocating higher budgets and involving stakeholders in decision-making processes, which is also congruent with findings by Morris et al. (2022) while fostering collaboration between governmental bodies, NGOs, and the private sector to pool resources and expertise (Muriithi et al. 2016). Finally, strong security measures should be put in place to shield data from cyber-attacks to solve security issues, signalling a need to give traditional healers and other stakeholders training on cybersecurity best practices as a countermeasure.

Discussion of the Results

The study on the role of ICT in managing Tanzania's traditional medicine and healing knowledge has yielded valuable insights into the engagement, practices, impacts, readiness, and challenges associated with ICT integration. This discussion contextualises these findings through established models of technological acceptance and system success, such as the Technology Acceptance Model (TAM) and the Information Systems Success Model, alongside pertinent literature. Results on the engagement with ICT in managing traditional medicine and healing knowledge reveal that respondents favoured the use of ICT for managing traditional medicine and healing knowledge, citing benefits such as simplified metadata storage, enhanced communication, and improved access to information. These findings are consistent with the TAM, which posits that perceived usefulness and ease of use significantly influence technology adoption (Davis, 1989). The advantages highlighted by respondents also reflect ICT's potential to enhance efficiency and accessibility in managing traditional knowledge, aligning with Davenport and Prusak's (2000) and Oluic´-Vukovic´'s (2001) models, which underscore the importance of information technology in knowledge management.

However, the current practices of stakeholders expose a gap between ICT potential and its practical application. Despite the high level of support for ICT, traditional healers were

not effectively applying technology due to limited ICT knowledge and skills, compounded by low education levels. This discrepancy communicates the relevance of the Information Systems Success Model, which emphasises the importance of user training and system quality in achieving successful technology integration (DeLone & McLean, 1992). The lack of proper training and expertise among traditional healers reflects inadequate attention to these critical factors, impeding the effective application of ICT.

On the other hand, even though ICT has the potential to transform the management of traditional medicine and healing knowledge, this study's results indicate that severely limited impact due to a lack of optimal realisation. Traditional healers' limited ICT engagement and the absence of electronic management systems at the family level highlight a significant barrier. This observation is consistent with Ngulube (2002) and Dlamini (2009), who found that technological adoption is often hindered by inadequate skills and resources. The Information Systems Success Model supports this view by indicating that system effectiveness is contingent upon the quality of training and support provided to users (DeLone & McLean, 1992).

Also, the study found that readiness to adopt ICT, which is a strong willingness among stakeholders to adopt ICT for managing traditional medicine and healing knowledge, was often undermined by a lack of education, training, and infrastructure. The TAM suggests that perceived ease of use and perceived usefulness are critical determinants of technology adoption (Davis, 1989). In this study, the high motivation among stakeholders contrasts with their actual preparedness, highlighting a need for targeted educational and training interventions. The lack of infrastructure and support reflects a broader issue of alignment between stakeholders' readiness and the practical capabilities required for effective ICT integration.

The study found that several challenges impeded the integration of ICT into traditional medicine and healing knowledge management. Key issues include a lack of awareness, deficient skills, inadequate legal frameworks, and insufficient political will. These challenges are consistent with the barriers identified by Benmansour (2019), Nikonova and Biryukova (2017), and Oluic´-Vukovic´ (2001), who stressed the critical role of training, infrastructure, and supportive policies in successful ICT adoption. The study additionally emphasises the necessity of creating legislative frameworks to safeguard traditional knowledge and make significant investments in ICT infrastructure. The need for educational endeavours and infrastructural development is further highlighted by the dearth of qualified workers and ICT capabilities. The results of the study are in line with those of Ngulube (2002), who noted that a major obstacle to efficient knowledge management is a lack of technology application abilities. Moreover, Haralambos and Holbon's (2004) suggestions, which encourage comprehensive policy measures to facilitate ICT adoption, are echoed by the necessity of supporting legislative frameworks and political commitment.

Conclusion, Recommendations, and Implications

This study focused on the participation, practices, effects, preparedness, and problems of stakeholders in managing traditional medicine and healing knowledge in Tanzania via the use of information and communication technology. The results show that, despite stakeholders' high theoretical support for ICT's capacity to manage traditional knowledge, actual deployment of the technology is still constrained by a lack of ICT expertise, poor infrastructure, and lax legal protections. Although the stakeholders in this study were theoretically prepared, practical barriers prevented ICT from playing a transformative role in preserving and enhancing traditional medicine and healing practices in Tanzania. These

obstacles highlight a larger problem of alignment between theoretical readiness and practical implementation. Against this backdrop, there is an overriding need for a multimodal strategy aimed at addressing these issues and discrepancies, including further fostering the cooperation of stakeholders and the government in integrating ICT into the management of traditional medicine and healing knowledge. This intervention entails setting aside funds and ensuring the ready availability of ICT infrastructure to support the management of misguided knowledge deep-rooted in superstition and misconceptions. Other measures could include creating and putting into practice thorough digital literacy training programmes targeting equipping knowledge managers and traditional healers with requisite ICT skills and real-world applications they need to handle traditional medicine and healing knowledge. Additionally, there is a need to provide legislative frameworks that safeguard intellectual property rights and traditional knowledge in the digital era, which must address issues related to data security and ownership. The study has also emphasised how crucial information and communication technology (ICT) is to the preservation of traditional medicine and healing knowledge for posterity. Implicitly, ICT can safeguard intellectual property rights, preserve traditional knowledge, and enhance communication between traditional healers and stakeholders. Also, the study has implications for policy intervention, in which such policies must support the use of ICT in managing traditional medicine and healing practices, and a thorough programme of digital literacy training should be created to improve ICT proficiency. Collaborations between government agencies, educational institutions, and ICT specialists are essential to developing and executing successful training initiatives. Overall, the study's conclusions have important ramifications for the fields of education, culture, policy, and practice.

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