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A review of cultural factors influencing sustainable cattle production

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Abstract

Cultural attributes such as ceremonial celebrations and ritual performances continue to confer value upon cattle. The production of cattle is currently hampered by several factors including climate change and variation. Severe climate variations negatively impact the accessibility and excellence of essential natural resources vital for sustaining cattle production. This review describes the cultural factors that influence sustainable cattle farming among small-scale farmers in South Africa's Limpopo Province. The study used peer-reviewed scholarly literature sources to elucidate the cultural variables that influence subsistence cattle production. The study findings indicate that cattle are bred and raised to meet and maintain cultural values such as bride price payment, household products, and ceremonial practices. Ensuring the long-term viability of cattle production in consideration of its cultural significance is essential for protecting and conserving tangible and intangible aspects of heritage from the adverse effects of climate change.

Keywords: Culture; Cattle Production; Climate Change Adaptation; Sustainable Development; Cultural Heritage

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1. Introduction

Human societies have developed the skills, traditions, habits, technology and sophisticated place-based knowledge that enhance the ability to thrive in diverse environments (Few et al., 2021). This type of human-nature connectedness helped communities to perceive and respond to any changes observed in the natural environment. The cultural response to climate change consists of ideas, norms, and behaviours that influence human and ecological outcomes, which are iteratively spread and refined within a community (Waring et al., 2023,). These practices are presumed to sustain the relationship between humans and the natural environment from which livelihoods and other cultural needs are derived (Rankoana, 2023). Waring et al. (2023) concede that cultural adaptation to the environment occurs when cultural traits that benefit human survival and reproduction spread among individuals or groups. However, the local adaptation practices to preserve a culture could benefit climate response policies.

The present study contributes substantially to comprehending the relationship between culture and climate change. The study offers insights into how culture plays a pivotal role in determining the need for adaptation to extreme weather change to ensure the sustainability of cattle production in the era of climate change. The study is informed by research conducted in Limpopo Province, where cattle production is carried out despite challenging climatic conditions that have negative effects on the natural resources relied upon in cattle production. The studies referenced include those by Maponya and Mpandeli (2012), Stroebel et al. (2011), Thinda et al. (2020), Monkwe et al. (2023), and Rankoana (2024). These studies show that subsistence farmers engage in cattle production, which they highly esteem for diverse objectives such as sustenance and ceremonial practices. Sikhweni and Hassan (2013) endorse the notion that farmers in rural communities in Limpopo Province keep cattle primarily for non-economic advantages, such as cultural or social prestige.

Among Africans, cattle play key roles in the livelihoods of many households in low-income groups, where they contribute to informal household insurance and financing, soil fertility, and household nutrition. De Glanville et al. (2020) concede that livestock provides the social, cultural, and economic backbone to many rural communities in low-income settings, particularly those in marginal, semi-arid, and arid environments. Rankoana (2023) acknowledges that subsistence livestock production supports cultural practices such as food security, rituals, celebrations, and other customs.

The primary challenges to maintaining cattle output are the adverse effects of unpredictable precipitation, drought, and increasing temperatures, which result in the depletion of water supplies and forage. The implications of climate change encompass the anticipated negative impacts of the rise in variability of precipitation on subsistence farmers (Shongwe et al., 2011). Gebru et al. (2020) support that climate change has a detrimental effect on the livelihood sources of smallholder farmers, namely livestock farmers. In numerous low-income countries, livestock-dependent livelihoods are facing increasing challenges as a result of alterations in the accessibility of the essential natural resources required to maintain cattle production (Thornton, 2010). De Glanville et al. (2020) add that the consequences of climate change pose a threat to cattle production, leading to adverse effects on certain significant cultural elements.

Limiting the damage caused by climate change has become a challenge for the global community. In this regard, climate change mitigation and adaptation are crucial (McCarthy et al., 2011). Many indigenous communities have enduringly used various indigenous and local knowledge-derived adaptation mechanisms to sustain cattle production. This indigenous and local knowledge shall continue to be used to protect assets

and livelihood resources, such as cattle production. This makes adaptation critical to safeguard agricultural production and diminish the adverse impacts of climate change on cattle production (Ali and Erenstein, 2017). Farmers' choice of adaptation strategies against climatic risks varies depending on the type of risk, available livelihood assets, and adaptation options at their disposal (Amare and Simane, 2018).

Prior studies conducted in Limpopo Province report that various factors, such as age, gender, household size, depreciation ratio, access to extension services, frequency of extension visits, and non-farm income, have an impact on the adoption of climate change adaptation strategies to maintain subsistence production of crops and livestock. This review aims to identify cultural factors that impact the sustainable production of cattle as described in prior studies on climate change and culture in Limpopo Province. Comprehending the cultural factors that influence cattle production is essential for safeguarding and preserving the cultural significance of cattle, as well as implementing adaptive measures that enhance climate resilience. Therefore, the purpose of this review is to outline the cultural factors that influence cattle farmers' continued production of cattle.

2. Methodology

The research used peer-reviewed scholarly literature sources to describe cultural factors that determine the need to adopt adaptation strategies to sustain cattle production in Limpopo Province. The literature sources were retrieved from prominent databases like Semantic Scholar, Elsevier, Google Scholar, Research Gate, Taylor and Francis, Sage, and Willy online libraries. The literary sources were utilised irrespective of their publication year. These sources were purposefully according to their relevance to the study's goal. To include or exclude secondary data sources, the researcher first conducted a search for each piece of information and source, subsequently screening the publications based on their titles and abstracts. Consequently, the researcher utilised content analysis to examine the data. A substantial dataset was categorised into smaller segments, including climate change, climate change adaptation, indigenous livelihood resources, cattle ownership, the cultural significance of cattle, challenges in cattle production, and the practices implemented to sustain cattle production.

3. Results and discussion

3.1. Ownership of cattle

Cattle continue to be highly valued for their cultural significance, particularly in ceremonial celebrations and ritual performances, which have endured the adverse effects of Eurocentric influence on African knowledge systems. Like other cultural traits, communities learn and share cattle production as a means of establishing local livelihood patterns (Mayala et al., 2017). Multiple studies on small-scale cattle production indicate that families often possess and manage the cattle, typically under the guidance of an elderly male (Mönnig, 1964; Coertze, 1986; Monkwe et al., 2023). Usually, men have the authority to make decisions regarding the disposal of the cattle after discussing it with the family. An elderly male oversees the management of livestock that his unmarried sons have obtained via their earnings. Unmarried males do not hold the entitlement to own or exercise authority over livestock. Consequently, widows are only able to acquire temporary authority over livestock for their underage sons. In a polygynous family, when a daughter gets married, the cattle go to her

mother's house (Mönnig, 1964). However, her brothers have a higher priority in claiming these cattle to include them in the magadi (bride price), which they offer for their marriages. This practice is consistent with the findings of Coertze's (1986) study, which verifies that cultural groups in the Limpopo Province have a patrilineal and patrilocal structure, as evidenced by their involvement in cattle raising. According to Van Marle-Köster et al. (2021), it is acknowledged that over two million households in South Africa engage in livestock rearing to fulfil certain cultural values.

3.2. Cultural factors influencing sustainable cattle production

The review findings indicate that the cultural significance of cattle is the primary factor that significantly influences the adoption of adaption practices to sustain cattle production and management. The reported cultural values are still relevant and prevalent for cattle producers.

3.2.1. Cultural value of cattle

Table 1 presents the cultural uses of cattle. These include religious importance, a source of food security, and social cohesion. The primary motive for maintaining cattle is to slaughter them for family religious rites (Rankoana, 2024). According to Monkwe et al. (2023), cattle farming is important since it provides food for rural people and fulfils cultural values such as ritual ceremonies and initiations. According to Mapiye et al. (2019), cattle production is important in rural South African communities, contributing considerably to cultural and religious activities, social status, food production, and livelihoods (Van Marle-Köster et al., 2021).

Table 1. Cultural factors influencing sustainable cattle production

Determinants	**Value**
Religious Significance	Slaughtered for funerals and rituals
Social Security	Source of bride-price to bind families in marriage
Food Security	Source of meat and milk

3.2.1.1. Religious significance

Cattle are slaughtered only for ceremonial and religious purposes. People never consider slaughtering for meat, even in times of severe scarcity (Sikhweni and Hassan, 2013). The most essential aspect of cattle is their social and religious significance. Cattle are important in most traditional religious activities, such as funerals and propitiatory sacrifices. Cattle are the most effective means of ensuring success with ancestor spirits and living in harmony with the supernatural realm, making them the ultimate kind of sacrifice, to promote health, prosperity, and happiness (Sikhweni and Hassan, 2013; Rankoana, 2024). According to Coetze (1986), cattle are frequently essential in South African rural communities not just as a source of subsistence, particularly in distant locations where numerous tribes live, but also for their cultural and spiritual value. Coertze adds that

cattle are used as sacrifice products, giving the best way to gain the favour of one's ancestors and ensure one's prosperity.

In African cattle farming, the emphasis is not on the economic importance of beef production, but on cattle's essential role as sacrificial animals and in the establishment and maintenance of good social connections when entering into marriage or lease-lending agreements. Many of these observances in Southern Africa centre on prayer to their ancestors' spirits (Mapiye et al., 2019). The cattle kraal is where males are buried; in most situations, the saying goes that ancestral spirits preserve their descendants' property (Mayala et al. (2017). As a result, the ancestors can expect the occasional slaughter of an ox for their benefit. If this does not happen, they may seek it. Thus, cattle serve as sacrifice objects, providing the most effective way to win the goodwill of one's ancestors and ensure one's prosperity (Ade and Silas, 2020; Mapfumo et al., 2021).

3.2.1.2. Social security

Mönnig (1964), Sikhweni and Hassan (2013), Monkwe et al. (2023), and Rankoana (2024) all agree that cattle are the most significant herded livestock. Cattle are important because they provide a primary means of living in peace with family and relatives. They are the fundamental way of resolving disputes and, above all, exchanging marital property. Cattle exchange creates a network of familial ties that connect members of lineal groups and fosters interactions with other groups. It is a significant cultural commitment. Cattle are the major method of payment for bride prices. As the number of cattle-producing households has declined and the monetary system has gained importance, cash equivalency has largely replaced cattle (Monkwe et al., 2023). Transferring from the groom to the bride's family is a traditional cultural practice common in subsistence cultures. Cattle transfers foster important social relationships. Entrusting livestock to other family members strengthens and sustains in-law connections. The primary flow of cattle occurs through the exchange of marriage goods (bride-price), which creates a network of duties and rights over cattle. When a man marries, he acquires a claim to cattle owned by his paternal kin and, to a lesser extent, his affinal kin, all of whom are required to pay his bride price. In the future, he will be required to contribute to the marriage expenses for the sons of the families who aided him (Sikhweni and Hassan, 2013).

The social value of the links formed through cattle transfers is far bigger. de Glanville et al. (2020) refer to this mode of consumption as an investment in human relations and agrees with Mayala et al. (2017) conclusion that cattle in most of Africa are a form of wealth invested primarily in the development of a diverse variety of social ties. Aside from the cordial relationships formed between the bride and bridegroom's lineages as a result of the transfer of these marital cattle, a sophisticated structure of reciprocal obligations between blood relatives and in-laws emerges (Mayala et al., 2017). The delivery of marriage cattle and the acceptance of the reciprocal obligations arising from this transfer remain a reality to this day (World Bank, 2008). Adeyemo and Silas (2020) agree that the groom's family presents cattle to the bride's family as a cultural gift to encourage inter-social relationships. This cultural value of cattle aligns with the livestock practices in Botswana, as reported by Mrema (1996), where cattle serve as important household assets, providing security, money, food, and a sense of cultural and social identity. Mayala et al. (2017) confirm that the bride price is a customary practice that involves payment in the form of cattle. However, cattle investment is essential to sustain this cultural practice. Africans, for example, keep livestock mainly as a means of fostering cultural and social relations. Bride pride is an important cultural obligation to meet among communities in the study area and the rest of Africa.

3.2.1.3. Food security

The necessity to meet household food requirements is a cultural trait. Typically, humans use natural resources to meet their household food requirements. This type of production is referred to as subsistence farming which involves the growing of various crops and livestock for food security. Cattle production is not an exception. In addition to its cultural significance, sustainable cattle raising ensures food security in rural areas. According to Monkwe et al. (2023), rural communities in Limpopo Province rely on cattle as a coping mechanism for vulnerability and food insecurity. People use cattle meat for a variety of purposes, including ceremonies, and household consumption. Cattle's cultural values as food sources and role in rituals and entertainment are all crucial predictors of how owners would adjust and support initiatives to sustain their production (Coetze, 1986). In support of these observations, Tricarico et al. (2020) report that some 400 million people in Africa depend on livestock for a substantial part of their livelihood. Livestock is an important asset, serving as a source of food, and a key security net during the disastrous time (Mapiye et al., 2020). Cattle are especially important in communities because they produce meat for a variety of purposes, such as rituals, selling, and home consumption (Monkwe et al., 2023). In Gebregergs' et al. (2019) view, the livestock sector contributes to one billion of the world's poorest people's livelihoods and employs close to 1.1 billion people. However, cattle productivity improves the food supply and reduces high rates of poverty and malnutrition (Tricarico et al., 2020; Mapfumo et al., 2021). Smallholder farmers keep livestock for multiple purposes, including the need for household food security (Mayala et al., 2017).

3.3. Challenges in subsistence cattle production

The cattle raised in Limpopo Province mostly rely on grasslands for their sustenance. About 40% of cattle producers in Limpopo Province share land for livestock grazing (Monkwe et al., 2023). There are no formal systems of production except that the cattle feed on natural resources. The main feed embraces natural pasture grazing, crop residues, browse plants, and commercial diet, as well as getting water from the ponds, wells, and rivers (Maponya and Mpandeli, 2012; Monkwe et al., 2023). In numerous rural communities, cattle producers depend only on this form of grazing, when cattle solely consume vegetation from natural rangelands to enhance production (Mayala et al., 2017; Rojas-Downing et al., 2017; Adesogan et al., 2020). However, the production of cattle in Limpopo faces numerous challenges. The main challenge is the adverse effects of climate change on livestock productivity. The primary concern is the widely reported alteration in meteorological patterns, resulting in drought, unpredictable rainfall, and increasing temperatures (Monkwe et al., 2023). These endanger livestock productivity due to a decrease in the quality of feed crops and forage, the availability of water, animal and milk production, livestock health, and reproduction (Mpandeli and Maponya, 2012). Otte et al. (2019) admit that the stock feed resources are insufficient in terms of quantity and quality, which prevents the animals from reaching their maximum productivity (Gilo and Berta, 2017). According to Rankoana (2024), these variables limit cattle productivity because the cattle depend on natural resources such as water, leaves, shoots, and pods for their nourishment. The degradation of livestock feed and the shortage of water in rivers and ponds led pastoralists to drive their cattle to more distant locations for sustenance. Rankoana (2024) affirms that various factors, including shifting patterns of seasons, more frequent droughts, higher temperatures, vector-borne diseases, and parasites, as well as alterations in the overall availability and decreased nutritional quality of forage and feed crops, are presently impacting cattle production.

The detrimental effects of climate change on stock feed and water supplies are widely recognised as a significant setback in livestock production. The Intergovernmental Panel on Climate Change (2022) acknowledges that increasing temperatures impair livestock production due to alterations in feed quality leading to poor cattle fertility, decreased production, and disease susceptibility. Climate extremes are responsible for nutritional stress, sickness, limited access to pasture and water, inadequate rangeland management, and a scarcity of feed resources (Rolla et al., 2019; de Leeuw et al., 2020). Niyas et al. (2015) study confirms that climate change stressors have a notable effect on the fertility, growth rate, and mortality of cattle, ultimately limiting cattle productivity.

3.4. Adaptation

Research conducted by Maponya and Mpandeli (2012), Monkwe et al. (2023), and Rankoana (2024) has shown that climate change in Limpopo Province has detrimental impacts on cattle output. This is mostly due to alterations in rainfall patterns and meteorological conditions. Conversely, subsistence farmers have developed adaptive mechanisms to maintain cattle output. As per the findings of Monkwe et al. (2023), cattle producers in the Limpopo Province implement initiatives to alter their production methods to mitigate the negative impacts of climate change and variability. For Van Marle-Köster et al. (2021), the success of cattle production in Limpopo Province can be attributed to diverse and distinctive adaptation strategies. These encompass transhumance, which entails lowering livestock numbers through sales, acquiring alternate stock feed, and ensuring sustainable water supply. Napogbong et al. (2021) advocate for the implementation of transhumant as a strategy for adaptation, highlighting the Fulani people's utilisation of this technology as a component of their traditional climate-adaptation methods to maintain cattle production. Maponya and Mpandeli (2012) advocate for the decrease in cattle reared by households, asserting that harsh climate conditions, such as drastic fluctuations in temperature, changes in rainfall patterns, and an increase in the frequency of droughts, compel livestock farmers to sell their livestock. According to a recent study conducted by Rankoana (2024), subsistence cattle production relies on rain-fed fodders and pastures. This type of production is supported by local authority regulations such as control of the use of natural vegetation by chiefs and indunas. There is a prohibition on the cutting of plant species including fodder sources (Rankoana, 2016), which is a cultural practice of conserving the local vegetation.

Due to the growing demand and limited availability of alternative feeds caused by reduced rainfall and harsh climate conditions, crop residue and fodder obtained from white farms have become crucial resources for cattle production. Monkwe et al. (2023) found that small-scale farmers commonly maintain cattle production by adopting alternative means such as purchasing feed and additives. This alternate approach to cattle production is consistent with the conclusions drawn from Coetzee's (1986) research that climate extremes compel cattle farmers to resort to supplemental feed to sustain production. According to Maponya and Mpandeli (2012), crop residues serve as the primary means of replenishment in communal agricultural systems.

The procurement of alternative stock feed by the Limpopo cattle farmers is corroborated by the World Bank (2012) that enhancing the availability, quality, and quantity of stock feed is one of the most important factors of livestock production in the era of climate change. Bai et al. (2019) found that purchasing alternate pastures improves the health and productivity of livestock. Adeyemo and Silas (2020) assert that enhancing cattle feeding by incorporating supplementary feed sources, such as silage and hay, significantly enhances cattle

output. Noya et al. (2019) found that certain livestock producers are modifying and expanding their management strategies, such as enhancing the availability of water sources, to ensure the long-term viability of subsistence livestock production (Espeland et al., 2020). Additionally, the Endorois people employ livestock destocking and additional feeding of livestock as part of their adaptation strategies to mitigate the impacts of climate change (Endorois Welfare Council, 2019). Erdaw (2023) states that due to rising demand and limited availability of alternative feeds, crop residue has become a crucial resource for livestock production. For Mayala et al. (2017), smallholder farmers commonly sell their livestock to acquire food, particularly during drought seasons, or to obtain capital for small business ventures.

To the above adaptation practices, Adger et al. (2013) believe that culture mediates changes in the environment and changes in societies. Adger et al., 2014 recognise the practices as major resources for climate change adaptation, but their consistent use in adaptation efforts and their neglect in policy and research (IPCC, 2014) is ignored. For example, the Fulani people use indigenous climate adaptation strategies, including diversifying livestock feed, implementing cattle stress-management techniques, and practicing division of labour (Napogbong et al., 2021). Filho et al. (2022) acknowledge that Africa, being abundant in indigenous and local knowledge, has a history of using local approaches to cope with climate variability and change. The utilisation of indigenous knowledge, which is intricately linked to the biocultural linkages about observed climate change patterns, has the potential to augment the efficacy of adaption measures. Research conducted by Parsons et al. (2019) and Wilson (2019) suggests that the ability of indigenous communities to adapt to environmental change is influenced by various factors including indigenous knowledge systems, worldviews, cultural values, and attachment to the land. Pretty et al. (2018), endorsed by the IPCC (2022), argue that adopting local methods to sustain subsistence cattle can enhance livestock productivity and offer substantial advantages to society. Panel (2020) suggests that promoting sustainable intensification of production, particularly in the cattle sector, could lead to improved environmental efficiency. According to the IPCC (2022), it is acknowledged that certain livestock areas around the world may become unsuitable for farming due to climate change by 2050, however, subsistence producers should implement local strategies to maintain cattle production.

4. Conclusion

The review findings revealed that rural communities in Limpopo Province produce cattle to fulfil cultural obligations. Harsh climatic conditions impact negatively on subsistence cattle production, leading to scarcity and depletion of natural resources that provide cattle with feed and water. Cattle farmers adopted local practices, such as transhumant practices, herd reduction to a manageable size, and alternative feed and water resources to mitigate and adapt to the impacts of climate extremes on the natural resources exploited for cattle production. The cultural value of cattle as a source of food, bride price, and importance in religion and ritual performance greatly influences this capacity for adaptation. These cultural values explain why most households in the Limpopo Province rural communities produce cattle despite the obvious negative impacts of erratic rainfall on natural stock feed and water resources. Sustainable production of cattle for continued cultural value addresses the need to protect and conserve tangible and intangible heritage from the detrimental effects of climate change. The policy implication of this review findings is for the government to focus on smallholder cattle farmers to strengthen their resilience by improving their persistence and

adaptability. Given that cattle farmers employ local and community-oriented strategies to adapt to climatic extremes, offering agricultural extension support through fodder provision, improving access to agricultural credit and inputs, and augmenting smallholder farmers' participation in agricultural drought resilience could enhance small-scale cattle production. Moreover, the results of this study will assist policymakers and stakeholders in developing policy interventions that enhance the resilience of smallholder farmers to agricultural drought.

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