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Indigenous Information Systems for Communicating Agricultural and Climate Change Knowledge among Maasai Communities in Morogoro District, Tanzania

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Abstract

This study examined the role of indigenous communication systems in disseminating indigenous knowledge on agriculture and climate change among Maasai communities in Morogoro District, Tanzania. Guided by the Indigenous Communication Systems framework, the study focuses on two specific objectives: to establish the indigenous communication systems the Maasai of Ngerengere use or depend on to disseminate indigenous knowledge on agriculture and climate change; and to explain the reasons for categorising such communication systems as indigenous. The study employed an embedded case study design combining qualitative and quantitative approaches. Data were collected through interviews and observations from 80 respondents, including Maasai pastoralists, agricultural officers, journalists, and communication experts. The results show that the Maasai predominantly rely on interpersonal communication, village meetings, divine practices, and cultural traditions to disseminate and preserve agricultural and climate-related knowledge. Elders play a central role as information authorities, while oral traditions and participatory methods ensure trust, inclusivity, and local ownership of messages. Indigenous communication systems were preferred over modern media due to their cultural relevance, contextual adaptability, and low cost. The study concludes that indigenous communication approaches are effective in conveying indigenous knowledge about agriculture and climate change. It recommends policies that recognise and mainstream indigenous knowledge in agriculture and climate change communication strategies to strengthen sustainable development and local empowerment.

Keywords: Indigenous information systems, Climate change, Agriculture, Communication.

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Introduction

In Tanzania, more than 80 per cent of the population is dependent on agriculture or agriculture-related activities (Irish Aid, 2017; NBS, 2017). However, agriculture remains one of the most vulnerable sectors, as the impacts of climate change directly affect it through drastic alterations in temperature, rainfall patterns, and CO2 levels, and indirectly through water and forestry sectors. Thus, climate change adversely affects crop and forage productivity and production costs, soil suitability for agricultural production, and livestock

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productivity and production costs (URT, 2007). In Tanzania, unreliable rainfall and frequent droughts over the years have led to widespread crop failures, low agricultural production, and significant livestock losses in many parts of the country, especially in arid and semiarid areas (URT, 2014).

Severe floods caused by unpredictable and intense rainfall have led to loss of lives, destruction of crops and property, and substantial economic damage across Tanzania (URT, 2014). Government assessments indicate that semi-arid regions experience greater food shortages, with agriculture and food security identified as the most vulnerable sector to climate change impacts (URT, 2014). Formerly productive zones, such as the southern and northern highlands, are increasingly affected by declining rainfall, recurrent droughts, and greater variability in rainfall patterns (URT, 2012; Irish Aid, 2017). These shifts have long-term implications for agricultural planning, seed and pesticide use, and crop selection (URT, 2012). Recent studies reaffirm the worsening trends in climatic variability and food insecurity in Tanzania (World Bank, 2022; FAO, 2023).

Agriculture is both a major emitter and a potential sink of greenhouse gases, yet adaptation measures and technological innovations remain limited (FAO, 2008; World Bank, 2022). Agricultural activities, which contribute about 4.5 per cent of global warming potential, significantly influence climate outcomes. Integrating indigenous knowledge into climate adaptation is vital for sustaining production, enhancing resilience, and reducing vulnerability across generations (McGuigan *et al*., 2002; Mwakajinga, 2009; IPCC, 2021; FAO, 2023).

Indigenous Communication Systems

Indigenous communication systems are rooted in oral traditions expressed through songs, dances, proverbs, storytelling, and rhetorical speeches, all deeply embedded in community life. These forms of communication, often infused with ritual respect for elders and authority figures, remain vibrant and influential in many African societies (White, 2008). Within the African context, the Indigenous Communication framework advanced by Ansu-Kyeremeh (1994) and White (2008) underscores the embeddedness of communication in local culture, its participatory and inclusive nature, and its spontaneity in small community settings. Such systems promote information exchange and mutual understanding, enabling community participation in decision-making processes (Epskamp, 2006). Indigenous communication systems are largely based on oral networks and are characterised by singing, dancing, speaking with rhetorical effect, rhythmic word cadence and proverbs, and storytelling(White, 2008). These modes of communication, like other modes, namely modern communication systems, help create awareness, transfer knowledge, educate, mobilise, or entertain (Warren, 2001).

Importantly, indigenous communication channels play a significant role in influencing local responses to challenges such as climate change by facilitating the dissemination of adaptation knowledge and practices. As scholars (such as Wilson, 1987; Moti *et al*., 2025) observe, despite their age and contrast with modern systems, indigenous communication systems continue to meet the information needs of rural populations, who constitute the majority in many developing nations. Recent studies reaffirm that integrating indigenous communication practices enhances the effectiveness of environmental and development communication initiatives (Manyozo, 2021; FAO, 2023; Moti *et al*., 2025). In some contexts, these systems

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complement modern media, while in others, they prove more effective in reaching rural audiences than conventional communication channels (Kidd, 2002; UNESCO, 2022).

Indigenous communication in Africa employs a range of instruments, namely drums, horns, woodblocks, bells, and gongs; each with distinct communicative and cultural significance, forming a complex language of its own (White, 2008). Wilson (2005, cited in White, 2008) categorised these instruments and practices into several forms: *idiophonic* (self-sounding instruments such as drums and gongs), *aerophonic* (horns and flutes), *membrophonic* (leather drums), *symbolographic*(cryptic writings), *demonstrative* (storytelling, music, and rhetoric), *iconographic* (objects and symbols), *visual* (colourcodes), *institutional* (chieftaincy, rituals, masks), and *extra-mundane* (spiritual or invisible communication). These categories reflect the richness of African indigenous semiotics and their embeddedness in communal and spiritual life. Contemporary studies reaffirm that such instruments and practices remain vital tools for social mobilisation, cultural preservation, and environmental awareness, particularly in rural Africa (Manyozo, 2021; UNESCO, 2022; Abdulai *et al*., 2024).

Analyses of indigenous communication systems often use the linear model of source, message, channel, receiver, and effect, while also considering the participatory, consultative, and fluid nature of communication in African communities (Ansu-Kyeremeh, 2005; Wilson, 2008). In the process, the source is typically the village or community leader, alone or with a council of elders, who authorises messages. At the same time, the indigenous newsman conveys these messages without altering content, though embellishments such as humour or anecdotes are often added to enrich meaning (Wilson, 2008). Messages combine verbal and non-verbal forms, encompassing instructions, announcements, news, advertising via goods or hawkers, public relations, performances, entertainment, and education, delivered formally or informally through cultural groups or societies (Wilson, 2008).

In indigenous communication, the channel doubles as both a medium and an instrument, encompassing people, places, and agencies such as the gongman, as well as venues like markets, churches, or shrines. Channels include speech, writing, gestures, facial expressions, dress, and the performing arts, which facilitate the delivery of messages to individuals or groups depending on context, content, and timing (Wilson, 2008; Nightingale, 2003). Desired effects vary with urgency and message type, reinforcing communal bonds, mutual respect, and collective action, including conflict reconciliation or community mobilisation (Wilson, 2008).

These systems are closely tied to local culture, making them effective for knowledge transfer as messages are identifiable, trusted, and accepted by the community (Mundy & Compton, 1995). Rural communities rely on local channels to generate, store, share, and utilise information for daily life and farming. Indigenous channels are heterogeneous, cost-effective, flexible in time and location, socio-culturally appropriate, and widely accessible. Interpersonal, peer, and group networks influence decision-making and innovation. By combining traditional and modern communication methods, indigenous systems provide platforms for disseminating knowledge on climate change adaptation, with communities demonstrating greater receptivity to messages delivered through familiar, culturally grounded channels (Mundy & Compton, 1995; Nsi, 2003).

Agriculture and Climate Change Indigenous Knowledge

University of Dar es Salaam Library Journal
Vol 21, No 1 (2026), pp 32-48
ISSN: 0856-1818

Indigenous Knowledge (IK) plays a critical role in supporting livelihoods, particularly through agriculture. IK is a cumulative body of knowledge and practices passed down through generations, reflecting communities' relationships with one another and their environment (Bernet et al., 2005). In African societies, such as the Maasai, IK encompasses practices developed through trial and error, flexible enough to adapt to changing conditions, and forms essential literacy skills for survival (Semali, 1999). Each community's knowledge is context-specific, shaped by unique environmental conditions, rainfall patterns, soils, water systems, social events, and historical legacies, resulting in locally adapted knowledge bases (Beckloff, 2009).

IK informs decision-making in daily life and is culturally, economically, and politically embedded; it is orally transmitted, adaptive, holistic, and closely linked to survival (Little *et al*., 2001; Barrera-Bassols & Zinck, 2003; Pottier, 2003). In agriculture, IK guides climate change adaptation strategies that are often cost-effective, participatory, and sustainable, as documented in African and other developing communities (Raygorodetsky, 2011; Kahindi *et al*., 2003). Techniques include land preparation, water conservation, and local pest management. Recognising the value of IK positions local communities as active participants in climate solutions rather than mere victims (Long Martello & Jasanoff, 2004).

Moreover, IK often complements modern scientific knowledge. It is tested in the context of survival, providing practical, locally relevant solutions, enhancing farmers' problem-solving capacity, supporting the adoption of new technologies, and fostering ownership and identification with agricultural practices (Davies, 1994; Kalland, 2000; Briggs, 2005; Kumar, 2009). Recent studies emphasise that integrating IK with modern communication systems improves climate adaptation outcomes by addressing floods, droughts, pest outbreaks, food scarcity, and extreme weather events in rural communities (FAO, 2023; World Bank, 2022; IPCC, 2021). By leveraging both indigenous and contemporary knowledge, communities can strengthen resilience, enhance local decision-making, and contribute effectively to broader climate adaptation strategies.

Maasai Communities' Livelihoods, Climate Change and Indigenous Knowledge

The Maasai are a Nilotic ethnic group of semi-nomadic pastoralists inhabiting East Africa, occupying approximately 70 per cent of Kenya's rangelands, 50 per cent of Tanzania's, and 40 per cent of Uganda's (Jens, 2000; Fratkin, 2001). Renowned for their distinctive dress and proximity to game parks, the Maasai have inhabited the region for over 2,500 years (McCabe *et al*., 1992; Kerubo, 2016). They speak Maa, a Nilo-Saharan language, and communicate in Kiswahili and English (Jens, 2000; Kerubo, 2016). Their livelihoods are communally-based, reliant on livestock for subsistence and income, with cattle central to both culture and economy (Kerubo, 2016; Baxter, 1994). Pastoralism in Tanzania, as practised by the Maasai, involves mobility to optimise grazing while aligning with socio-cultural and environmental objectives (Hesse, 2006). Livestock are integral to rituals, inter-clan relations, and food security, with families moving seasonally between permanent dry-season settlements and temporary wet-season camps (Talle, 1988; McCabe *et al*., 1992).

Natural vegetation supports livestock, though grazing is constrained by seasonality and rainfall unpredictability, particularly in Arid and Semi-Arid Lands (ASALs). During rainy seasons, herds access distant pastures and water points, returning to villages in the dry season

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where grass is limited but sustainable for livestock (Homewood *et al*., 2004). This opportunistic grazing strategy enhances stock survival during adverse conditions (Lane, 1996). Secondary livelihoods include beekeeping and honey collection, while crop cultivation becomes essential during drought or livestock loss (Ndesanjo, 2017).

Environmental and climate knowledge is imparted to *morans* and other community members through indigenous ecological practices (Kerubo, 2016). Maasai possess detailed indigenous knowledge for exploiting marginal rangeland resources, including vegetation and soil classification (Oba, 1985) and the identification of forage plants that enhance cattle fattening and milk production (FAO, 2006). Water sources are assessed using environmental indicators, such as butterfly behaviour, to ensure livestock health and productivity (Tabuti *et al*., 2016). Diviners, known as Iloibonok, predict calamities and weather changes and advise on disease management, while cultural taboos, including restrictions on wild meat consumption, reinforce environmental stewardship (Saitabau, 2014).

Indigenous knowledge underpins livestock and livelihood management, supplementing food supply through small-scale farming and gathering of wild foods. Cultural norms, practices, and institutions serve as climate adaptation strategies, mediating the community's adaptive capacity (Goldman & Riosmena, 2013). Recent studies confirm that integrating indigenous ecological knowledge with contemporary climate adaptation approaches enhances resilience in pastoral communities, supporting sustainable rangeland management and adaptive responses to climate variability (FAO, 2023; World Bank, 2022; IPCC, 2021). These strategies demonstrate Maasai's capacity to combine traditional knowledge, resource management, and socio-cultural practices to adapt effectively to climate change impacts, including droughts, floods, and pasture scarcity, highlighting their role as active agents in environmental stewardship and climate adaptation.

Materials and Methods

This study was conducted in Ngerengere Division, Morogoro District, in Morogoro Region. Morogoro Region lies in the southeastern part of Tanzania between the central highlands and the coastal lowlands (Burgess *et al*., 2002). Morogoro District is located in the Northeastern part of the Morogoro Region. Geographically, Morogoro District is divided into mountainous areas, low mountainous areas and savannah. The mountainous zone takes a large part of the Uluguru and Unguu mountains. This part occupies about 25 per cent of the district. The low mountainous zone occupies roughly 20 per cent of the district's land area.

Area of the Study

This study focused on Ngerengere Division in Morogoro District, which comprises five (5) wards: Ngerengere, Kidugalo, Matuli, Tununguo, and Mkulazi. At an altitude of 100 to 300 metres above sea level, the Ngerengere area features sparsely wooded, rolling plains that connect the coastal lowlands with the higher elevations of the central region. The area consists of several rivers, including Ngerengere, Mgeta, Kafa, Ruvu, Wami, Msongozi, and Mbulumi (Mollel, 2010). River valleys and basins shape the landscape and provide a continuous water supply throughout the year. Bodies of water are crucial to the survival of Maasai pastoralists' livestock during the dry season, which usually lasts from June to mid-November. The 500- 1000 mm of precipitation that falls during the rainy season follows a somewhat bimodal pattern, with a dry spell around February (URT, 2007). Average monthly

temperatures are around 25 to 28°C (URT, 2008). Ngerengere Division and its surrounding catchment receive bimodal rainfall: the first short rainfall season runs from November to early January, followed by a short dry season. The long rainy season starts at the end of February and runs through May, followed by a long dry season. The annual rainfall ranges from 800 mm to 1000 mm, except in the Uluguru Mountains, where mean rainfall exceeds 1500 mm (Van Aelst & Holvoet, 2017; Yanda & Munishi, 2007).

Ngerengere Division was chosen as the area of study because, firstly, this is an area where both production systems, namely agriculture and pastoralism, are practised (Mero, 2011). Secondly, the Maasai of Ngerengere are among the leading indigenous communities in Tanzania that have been organising themselves and their struggles around both concepts of indigenous people and modernisation (IWGIA, 2009). The Ngerengere area has also proven to be among the notable areas with more climatechange adaptation activities and options in Tanzania (Van Aelst & Holvoet, 2017). Also, pastoralism and farming are widely practised in Ngerengere due to the presence of the Ngerengere River. There is a significant increase in agricultural activity and population growth in the downstream zone, exacerbating water pollution. The crops cultivated in Ngerengere include maize, bananas, tomatoes and vegetables (Kihila, 2005).

The type of agriculture practised is a combination of irrigation and seasonal cultivation, complemented by the year-round application of fertilisers and pesticides (Mero, 2011). Finally, Ngerengere Division was chosen for this study because the area, and Morogoro district in general, is an under-researched part of Maasailand as compared to other Maasailand parts (Loos, 2014) such as the northern part of Tanzania, which includes areas such as Loliondo and Simanjiro where many studies on the Maasai and their livelihoods havebeen undertaken (Ndesanjo, 2017). Hence, as Ngerengere Division has both rural and urban areas (Loos & Zeller, 2014), this study was essential to explore distinctive Maasai livelihood strategies, including thoserelated to climate change adaptation.

The study population comprised households of the Maasai community living in Ngerengere Division, Morogoro Rural District, Morogoro Region. The population of the study also involved Agricultural and Livestock Extension officers working in various villages in Ngerengere Division and media/communication experts, preferably indigenous and modern communication systems experts, as well as environmental and climate change experienced or senior journalists.

This study used an Embedded Case Study design. This research design typically involves more than one unit or object of analysis and is not limited to qualitative analysis; it also incorporates elements of quantitative methods. The embedded case design enabled qualitative methods and data, as well as strategies for synthesis and knowledge integration. Although the design allows both methods to be used, for this study, more emphasis and direction were on qualitative methods. The emphasis was on qualitative methods; hence, the use of moderate sample sizes of subjects or respondents (80). The number of respondentsemerged after the study reached data saturation in the qualitative dimension. To begin with, the researcher observed behaviour in a natural setting (the Ngerengere villages and the activities of Maasai communities) without the artificiality that sometimes surrounds experimental or survey research (Wimmer & Dominick, 2011). Secondly, qualitative techniques offered greater depth

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of understanding of the issue under investigation. They were flexible enough to allow the researcher to pursue new areas of interest related to the study's focus.

In addition, qualitative approach and, hence, a moderate sample size (80 respondents reached after a data collection saturation point) allowed for detailed generation of information from the respondents and elaboration of data concerning the respondents' opinions, values, experiences and feelings in addition to observing the respondents' non-verbal responses and their surrounding environment, and hence obtaining comprehensive data (Deacon *et al*., 2010; Wimmer & Dominick, 2011). The methods applied were used to interrelate and integrate the variables, findings andevaluations from the various facets of the case or sub-units of case inquiry. The study collected both primary and secondary data.

The study sample consisted of 60 Maasai respondents (farmers or pastoralists) from Ngerengere Division. These were purposively selected using the criteria noted above until data saturation was reached. The purposive selection of interviewees was carried out with guidance from local government leaders of the respective wards and villages in Ngerengere, based on the roles, knowledge and experience of the respondents (pastoralists and farmers) with agriculture and climate change, as well as communication in the area of study, from an indigenous perspective. In fact, the inclusion of both young and elderly Maasai in the study was intended to capture views that reflect the nexus among indigenous communication means, agriculture, and indigenous knowledge of climate change. Second, efforts were made to ensure representation of each village's population in the division, and each respondent had to be from a particular household in that village. These respondents who met the set criteria were co-opted into the study until a data saturation point was reached. In addition, gender and age, that is, both youth and elders, were factors that facilitated the representation of all important groups in the Maasai community. Everyone, be it an experienced elder or a knowledgeable person, came from a particular household.

Second, the sample consisted of 10 agricultural and livestock extension officers, who were purposively selected from 10 villages (each providing a representative officer from the selected study ward) in Ngerengere Division. It also included fivesenior or experienced journalists (who have covered climate change and environmental issues for many years and are members of the Association of Journalists for Environment in Tanzania-JET); and finally, five communication/media experts from the University of Dar es Salaam (UDSM) to provide proficient insights into indigenous communication systems, thus a total of 80 respondents.

This study used structured and unstructured interviews, which promote an active and open-ended dialogue with interviewees. In particular, the study used one-on-one and group interviews. Most interviews were unstructured and intensive. The study largely relied on intensive interviews, which typically require smaller samples and yield a wealth of detail. Unlike traditional survey methods, intensive interviewing provides extended observation of respondents' nonverbal cues and more accurate responses to sensitive issues (Wimmer & Dominick, 2011). Through intensive interviews, the researcher collected detailed information on indigenous communication systems in agriculture and on indigenous knowledge of climate change. Selection of interviewees was purposive and guided by the local government leaders of the respective wards and villages in Ngerengere (for pastoralist and farmer respondents, as well as extension officers) and the heads of the respective institutions (media houses and higher learning institutions) for the journalists and communication/media experts, respectively. Local government leaders and heads of institutions were consulted to identify

University of Dar es Salaam Library Journal
Vol 21, No 1 (2026), pp 32-48
ISSN: 0856-1818

the appropriate individuals for interviews. For journalists and communication/media experts, selection was also made purposively, considering their roles and experience in communicating, covering, and researching indigenous knowledge of agriculture and climate change.

Observation, as another useful qualitative method, was used because it focuses more on description and explanation than on measurement and quantification (Wimmer & Dominick, 2011). The researcher used a simple observation method to examine and evaluate indigenous communication system practices among residents of the 20 villages in Ngerengere Division, focusing on indigenous knowledge of agriculture and climate change in the same locality. Simple observation was also used because it is relevant and well-suited to mass media problems or communication studies such as this one, especially when there is free access to the research location; hence, a sense of a natural, real-life situation is apparent (Deacon *et al*., 2010; Wimmer & Dominick, 2011).

Results and Discussion

This study explored the indigenous communication systems that communities in the Morogoro District employ to convey indigenous knowledge about agriculture and climate change. In this regard, the study examined the specific indigenous communication systems used to convey agricultural and climate change indigenous knowledge in Morogoro District, and the factors that led respondents to term them as indigenous means of communication. Hence, in this regard, *two sub-aspects* were examined: *first,* the indigenous communication systems the Maasai of Ngerengere use or rely on to disseminate indigenous knowledge on agriculture and climate change. *Second,* the reasons given by both groups of respondents (Ngerengere Maasai and journalists/communication experts) for categorising these communication systems as indigenous.

Indigenous Communication Systems in Use

In the *first sub-aspect*, the researcher used the frameworks and lists of indigenous systems identified by scholars (Mundy & Compton, 1995; Warren, 2001; White, 2008) to identify the types of indigenous communication systems mentioned by the Ngerengere Maasai respondents; the indigenous communication systems they use or depend on most to disseminate information on agriculture and climate change indigenous knowledge. These systems included the following categories: *Interpersonal systems* which included elders' information and other oral traditions such as sayings and perceptions of the Maasai on land size, use of *vigwena* and other traditional beliefs; *Ethnic and village meetings* which included traditional meetings led by local or ethnic leaders such as the *Laigwenan* and village/local government leaders, with orders such as forbidding the Maasai to cut down trees; *Divine means and practices* in which beliefs related to God, myths and others on the environment and climate change, for instance, they reported some places or trees to be sacred and, hence, they used them with great care; *Traditions* included practices and systems such as cultural initiation processes, certain customs and norms. In this regard, a bigger number of respondents, 49 (81.6%) out of all 60 (100%), responded to this question and mentioned such particular systems, as compared to 11 (18.3%) respondents who did not respond. Explaining these kinds of indigenous communication systems, some of them (Ngerengere Maasai respondents) noted:

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> Our community, especially the youth, learns about and follows many things on these issues from the elders. Elders teach the youth; they can be warned, for instance, 'Do not burn the wild, give us information if yousee anyone doing so against our order'. Even the daggers we walk with are not for cutting trees. The daggers are for personal defence (Pastoralist and farmer B15).

> Through our traditions, the information from our elders and different beliefs has taught us since childhood. Moreover, I would suggest we continueusing these indigenous methods because they command respect. However, ifwe say we use TV only a few, we will listen, but not everyone will hear. Through indigenous methods, we all hear at once and are likely to act (Pastoralist and farmer C9).

This dependence on indigenous communication systems to disseminate information about agriculture and climate change, as well as indigenous knowledge, indicates how closely intertwined these systems are with Maasai culture. As such, these indigenous communication systems are effective at imparting knowledge to locals because the message is delivered in a way the target population can identify withand understand. Indeed, people are likely to be influenced by the message more than in situations where they are bombarded with messages via modern communication systems unfamiliar to them (Mundy & Compton, 1995). In fact, the merit of using indigenous communication systems is associated with how such systems deploy the society's culture or traditions to transmit the intended information, as one Maasai respondent noted:

> Such indigenous ways are linked to our environment and the norms and traditions of our society. For instance, the message forbidding us to cut down trees is easily conveyed in line with our traditions and beliefs, and it can be well received and implemented (Pastoralist and farmer A4).

Thus, through culture, indigenous systems of communication help to create awareness, store and transfer accumulated knowledge, educate, mobilise,or entertain (Warren, 2001). All these aspects can be expressed through artefacts, morality, behaviour, and attitude as part of their culture (Kerubo, 2016).

Reasons for Using Indigenous Communication Systems

In the *second sub-aspect* of this part, the study examined the reasons given by both types of respondents (Ngerengere Maasai and journalists/communication experts) for categorising the communication systems deployed to disseminate information on agriculture and climate change (see the previous sub-set) as indigenous. The study used a framework for understanding the analysis and features of indigenous communication systems, that is, what characterises such systems as indigenous, as identified by scholars (Mundy & Compton, 1995; Warren, 2001; Kyeremeh, 2005; White, 2008; Wilson, 2008). Using this framework and the researcher's field observation, the reasons given by both types of respondents (Ngerengere Maasai and the journalists/communication experts) on why these communication systems employed in disseminating information on agriculture and climate change were indigenous, were grouped as follows: source and ways of transfer; authority of information; ownershipof communication system and its message (and effect); channel or means used by a particular system; and relevance of information a particular communication system delivers.

University of Dar es Salaam Library Journal
Vol 21, No 1 (2026), pp 32-48
ISSN: 0856-1818

Reasons related to 'source and ways of transfer', according to the respondents, included considering the source of information, which needed to be community members themselves, especially the elders. Also, the transfer of information was to be carried out locally by community members, such as elders and youths, who served as messengers conveying messages from one place to another.

'Authority of information' group of reasons considered those who had command and influence on the kind and meaning of information given in their traditional communication systems. These were usually local, familiar elders. Thus, these local authorities made the systems indigenous, or theirs (traditional), as opposed to modern systems whose information the Maasai or rural people had no authority over. Relatedly, 'ownership and application of communication system and its message (and effect)' reasons related to how they knew how these systems workedand the process of receiving and working on the message was easier than in modern means. Such indigenous systems involved only locally situated factors, such as familiar divine beliefs, community-inspired discipline, and local rules. 'Channel or means used by a particular system' included the medium or tools used notbeing modern, affordable, accessible, and simple to use. For instance, it required only that they attend a meeting near their homes to receive the message. 'Relevance of information a particular communication system delivers' as reasons that such systemswere indigenous included how such systems' information was familiar to the community, their needs and aspirations. Respondents, especially journalists and communication experts, provided further analysis about these:

> Indigenous communication means are local because they are contextualised and localised to suit the environment, culture, and climate (Communication expert 3).
>
> Local people use gatherings, which are indigenous because they involve few and familiar participants in the locality (Journalist 4).
>
> Indigenous communication systems, which rural people mostly use, are those that apply the two-step flow of information mechanism, involving opinion leaders and opinion followers (Communication expert 5).
>
> I think most of the villagers still use indigenous communication because these means relate to their needs, and they use relevant plans, such as using stars and birds to predict the weather (Journalist 5).

Implicitly, particular communication systems, such as those used to disseminate information on agriculture and climate change in Morogoro district, are indigenous because people are familiar with them and can understand, trust, accept and handle them better than externally introduced ones, particularly modern means. In addition, they are heterogeneous, flexible in time, location-specific, suited to local socio-cultural conditions, already in place and thus involve lower costs, and accessible to the majority of a community (Mundy & Compton, 1995). These are indigenous communication systems, as they rely primarily on oral networks and traditional practices. One ofthe most significant issues in this regard is the context in which such indigenous communication systems operate. The cultural and social conditions influence their contexts; as such, they largely take the form of speaking with rhetorical effect, the rhythmic cadence of words and proverbs, storytelling, singing, and dancing (White, 2008).

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In addition, these findings on the nature and features of indigenous communication systems applicable in Morogoro district describe their position and roles in society. The reasons the respondents provided for such particular systems to be indigenous included ‘authority of information sourceand ways to transfer the message’. In other words, in their indigenous communication systems, the ones who had command and influence over the kind and meaning of information were the local, familiar elders. Similar aspects are explained by the propaganda model, which treats the media or communication systems as tools in the hands of the dominant classes (Mullen, 2009; Mullen & Klaehn, 2010). The dominant class in this regard comprise the Maasai elders. The production, dissemination, and use of information are arguably restricted to acceptable ideas (Pedro, 2011).

Generally, these findings establish that rural communities have well-established indigenous communication systems through which they have traditionally generated, stored, shared, and utilised information. Such local systems and networks provide effective means for rural communities to access various types ofinformation related to their day-to-day life and activities, such as climate change, farming, livestock keeping, trade, and so on (Mundy & Compton, 1995).

Conclusion

This study has identified the indigenous communication systems used to convey climate information in Ngerengere, Morogoro district. Such indigenous communication systems identified included interpersonal systems; ethnic and village meetings; divine means and practices; and traditions such as cultural initiation processes, certain customs and norms. Societies and individuals, such as the Maasai of Ngerengere, Morogoro district, prefer communication systems and networks that provide them with, one, an effective means for accessingvarious types of information related to their needs such as climate change, farming and day-to-day life; and two, relevant content that suits their needs and interests. Generally, this study has established that indigenous communication systems are preferable in communicating information related to agriculture and climate change indigenous knowledge due reasons including their interactivity nature (accommodating their situations, integrating);proximity to meeting needs (being relevant to their needs and interests); ability to effect change (responding relevantly to the communities’ needs); and being more trustworthy (the communication systems’ message could work relevantly to the community, and could be adhered to, and bring results). Therefore, the significance of indigenous communication systems lies in peoplebeing familiar with them and understanding, trusting, accepting, and handling them better than externally introduced modern ones.

More critically, the preference for indigenous systems appears to be based more on the nature and type of channels used rather than on the content (message). Accordingly, this is evident as the reasons for preferring certain communication systems for agriculture and climate change adaptation indigenous knowledge is based on reasons related to channels of such systems such as being heterogeneous, flexible in time, location specific, suited to local socio-cultural conditions, being already in place and so involving less cost, and being accessible to most of a community (Mundy & Compton, 1995). Hence, communication channels and media are significant factors influencing people’s choices and preferences for certain communication systems. Generally, people are more receptive to messages delivered through traditional rather than modern communication systems (Nsi, 2003). Thus, the government should formulate policies that recognise and mainstream indigenous knowledge in agriculture

and climate change communication strategies to strengthen sustainable development and local empowerment.

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