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Livelihood Strategies for Food Shortages during Dry Seasons in Tanzania: A Case Study of the Halali River Catchment Areas in Wanging'ombe District

Christopher Aaron Mulungu[1*], Ubaya Simon Msemwa[2]

[1]Department of History, Political Science and Development Studies, Mkwawa University, College of Education, (A Constituent College of the University of Dar es Salaam) P. O. Box 2512, Iringa, Tanzania.
[2]Department of Geography and Economics, Mkwawa University College of Education (A Constituent College of the University of Dar es Salaam), P. O. Box 2512, Iringa, Tanzania.

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abstract

This paper examines the livelihood strategies adopted by people in the Halali River catchment areas of Wanging'ombe District, Njombe region, Tanzania, during food shortage. The study employed a mixed research approach, utilising quantitative and qualitative methods. Questionnaires, in-depth interviews, focused group discussions (FGDs) and documentary reviews were used for data collection, involving 310 heads of households and 23 key informants. Descriptive statistics and content analysis were used to analyse data. The results indicate that people in the Halali catchment area adopted various off-farm income-generating activities such as business, carpentry, masonry, pottery, basket making and brewing beer as survival strategies during food shortages. Other sources of off-farm income-generating activities included wage employment, casual agricultural labour and remittances from relatives living far from the basin. It is concluded that most households in the study area were poor and likely to be food insecure due to limited opportunities for off-farm income-generating activities. It is recommended that the government should disseminate knowledge on the availability of reliable markets for agricultural products and the protection of the Halali River catchment areas.

Background of the Study

The survival patterns of individuals or households are evident in the assets and activities undertaken to sustain their livelihood. Indeed, the resilience of a given social unit often hinges on the success of these livelihood activities. Consequently, various survival strategies have been adopted to enhance food self-sufficiency at the household level. As integral components of the assets-activities-outcomes cycle, survival strategies typically adapt over time, responding to opportunities and changing constraints (Scoones, 2009).

For example, Regassa (2011) shows that among the strategies adopted were reducing the number of meals and amount of food consumed, as well as out-migration of household members during chronic food shortages. Tam *et al*. (2014), in a study on survival strategies for food insecurity and hunger among Aboriginal societies in Canada, showed strategies such as seeking assistance from relatives and friends, food sharing, reducing food intake and skipping meals.

Empirical evidence shows that rural households in Sub-Saharan Africa rely on diversified income sources (Ellis, 1998). Diversification of livelihood strategies serves as a buffer against environmental and economic shocks (Ellis &Allison, 2004). Longhurst (2009) documented various strategies to cope with seasonal hunger, including off-farm income earning, selling assets, reducing food intake and out-migration. Woldeamanuel (2009) also reported that daily wage labour, charcoal burning, handcraft, petty trade, out-migration and skipping meals were survival strategies for coping with hunger and famine in Haroressa, Ethiopia.

Similarly, a study conducted in Southern Sudan by Miji-tesse (2011) identified eating immature crops, reducing the size and number of meals, consuming less-preferred foods, and increasing collection and consumption of wild foods as some of the common coping mechanisms used by the smallholder farming communities during food shortages. Milich (1997), in his study in West Africa, found that households survived by gradually selling assets as part of the temporal sequence and organisation of household responses to food shortages and food security emergencies. However, when assets were exhausted, people with no livelihood alternatives migrated to other areas.

Moreover, Wilhemina and Quaye (2008) found that households employed a wide range of mechanisms and communal support networks to cope with food shortages in northern Ghana. These mechanisms included the collection of wild foods, market purchases, in-kind (food) payment, support from relatives and friends and sales from livestock and household valuables. Additionally, households utilised options such as out-migration and wage labour, reducing the number of meals served each day, reducing portions/sizes of meals and consuming less preferred foods. The study found that during months of inadequate household food provision, coping mechanisms included out-migration to southern Ghana for wage labour, support from relatives and friends outside the regions, sales of livestock and household valuables, and reducing food intake and consuming less preferred food.

Liwenga (2003), drawing experiences with the Gogo tribe living in Mvumi Dodoma in the semi-arid zone of central Tanzania, reported that the Gogo adopted making and selling local brew, making and selling charcoal, out-migration and casual labour as livelihood survival strategies. Likewise, Lyatuu and Urassa (2015) observed that most households in the Mvomero district remain reliant on exclusive farming and/or livelihood survival strategies due to a lack of financial capital, labour skills, savings and access to credit for meaningful diversification of livelihood strategies.

To earn a living and enhance food self-sufficiency at the household level, individuals adopt a livelihood survival strategy. Studies by Mulungu and

* Corresponding author.
E-mail addresses: christopher.mulungu@udsm.ac.tz (C.Mulungu).

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Myeya (2018) assert that migrants in the Mbozi district survived by gradually selling assets as part of the temporal sequence and organisation of household responses to food shortages. The survival patterns of individuals within the households are reflected in the assets and activities that contribute to better livelihoods. However, when assets are depleted, individuals with no alternative livelihoods migrate to other areas. Thus, one of the drivers of migration is the disparities in the quality of life or employment opportunities between two geographical locations.

Moreover, Msemwa (2018) argues that in sub-Saharan Africa, particularly in Tanzania, where agricultural practices are predominantly rain-fed, the absence of irrigation exposes smaller farmers' livelihoods to risk. Although their contribution is minor, nonfarm activities serve as a supplementary source of livelihood for a more significant portion of households. In the Njombe district, heads of households depend on products from dry-season irrigation farming. Cultivating valley bottom lands in the district is one of the oldest land-use practices in Southern Tanzania, playing a crucial role in meeting local household food security and providing cash income (Lema, 1999). Therefore, dry-season irrigation farming is integral to the livelihoods of the area. Majule and Mwalyosi (2003) noted that river bottom cultivation (*vinyungu*) in Iringa and Njombe regions had been practised since before 1939, albeit on a small scale. Dry season irrigation farming, inherited from generation to generation, has been a long-standing activity in the region.

Rural households usually rely on various livelihood strategies to sustain themselves (Steel and Lindert, 2017; Ørtenblad, 2015). Consequently, promoting and diversifying productive activities by adopting modern approaches is important, thereby enhancing traditional practices elsewhere (Scoones, 1998). Furthermore, households often resort to shifting cultivation in forested areas to address food insecurity in semi-arid areas (Madely, 1999). Research conducted by Mung'ong'o (2002) and Msemwa (2018) shows that relying solely on business as a survival strategy during food shortages in the Njombe district proved ineffective due to susceptibility to price fluctuations and the low purchasing power of local residents.

Furthermore, Mulungu and Mteti (2020) have identified several survival strategies employed by the people of the Ileje district, including out-migration, crop farming, trade, livestock, casual labour, carpentry, masonry, brick making, grain milling and cargo transportation. The study further shows that farming is the predominant survival strategy, with most of the surveyed population engaged in crop production. While some young men in Ileje District favoured out-migration, casual labour and trade, women generally gravitated towards trade activities. Temporary labour migration is noted as the most effective strategy, not only for ensuring food security but also as a means of generating household cash income. Similarly, Mushi (2003) observes that out-migration is one of the most important methods of diversifying rural livelihoods.

Moreover, Mbonile (2008) notes that poverty in the peripheral districts prompts people to adjust their livelihood strategies in several ways. Firstly, they increasingly turn to out-migration to urban areas. Furthermore, Woldeamanuel (2009), Mulungu (2013), as well as Mulungu and Myeya (2018) and Mulungu and Mteti (2020) document temporal seasonal migration as a survival strategy to ensure access to food during shortages.

For decades, smallholder farmers in the Wanging'ombe district have relied on valley bottom cultivation, known as*"vinyungu,"* and irrigation farming as strategies to mitigate food shortages resulting from unreliable rainfall (URT, 2013). In the catchment areas, irrigators can divert water through canals to irrigated fields at any point along the river. While this process has improved household food security, the proliferation of irrigation canals and excessive obstruction have reduced river water flow, particularly during the dry season (Msemwa, 2018). Despite ample documentation, limited information regarding livelihood strategies to address food shortages is available. Therefore, the present study addressed this knowledge gap and broadened our understanding of strategies to combat food shortages during dry seasons in the Halali River catchment areas.

Sustainable Livelihoods Approach

This paper is guided by the Sustainable Livelihoods Approach (SLF), which serves as a framework for understanding and analysing impoverished populations' livelihoods while identifying key influencing factors (Carney, 1998). Livelihoods encompass how individuals sustain themselves, including their assets, capabilities and activities. Strategies for livelihood maintenance span agricultural practices like diversification, crop rotation, conservation farming, and non-farming strategies such as off-farm work and remittances (Barrett, Reardon & Webb, 2001). Chambers & Conway (1992) emphasise the importance of comprehending the diverse livelihood strategies adopted by individuals and communities to tailor context-specific interventions aimed at addressing food shortages. These strategies aim to achieve various livelihood outcomes, which may involve natural-resource-based activities, non-natural-resource-based activities, off-farm activities, migration and remittances, pensions and grants, intensification versus diversification and short-term versus long-term outcomes, some of which may be mutually exclusive (Bebbington, Hickey & Mitlin, 2008). Potential livelihood outcomes include increased income, enhanced well-being, reduced vulnerability, improved food security, more sustainable utilisation of natural resources, and restored human dignity. However, conflicts may arise among these goals (Adato & Meinzen-Dick, 2002).

The weakness of Sustainable Livelihood includes underplaying elements of the vulnerability context, such as macroeconomic trends and conflict, expanding capital assets in a generalised and incremental fashion, not paying enough attention to inequalities of power, and underplaying the fact that enhancing the livelihoods of one group can undermine those of another (Serrat, 2017).

Overall, this conceptual framework highlights the importance of understanding individuals' livelihood strategies to deal with food shortages and the factors influencing their efficacy. By identifying and promoting effective strategies, policymakers can improve food security and reduce vulnerability to food shortages.

Literature review

Livelihood refers to how individuals or households sustain themselves over time (Babulo, 2008; Mulungu & Myeya, 2017; Mulungu & Mteti, 2020). It comprises both assets and activities, as well as access to these resources, which are influenced by institutions and social relations. These factors collectively determine an individual's standard of living (Ellis, 2000 &Kassie, 2017). For example, Kassie (2017) argues that rural communities rely on three main strategies to support their livelihoods: agricultural intensifications, diversification of income sources and out-migration. Among these, agriculture remains the predominant means of household survival. This can involve increasing labour or capital inputs on existing land or expanding cultivation or grazing.

Furthermore, Kassie *et al.* (2017) notes that agricultural practices in Sub-Saharan Africa, particularly in Ethiopia, are predominantly rainfed, leaving small-scale farmers vulnerable to weather fluctuations. While nonfarm activities play a small role, they still contribute significantly to household income. Kassie (2017) identifies four distinct rural livelihood strategies: nonfarm agricultural production, unskilled on-farm or off-farm wage labour, nonfarm earnings from trade, commerce and skilled employment, and the fourth mixed strategy combines all three strategies.

Livelihood activities are individuals' activities to achieve their livelihood goals (Alinovi *et al.*, 2010). These activities include productive endeavours, investment strategies and reproductive choices. Key factors influencing people's choice of livelihood strategies include their access to assets, prevailing policies, institutions, and processes that affect their ability to use these assets to attain positive livelihood outcomes.

Livelihood survival strategies refer to the method utilised by households to generate income for purchasing food during periods of food scarcity. The classification of these strategies stems from the recognition that, for most rural households in Sub-Saharan Africa, reliance solely on farming is insufficient for survival (Ellis, 2000). Consequently, households increasingly diversify their income sources to enhance their quality of life, engaging in agricultural and non-agricultural activities. In this context, both on- and off-farm activities are undertaken to generate income (including monetary and non-monetary contributions to household consumption) alongside the primary agricultural activities of the household. Livelihood survival strategies also encompass the array of skills, resources, and actions necessary for sustaining life (Asfaw *et al*., 2017).

For example, Ellis (2000) categorises these activities into natural and non-natural resources. Various factors that may drive individuals to pursue different livelihoods voluntarily include seasonal variations, risk factors, labour market conditions, alternative credit options, and asset management strategies (such as investing to improve future livelihood opportunities such as networks and education). The benefits derived from these pursuits include consumption, employment opportunities, risk mitigation and accumulating resources for asset investment and consumption. Diversification strategies based on natural resources include activities like gathering resources (e.g. from woodlands and forests), food and non-food cultivation, livestock

keeping and pastoralism, and non-agricultural activities like brickmaking, weaving and thatching. On the other hand, non-natural-resource-based activities include rural trading (such as marketing agricultural products, inputs, and consumer goods), other rural services (e.g. vehicle repair), rural manufacture, remittances (both from urban areas and international resources) and transfers (e.g. pensions from past formal sector employment).

Season irrigation farming is supplying water to cultivated crops using resources such as rivers, swamps and canals instead of relying on natural precipitation (Stern, 1989). Irrigation irrigation farming involves providing plant water at regular intervals (Albinson and Perry, 2002). It is commonly used to support the growth of crops, maintain landscapes and facilitate re-vegetation when there is insufficient rainfall. Magembe (2007) notes that humans have cultivated wetlands for thousands of years to meet their food security and livelihood needs. Dry season irrigation farming plays a significant role in rural livelihoods by providing direct cash income and enhancing food security (Mkavidanda and Kaswamila, 2001). Many households living near wetland ecosystems in Tanzania and other areas utilise these resources as coping strategies during drought and food scarcity (Munishi and Kilungu, 2004). In this study, dry season irrigation farming encompasses practices such as river bottom cultivation "*vinyungu*" and irrigation through canals, rivers, and other means.

Livelihood Survival Strategies

Three main livelihood strategies have been identified: intensification of existing productive activities, diversification through adopting additional productive activities, or migration to engage in productive activities elsewhere (Scoones, 1998). In forest areas, people resort to shifting cultivation as a survival strategy to address food shortages in semi-arid regions (Madely, 1999). Various activities are undertaken by people to earn a living. In rural areas where land is available for cultivation, agricultural intensification seems to be the main survival strategy (Mulungu and Mteti, 2020). In some regions like Makambako and Njombe, people make charcoal to earn money to purchase food, with the main constraint being the lack of legal documentation for this business from the department of natural resources (Msemwa, 2018).

Mulungu and Mteti (2020) further argue that people in the Ileje district adopt survival strategies such as out-migration, crop farming, petty trade, livestock keeping, casual labour as well as other activities like sailing local brew, carpentry, masonry, brick making, grain milling and cargo transportation. However, farming remains the dominant survival strategy, with 80% of the population engaged in crop production. Additionally, many young men in the Ileje district prefer out-migration, casual labour and trade, while women generally favour trade activities.

Urassa (2009) observes that nearly 90 per cent of households have adopted various livelihood strategies, enabling them to achieve livelihood security amidst improving economic conditions. Female-headed households predominantly engage in livestock production, non-farming activities and crop production as their livelihood strategies, while male-headed households often focus on fishing, livestock keeping and craftsmanship.

Lyatuu & Urassa (2015) note that most households in the Mvomero district primarily rely on farming and/or survival livelihood strategies due to a lack of capital for meaningful diversification. Mulungu & Myeya's (2018) study shows that the migrants from Ileje in Mbozi district adopt survival strategies such as intensification of non–traditional cash crops (such as maise, rice, millet, and banana), out-migration, establishment of petty businesses in major trading centres of Vwawa, Ihanda and Mlowo, and engagement in casual labour. While these strategies may improve livelihoods, they are not necessarily sustainable.

Out-migration is commonly adopted by heads of households to generate income for survival. In contrast, relatively wealthy households may use migration to enhance their social status by securing prestigious jobs in the modern sector (Mbonile, 1993). Studies by Mbonile (2002), Niboye (2003) and Mulungu (2013) have shown that many rural households in Tanzania depend on agriculture as their primary source of livelihood, often selling surplus food to meet household needs.

Other factors influencing a household's choice of survival strategies include farm size. According to Block & Webb (2001) and Ellis & Allison (2004), farm size and fragmentation influence crop diversification and survival strategies. Therefore, farmers with larger farms are more likely to diversify by either moving out of agriculture (in cases where activities require collateral) or adopting new crops. As Minot *et al*. (2006) noted, education also plays a role in household diversification of survival strategies and the types of crops grown. Gender (Black *et al*., 2013), household size (Minot *et al*., 2006), and location (Abdulai and CroleRees, 2001) are additional factors behind household choices of survival strategies.

Household diversification of livelihood strategies can be categorised into four major ways: engagement in both farm and nonfarm activities, diversification into high-value activities, commercialisation of production, and engagement in multiple sources of income (Minot et al., 2006). The first three methods are complex as they consider the number of sources and the balance among them, while the fourth method simply accounts for the number of income-generating activities a household is involved in. Ellis (1998) and Toulmin *et al*. (2000) suggest that women's livelihood choices may be influenced by community norms regarding permissible activities for them, while Carswell (2002) highlights preferential differences in livelihood strategy adoption between men and women, with men preferring trade and casual work, women prioritising trade.

In the Ugandan case, Smith *et al*. (2001) found that men exhibited greater occupational livelihood diversification than women, who were mainly involved in agricultural activities, alcohol brewing, handcrafts and farm labour. Men, on the other hand, engaged in carpentry, brickmaking, and construction, in addition to traditional agriculture-based livelihoods. Babulo *et al*. (2008) note that female-headed households are likelier to engage in informal activities such as producing and selling local brew or collecting forest products. However, there was no statistically significant variation in the number of livelihood strategies adopted between male and female heads of households. However, about two-thirds of female-headed households reported adopting three or more livelihood strategies, compared to less than half of male-headed households. Babulo (2008) suggests that households with more working members have greater flexibility to participate in supplementary activities.

In the Ileje district, a single activity is often insufficient for household survival. Mbonile and Mwamfupe (1997) and Mulungu (2013) found that people in the Ileje district resorted to producing non-traditional cash crops such as maise, rice, millet and bananas, in addition to traditional crops like coffee and pyrethrum due to the availability of abundant water.

Various studies on survival strategies during food shortages, such as those by Mulungu and Mteti (2020), Mulungu and Myeya (2018), Kassie (2017), Asfaw *et al*. (2017) and Mung'ong'o (2002), have examined livelihood strategies in Africa and Tanzania specifically. Although strategies are similar across communities, this study assumes that the effectiveness of a strategy for coping with food shortage varies depending on the environment. Despite existing literature, little is known about household adoption of survival strategies during food shortages in dry seasons in the Halali River catchment area. This necessitates conducting the current study to asses livelihood strategies for coping with food shortages during the dry seasons in Tanzania, focusing on the Halali River catchment areas in the Wanging'ombe district.

Methodology

The study was conducted in the Wanging'ombe district of the Njombe region. This district was selected due to its reputation for experiencing frequent droughts and its river bottom bottom-farming, which is more prevalent compared to other areas in the Njombe region (Msemwa, 2018). The district's climate, characterised by irregular and unreliable rainfall due to its location in a rain shadow area, led smallholder farmers to engage in dry season farming in the river basins to improve food security and livelihoods. The study focused on four villages from two administrative wards, selected based on their proximity to the Halali River. These villages have a history of practising valley bottom (*vinyungu*) and irrigation farming, making them particularly vulnerable to food shortages during dry seasons.

The Halali River Catchment is one of the catchments of the Ruaha River, situated between 8º 2' to 9º 07' south and 34º31' to 34º50 'east. Its course lies near the Itulahumba and Itunduma villages, flowing through various others such as Mtwango, Sakalenga, Iteni, Welela, Usuka, Ikwega, Udonja, Matowo, Korindo and Kasagala. Additionally, it passes through villages like Igelehedza, Igula, Mayale, Isindagosi, Mawande, Iponda, Kanamalenga, Mpululu, Lugoda, Ujange, Lunguya, Ilembula and Iyayi before connecting with the Ruaha River in Mbarali district. Within the Wanging'ombe district, the river spans parts of Mdandu, Makambako and Wanging'ombe divisions (Table. 1 and Figure. 1). According to Kayunze (2008), main water uses in the Halali River catchment include domestic consumption, irrigation, construction and livestock (Kayunze, 2008).

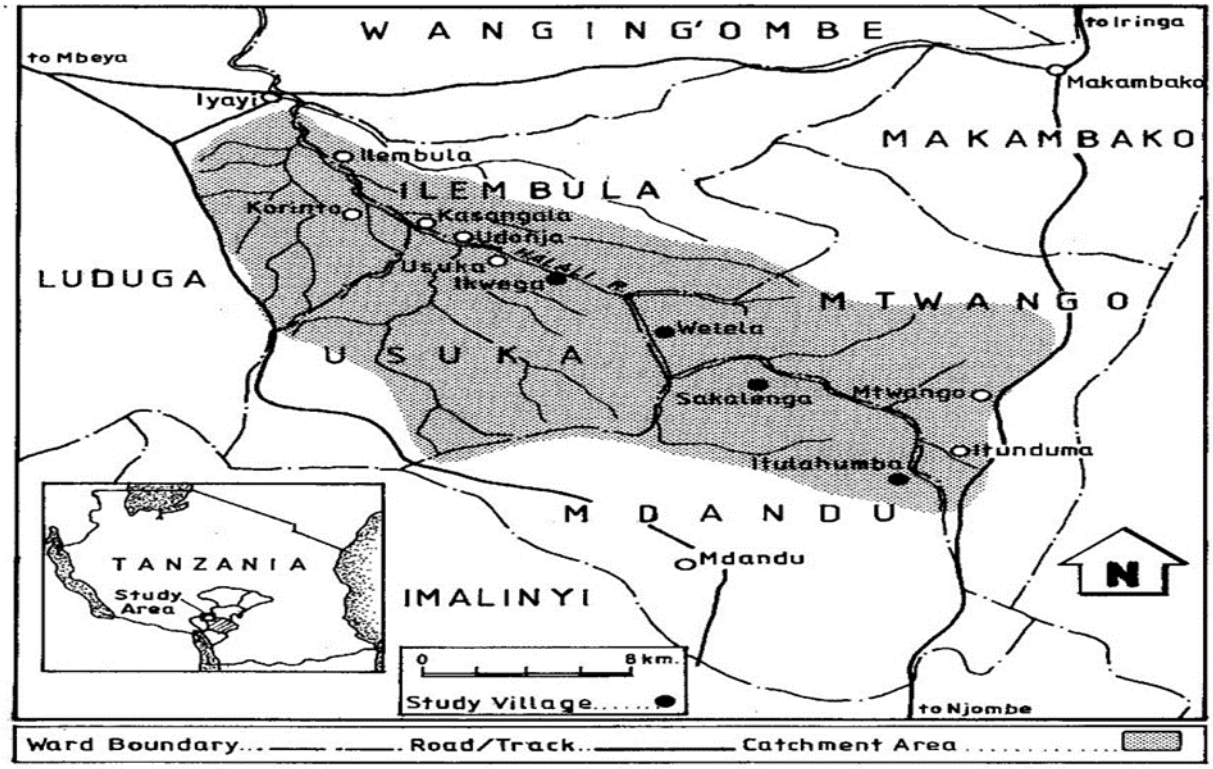

Figure 1: The Map showing the Halali River Catchment Areas
Source: UDSM, Cartographic Unit (2021)

Study design

This study employed a cross-sectional design to investigate the livelihood survival strategies of the people residing in the Halali River catchment areas. The sampling unit consisted of the heads of households within smallholder communities in these areas. Purposive sampling was employed to select two administrative wards: Itulahumba and Usuka. Additionally, four villages were chosen from twelve villages in the study area based on their proximity to the Halali River using the same sampling technique. The selected villages were Ikwega in the Usuka ward, and Itulahumba, Ihanzutwa and Sakalenga in the Itulahumba ward. To obtain participants, a simple random sampling method was used, aided by an inventory list of household heads from each village.

Study Data

Both quantitative and qualitative methods were utilised in this study. Quantitative data were gathered through questionnaires, while qualitative data were obtained through in-depth interviews and Focus Group Discussions (FGDs). The in-depth interviews involved elders and key informants from each village who were identified as having extensive knowledge about food shortages during dry seasons. Additionally, some heads of households provided valuable and detailed information during informal conversations, supplementing the data obtained from questionnaires. These discussions focused on their experiences and perceptions regarding dry-season irrigation farming. FGDs were conducted subsequent to the interviews to identify common themes and patterns in the responses across different groups. Including FGDs in the study enhanced the reliability of the data obtained from the interviews. Participants in the FGDs included ward/village executive officers, members of the ward/village development experts, elderly individuals, youth, and women.

Sample size and analysis methods

The study employed a sample size of 310 individuals determined through sample proportions. If θ or q = $\frac{x}{n}$ is used as an estimate of θ, we can assert with *(1-á) 100%* confidence that the error *(ę)* is less than *Zá/2* times the square root of θ times *(1- θ)* or *p* over *n;* where *n* is the number of samples, *á* is a confidence interval and θ is the population proportions.

$$n = \frac{Z_{\frac{\alpha}{2}}^2 Pq}{e^2}$$ (Modified from Freund, 1992)

If α =0.05, P=0.5, for $q = 1 - p$

Consequently

$q = 1 - 0.5$ = 0.5,

e =0.0557

$Z_{\frac{\alpha}{2}}$ =1.96 is a constant coefficient associated with the confidence level that is being used (from a table of areas in a standard normal curve).

$\frac{1.96x1.96x0.5x0.5}{0.0557*0.0557}$ = 310.

The computations enabled the researcher to determine the optimum number of individuals (*n*) from the households in the study areas.

Quantitative data from the questionnaires were analysed through descriptive statistics to determine frequencies and observe response occurrences from the interviewed heads of households. Qualitative data from focus group discussions, in-depth interviews and field observation were analysed using content analysis techniques.

Findings and Discussion

Demographic profile of heads of households

The study examined the age-sex distribution, marital status and education levels of the population, as they play a crucial role in determining the livelihood survival strategies adopted by smallholder households. Age, in particular, is important for determining land ownership for food production and understanding the history and current status of household's food security. Moreover, individual age influences the strategies used to address insecurity within households, as noted by Msemwa (2018). Results in Table 1 show that 30 % of household heads were under the age of 29, 20% were aged 30-34, and 13% were aged 35-39. Moreover, 20% were aged 40-44, and 17% were over 45.

Table 1: Age Composition of the heads of households (n=310)

Age	Percentage (%)
<29	30
30-34	20
35-39	13
40-44	20
>45	17
Total	100

Source: *Field Survey* (2021)

In terms of education, the study shows that about 10 % of the household heads in the study area had informal education, indicating they had never received formal education. This group was followed by 70.5% who attained primary education. Similarly, 10% of household heads had attained secondary education, while 9.3 % had attained post-secondary education. Regarding sex, 73.5% of respondents with informal education were male, while 26.5% were female. Of those with primary education, 67.2% were male, and 32.8% were female.

Furthermore, 6.2% of respondents who completed secondary schools were male, compared to 30.8% female. About 70% of respondents with post-secondary education were male, with 30% female (see Figure 2). Generally, the majority of respondents had completed primary education. These results concur with those of Msemwa (2018), who observed that education is crucial in human resource development for food production and security. Furthermore, education can lead to employment opportunities, thus providing an alternative means of livelihood. The level of education also influences the adoption of technologies in production, such as irrigation, fertiliser application, and food processing and storage.

Marital status of the heads of households

Marital status is important in determining family stability and household food security. Studies have shown that marriage is a fundamental aspect of the population composition (Mbonile, 2002; Mulungu, 2013 & 2018). In this regard, the study revealed that most heads of households (74.3%) were in marital unions. In comparison, 10.1% were widows, and 8.6% were widowers, indicating high mortality rates among adult men. Furthermore, the findings showed that 4.4% of respondents were divorced, while 2.7% were single, as presented in Figure 3 below:

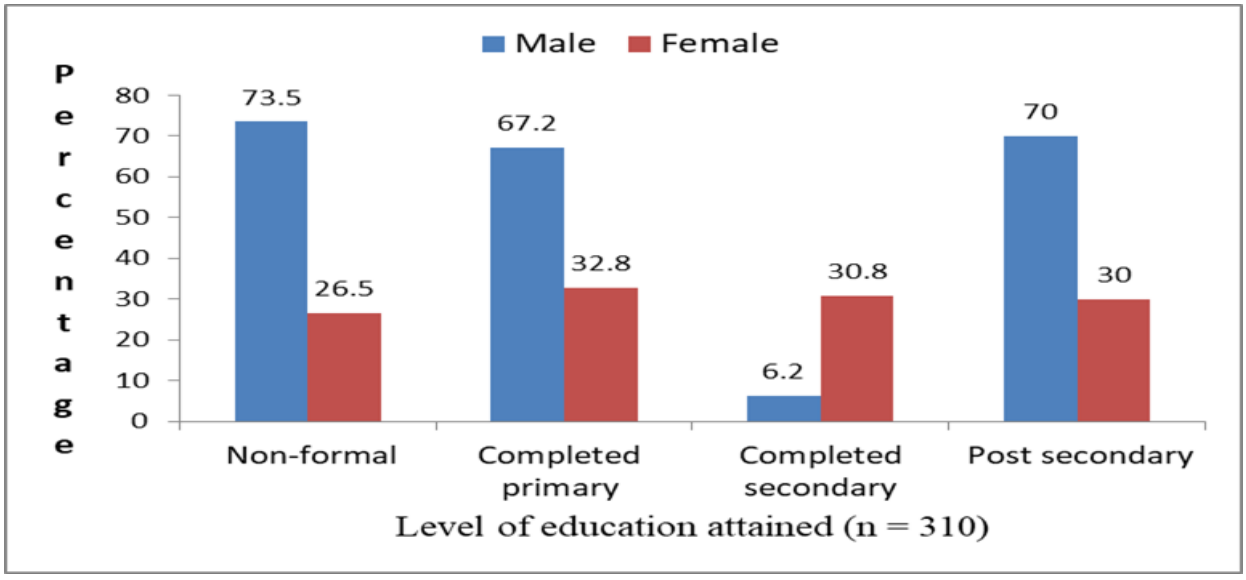

Figure 2: Level of education of respondents (n = 310)
Source: Field Survey (2021)

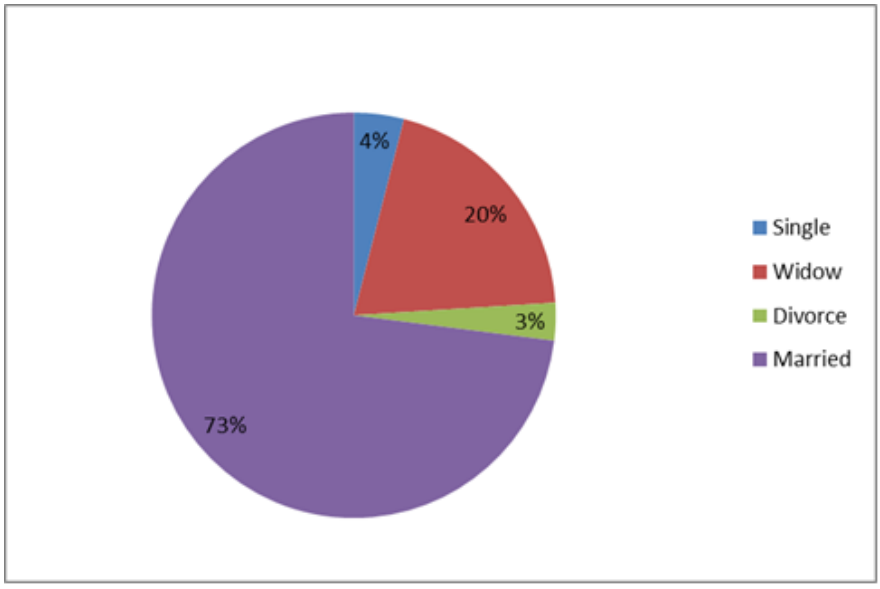

Figure 3: Distribution of respondents based on marital status (n =310)
Source: Field Survey (2021)

Survival strategies for livelihoods during food shortages in dry seasons in the Halali River catchment areas

Communities in the Halali River catchment area employed various strategies to survive during food shortages in dry seasons. When questioned about their approaches to surviving such shortages, heads of households primarily cited two main categories: income-generating activities and food-related strategies. Furthermore, they were queried about the presence of off-farm income-generating activities within households and the specific type of activities pursued by those households engaged in such endeavours.

Households engaging in off-farm income generation by demographic factors

The study revealed that 29.3% of heads of households in the research area were engaged in off-farm income-generating activities, while 70.7% did not participate in such activities. For example, Welela village had a more significant proportion (32.6%) of respondents in off-farm income-generating activities compared to other villages like Sakalenga, which had a lower proportion of households (25.6%) involved in such activities. The results showed that there were more female smallholders (29.3%) engaging in off-farm income-generating activities than male counterparts (29.1%), suggesting the existence of effective strategies for women's empowerment in the study area (Table 2).

The results further showed that most heads of households engaged in off-farm income-generating activities were those separated by marriage status (60%). In comparison, the group with the most minor involvement in such activities consisted of widows (8.1%), primarily due to mobility and instability. This suggests that the nature of economic activity contributed to marital instability. Additionally, the findings showed that greater efforts were needed to empower women smallholders, especially widows, to enhance their income accumulation and household food security.

The findings further revealed that most heads of households (70.6%) engaged in off-farm income-generating activities possessed post-secondary education, followed by those with secondary education (38.5%). Heads of households with a primary school education level were the least likely to participate in off-farm income-generating activities. These findings are in line with those by Liwenga (2003), Quaye (2008), Alinovi *et al.* (2010), Msemwa (2018), and Mulungu & Mteti (2020), who reported that a positive relationship between one's level of education and his/her involvement in off-farm economic activities, as shown in Table 2.

The findings in Table 2 above indicate a relationship between household food availability and off-farm income-generating activities. Households engaged in off-farm income-generating activities were generally more food secure than those without such activities. This is attributed to the ability of households to utilise income from off-farm activities to purchase food during times of scarcity. Studies by Woldeamanuel (2009) and Asfaw *et al*. (2017) conducted in Ethiopia have reported how reliance solely on agricultural income puts individuals at risk of exploiting overworked and fragile land resources due to limited employment opportunities.

Based on perceptions gathered from respondents during household surveys and FGDs, it can be argued that household food sources and off-farm income-generating activities are interdependent. This is evident as certain items such as meat, spices, salt, sugar and cooking oil are commonly purchased from the market. Consequently, households with additional sources of income are better equipped to afford these important food items than those solely reliant on agricultural income. The significance of off-farm income-generating activities in ensuring household food availability is also emphasised by Babatunde (2009) and Msemwa (2017), who advocate for investments in the nonfarm sector to provide alternative income opportunities and enhance food security for rural households. Further supporting evidence from studies such as those of Tschirley and Weber (2003) found a positive correlation between off-farm income and caloric intake among rural households in the Angoche district of northern Zimbabwe. They report that a 1% increase in off-farm income led to a 0.04% increase in caloric intake. Similarly, Ersado (2006) revealed that income diversification through nonfarm activities was associated with higher consumption expenditure levels in rural Zimbabwe, indicating a positive relationship between household wealth and nonfarm income diversification.

Effect of demographic factors on off-farm activities

Table 3 shows the significance of variables concerning households engaged in off-farm activities. Regarding age, the odds of heads of households utilising off-farm activities as a survival strategy during food shortages were significantly 1.6 and 2.9 times higher among those aged 30 – 34 and age 35 – 39, respectively, compared to those aged 29 and under (OR=1.6, p= 0.031 and OR=2.9, p=0.005, respectively). As the education level of respondents increases from secondary education to post-secondary education, the odds of engaging in off-farm activities as a survival strategy increase significantly from 0.5 to 2.6 times higher compared to those with non-formal education (OR=0.5, p=0.042 and OR=2.6, p=0.002, respectively). Concerning marital status, the odds of participating in off-farm activities were 0.3 times higher among those married to heads of households who are single/not married (OR=0.5, p=0.007).

Table 2: Correlation of households with off-farm income-generating activities by demographic factors

Variable	Categories	Responses on whether the households have off-farm income-generating activities (%)	
		YES	No
Village	Itulahumba (n=96)	29.2	70.8
	Sakalenga (n=82)	25.6	74.4
	Welela (n=67)	32.8	67.2
	Hatunzwa (n= 93)	30.1	69.9
Sex	Male (n=230)	29.1	70.9
	Female (n=108)	29.3	70.7
Marital Status	Married (n=247)	30.8	69.2
	Separated (n=15)	60.0	40.0
	Single (n=10)	40.0	60.0
	Widow (n=37)	8.1	91.9
	Widower (n= 29)	24.1	75.9
Level of Education	Non-Formal (n=34)	38.2	61.8
	Primary (n=268)	25.7	73.3
	Secondary (n=26)	38.5	61.5
	Post-Secondary (n=10)	70.6	30.4
	Total n= 310	**29.3**	**70.7**

Source: Field Survey (2021)

Table 3: Logistic regression model of respondents with off-farm income-generating activities by demographic factors

Variables	Categories	Odd Ratio	P-Value	95% Conf. Interval
Age	< =29	1	-	-
	30 -34	1.6	0.031	0.6 – 4.1
	35 - 39	2.9	0.005	0.3 – 3.1
	40 - 44	1.3	0.977	1.1 – 2.1
	45 - 49	1.9	0.692	1.5 – 4.8
	> = 50	0.7	0.549	0.3 – 1.8
Level of Education	Non-formal	1	-	-
	Primary	1.5	0.375	0.5 – 4.1
	Secondary	0.5	0.042	0.4 – 2.6
	Post-secondary	2.6	0.002	0.9– 3.2
Marital Status	Single	1	-	-
	Married	0.3	0.007	0.05 – 2.7
	Divorced	0.9	0.933	0.15 – 5.4
	Widow	2.1	0.123	0.8 – 5.9
Sex	Male	1	-	-
	Female	1.7	0.3311	0.6 – 5.1

Source: Field Survey (2021)

Table 3: Livelihood strategies of off-farm income-generating activities

Variable	Categories	Wage Employment	Causal Labour	Business
Sex	Male (n=230)	7.4	1.3	91.3
	Female (n=108)	2.5	1.9	30.5
Village	Itulahumba (n=96)	10.8	3.1	86.4
	Sakalenga (n=82)	0.0	0.0	100
	Ihatunzwa (n=67)	7.5	1.5	91.1
	Ikwega (n=93)	11.9	2.1	90.6
Marital Status	Married (n=247)	5.6	2.8	91.5
	Separated (n=15)	20.0	0.0	80.0
	Single (10)	0.0	0.0	100.0
	Widow (n=66)	2.7	89.2	8.1
Level of Education	Non-Formal (n=34)	8.8	0.0	91.2
	Primary (n=268)	8.3	2.6	89.1
	Secondary (n=26)	0.0	0.0	68.0
	Post-secondary (n=10)	0.0	0.0	100.0
	Total (N=310)			

Source: Field Survey (2021)

a. Types of off-farm income-generating activities among households

Findings regarding heads of households engaged in off-farm income-generating activities showed that 23.1% were self-employed in carpentry, masonry, pottery, basketry, and brewing businesses. Other sources of off-farm income identified in the area included wage employment (4.7%), providing casual agricultural labour to other farms (1.2%), receiving remittances from relatives (2.7%), and earning income from leasing out land and other resources such as oxen for farming, which accounted for 0.9% of households. It was observed that casual and long-term employment more effectively ensured food security in the study area.

The findings further showed that 7.4% of the heads of households engaged in wage employment as their primary income-generating activity were male smallholders, while female smallholders represented 2.5% of female heads of households. Another source of income-generating activity was supplying agricultural casual labour to other households' farms. Regarding gender breakdown, male-headed households accounted for 1.3%, while female-headed households accounted for 1.9%. Additionally, heads of households who reported business as their source of income generation comprised 91.3% of males and 30.5% of females (Table 3).

Multivariate logistic regression of factors associated with household livelihood strategy during dry season

Further analysis was conducted using multinomial logistic regression to examine how demographic factors influence household livelihood strategies during the dry season while controlling for potential confounding variables. Relative risk ratios (RRR) and their corresponding 95% confidence intervals were calculated and presented in Table 4. The effects of demographic factors as predictors on livelihood strategies were adjusted for age, education, marital status and sex.

The findings reveal that households headed by individuals aged 35 to 39 were significantly and independently 1.9 times more likely to engage in casual labour than those headed by individuals under 29 (RRR = 1.9, p = 0.009). Similarly, households involved in business were 3.1 times more likely among those aged 30 to 34 compared to those under 29 years old (RRR = 3.1, p = 0.004).

On the other hand, households where the head was engaged in casual labour or business activities were significantly 0.3 (p=0.002) and 0.6 (p=0.008) times more likely among those with secondary education and post-secondary education compared to those with non-formal education.

Generally, the findings show that males had more opportunities for wage employment than females, reflecting a gender imbalance in levels of wage employment. These findings further suggest that female smallholders were primarily responsible for household chores, while male farmers were engaged in wage employment or income-generating activities. Additionally, the findings revealed that male smallholders were hesitant to provide casual labour to other households' farms within the villages compared to female smallholders. It was also found that male farmers were less likely to offer casual labour within their villages but were willing to do so in surrounding villages. In the village, a higher percentage of female heads of households (1.9%) reported offering agricultural labour as their source of income-generating activities compared to males (0.9%). This aligns with Urasa's (2009) observation that male heads of households tend to rely more on crop production, out-migration, and nonfarm activities as survival strategies. Similarly, a higher proportion of female heads of households were involved in petty trade, brewing and selling of local brews, as well as casual labour. In addition, Lugalla (1995) observes that women in Tanzania often occupy low-paying and low-status jobs, consistent with the abovementioned occupations.

Table 4: Multivariate polytomous logistic regression of factors associated with household livelihood strategy during the dry season

		Casual labour strategy relative to business strategy			Agriculture strategy relative to agriculture strategy		
Variable	**Category**	**RRR**	**P-Value**	**95% Conf. Interval**	**RRR**	**P-Value**	**95% Conf. Interval**
Age	< =29	1	-	-	1	-	-
	30 -34	1.1	0.916	0.4 – 2.6	3.1	0.004	0.3 - 3.7
	35 - 39	1.9	0.009	0.2 – 2.9	0.9	0.943	0.3 – 3.4
	40 - 44	1.8	0.283	0.6 – 5.2	0.6	0.493	0.2 – 2.6
	45 - 49	0.2	0.218	0.0 – 2.3	3.8	0.030	1.2 – 7.3
	> 50	1.1	0.850	0.3 – 3.1	2.5	0.068	0.9 – 6.8
Level of Education	Non-formal	1	-	-	1	-	-
	Primary	0.7	0.605	0.2 - 2.3	1.6	0.398	0.5 – 5.1
	Secondary	0.3	0.002	0.0 - 2.3	0.8	0.848	01 – 5.9
	Post-secondary	3.1	0.303	0.3 - 24.6	0.6	0.008	0.1 - 9.1
Marital Status	Single	1	-	-	1	-	-
	Married	0.9	0.958	0.6 – 9.4	4.7	0.069	0.8 - 6.4
	Divorced	1.5	0.986	1.1 – 4.6	4.1	0.168	0.6 – 9.1
	Widow	0.6	0.718	0.1 – 1.8	1.7	0.230	0.7 – 4.3
Sex	Male	1	-	-	1	-	-
	Female	0.7	0.718	0.2 – 2.7	0.3	0.046	2.77040

Source: Field Survey (2021)

In this regard, a more significant percentage of households led by males cited lumbering, livestock keeping, trades, carpentry, masonry and welding as their means of survival. This phenomenon is common in many African societies characterised by patriarchal systems, where women, particularly those who are married, often lack the freedom to venture beyond their local communities as men do. This sentiment was also articulated by one of the key informants during an in-depth interview concerning the issue of male out-migration.

> *My son went to work in rice farms in Ubaruku Usangu Plain three years ago. He left his wife with two children schooling at Wanike Secondary School, and the other two were primary school pupils. He stayed there for two years without returning or communicating with anyone at home. I sent his young brother to look for him, and he found the man had married another woman and refused to return. He had left the burden of caring for his children to his wife. Now we are planning to sell a cow and send a militia to bring him back……* (Male respondent aged 62 at Itulahumba village).

This also similar to the findings of Mulungu and Myeya's (2018) study, which reported that men were involved in carpentry, brick making, out-migration and construction, while women were engaged in producing and selling local brews, food and fetching forest products.

The study also found that some heads of households engaged in carpentry, masonry, basketry and agricultural labour did not view these activities as reliable sources of income due to uncertain markets. For example, carpentry, pottery and basketry were often pursued after farm work and considered supplementary rather than primary income-generating activities.

b. ***Reasons for lack of off-farm income-generating activities***

Regarding the reasons for not engaging in off-farm income-generating activities, 44% cited a lack of capital as the primary obstacle. This was followed by a lack of training, which accounted for 20.1% of households, while 8% reported a lack of time for not engaging in such activities. Winrock International (2006) showed that nearly half of Tanzania's population was impoverished, struggling to fulfil basic food and non-food needs. Moreover, Mulungu & Mteti (2020) adds that the rural poor primarily relied on subsistence agriculture for survival. These findings align with the studies by Mung'ong'o (2002) and Mulungu (2013), which identified a lack of market for locally produced items and the limited purchasing power of rural residents as the factors hindering their involvement in off-farm income-generating activities, despite possessing capital or skills. The study further showed that communities resorted to a combination of income and food-related livelihood survival strategies during food shortages.

Income-generating survival strategies during food shortage

An analysis of household income-generating survival strategies during food shortages showed that 29.6% of the households relied on selling labour to other people's farms (Table 4). This was followed by seasonal labour migration, which accounted for 18% of all households, with charcoal-making and selling ranking third at 13%. The fourth income-generating strategy was business, accounting for 11%, followed by brick-making and selling at 8%. Remittances from relatives comprised 5.6%, while sand mining and selling accounted for 5.3%. Pottery making represented 4.4%, with local brewing and borrowing money, each containing 3%.

The findings indicate that most respondents (15.4%) who reported engaging in business had attained secondary education (Table 4). About 8.8% had received non-formal education. Notably, no respondents with secondary education reported engaging in the making and selling of local brew as a survival strategy during food shortages. This activity was primarily undertaken by respondents with only primary education (3.0%) and those with no formal education (2.9%) (Table 4).

Agricultural labour supply was commonly reported by respondents with non-formal education (35.3%), followed by those with primary education (29.9%) and secondary education (23.1%). Charcoal burning was dominated by respondents with primary education, accounting for 14.2%, while brick-making and sand mining were mainly reported by those with non-formal education, at 11.8% and 5.9%, respectively. Temporary labour migrations were mainly reported by respondents with primary education (18.7%) and non-formal education (17.6%). Due to the low levels of education, these activities were being undertaken without applying environmental conservation measures. Thus, there is a likelihood of degrading the environment so that it becomes unproductive, thereby creating difficulties in implementing strategies for poverty reduction.

The results have shown variations in income-generating activities' survival strategies between male and female heads of households. While 10.0% of male heads of households reported business as their survival strategy, only 6.0% of female heads of households did so. This indicates a greater prevalence of business ownership among men compared to women. Furthermore, the bivariate analysis shows a significant relationship between the level of education and survival strategies (P = 0.018) (Table 4). This finding also indicates differences in survival strategies between those with higher education and those with lower education levels. These findings align with the sustainable livelihood framework, highlighting how people combine activities to meet their diverse needs, varying by geographical, economic, and educational factors, and can even differ within a household (Kollmair & Gamper, 2002).

Table 4: Correlate of income generating activities on the level of education to heads of households

Survival Strategies	Responses on Income Generating Activities Survival Strategies (%)				
	Non-formal n (%)	Primary n (%)	Secondary n (%)	Post-Secondary n (%)	Total n (%)
Business	3 (8.8)	28 (10)	4 (15)	1 (10)	36 (10.6)
Local Brewing	1 (2.9)	8 (2.9)	0 (0)	0 (0)	9 (2.6)
Pottery and basketry	0 (0)	8 (2.9)	7 (26.9)	0 (0)	15 (4)
Agricultural labour supply	12 (35)	80 (29.8)	6 (23)	2 (20)	100 (29)
Migration	6 (17.6)	50 (18.6)	2 (7.6)	3 (30)	61 (18)
Remittances	2 (5.8)	15 (5.6)	2 (7.6)	0 (0)	19 (5.6)
Borrowing money	1 (2.9)	6 (2)	0 (0)	1 (10)	8 (2)
Making charcoal	3 (8.8)	38 (14)	3 (11.5)	1 (10)	45 (13)
Making and selling bricks	4 (11.7)	21 (7.8)	1 (3.8)	1 (10)	27 (7.9)
Sand mining	2 (5.8)	14 (5)	1 (3.8)	1 (10)	18 (5)
Total	34 (100)	268 (100)	26 (100)	10 (100)	338 (100)
Pearson Chi2 (27) = 44.5307		Pr = 0.018			

Source: Field Survey (2021)

Conclusion and recommendations

This study examined the livelihood survival strategies of people in the Halali River catchment areas during food shortages in the dry seasons. Various strategies for survival, including off-farm income-generating activities, were identified. These activities encompassed a range of businesses such as carpentry, masonry, pottery, basketry and brewing. Additionally, sources of off-farm income included wage employment, casual agricultural labour and remittances from relatives.

The study concluded that age, gender, education and marital status significantly influenced the survival strategies adopted by people in the Halali River catchment areas. However, it was noted that certain strategies proved to be insufficient and unsustainable, often resulting in issues such as purchasing power and environmental degradation. Activities such as charcoal and brick making were found to be gender-selective, with men being more predominant in these roles. Furthermore, high-interest rates affected borrowing money to purchase food items, leading to property loss for some households due to loan defaults. Based on these findings, it is evident that most households in the Halali River catchment areas are impoverished and likely to face food insecurity due to the lack of viable off-farm income-generating activities.

During the dry season, the risk associated with livelihood strategies was significantly greater for household heads engaged in agricultural activities than those involved in business activities. This trend was particularly pronounced among household heads aged 30 to 34 and 35 to 39, respectively. This observation may be attributed to the challenges faced by agricultural households in irrigating their crops due to water shortages. While irrigation development is crucial for agricultural transformation, poor irrigation management practices hinder efforts to improve livelihoods and expose household heads and the environment to food security risks. Household heads involved in business activities as an alternative strategy faced higher risks due to shortages of commodities such as beans and vegetables, which are derived from agricultural products. Therefore, improving water usage regulations to support and sustain irrigation activities for household food security during the dry season is imperative for enhancing household livelihoods.

The study suggests that involvement in livelihood survival strategies such as charcoal and brick production will likely contribute to deforestation. Despite the environmental impact, banning these practices is not feasible since charcoal is essential for cooking and other household needs in rural areas and urban centres. Similarly, the demand for bricks is driven by rapid construction fueled by urbanisation and population growth in rural and urban areas, further increasing the need for housing and infrastructure.

Therefore, local government should consider implementing appropriate agro-forestry programmes and tree planting campaigns in each village to conserve the environment, including catchment areas. Farmers should be provided with alternative sources of fuel energy to reduce reliance on firewood and logs for charcoal production. This approach would help preserve the environment in the Halali River catchment area, which is crucial for the livelihoods of the surrounding areas.

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