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CONTRIBUTION OF THE LUDUGA MAWINDI WATER SUPPLY PROJECT TO THE DIVERSIFICATION OF HOUSEHOLD ECONOMIC ACTIVITIES IN MBARALI DISTRICT

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ABSTRACT

This study assessed the contribution of the Luduga Mawindi Water Supply Project to the diversification of household economic activities in Mbarali District, Mbeya Region, Tanzania. The study guided by the Sustainable Livelihoods Framework of which a mixed-methods approach and a cross-sectional research design were used. A sample of 100 beneficiary households was used from Mawindi and Ipwani wards using Yamane's formula. The study used simple random sampling to select the Luduga Mawindi project's beneficiaries. Sixteen key informants and participants in Focus Group Discussions were purposively selected for qualitative information. Quantitative data was analysed using the Statistical Package for the Social Sciences (SPSS) software version 27, while qualitative data were analysed through thematic analysis. The findings showed that the project contributed to diversification of household economic activities through increased participation in livestock keeping, irrigated farming, food sales, brick making and water sales, while fishing showed a limited change. The project also contributed to increased household income-generating opportunities by improving access to water for productive activities and reducing the time spent obtaining water. The study concludes that the the Project made a positive contribution to the diversification of household economic activities by improving conditions for productive water use and creating opportunities for households to engage in multiple economic activities. The study recommends strengthening the reliability and accessibility of the water supply system and promoting productive uses of water, particularly irrigation, livestock keeping, food processing and other small-scale economic activities.

KEYWORDS: Luduga Mawindi Water Supply Project; household economic activities; economic diversification; rural water supply; household income.

1. INTRODUCTION

Access to reliable and safe water is important for rural households because water supports domestic activities, health, sanitation and productive activities. Limited access to water can increase the time spent collecting water and reduce time available for economic activities and children's education (Chingonikaya et al., 2025). Women and children often carry a large share of water-collection responsibilities in households without water supplies on premises (World Health Organization (WHO) & United Nations Children's Fund (UNICEF), 2023). Therefore, rural water supply projects can contribute to household well-being by improving access to water and reducing challenges associated with inadequate water supply.

Globally, rural communities continue to experience inequalities in access to safe and reliable drinking water. WHO and UNICEF (2023) reported that rural populations remain disadvantaged in access to household drinking water services in many areas. Long distances to water sources can increase the time spent collecting water and affect household activities. In Tanzania, Ingram and Memon (2020) found that the availability and location of water sources influence household water-collection patterns and the time used to obtain water. Improved water supply can therefore reduce water-collection burdens and support household economic activities, health and children's education. In Tanzania, rural water supply is an important component of efforts to improve health and support social and economic development. The National Water Policy 2025 emphasises adequate, safe, reliable, sustainable and equitable water services (United Republic of Tanzania, Ministry of Water, 2025). Government programmes have consequently continued to invest in rural water infrastructure, including projects implemented through the National Water Fund. However, the contribution of individual water supply projects to household outcomes may differ according to the availability, reliability and accessibility of water services (National Water Fund, 2024; United Republic of Tanzania, Ministry of Water, 2025).

Mbarali District Council provides the local context for this study. The Mbarali District Council Socio-Economic Profile reported limited clean water coverage in Mawindi and Ipwani wards in 2015, with coverage of 19.3% and 48.4%, respectively (Mbarali District Council, 2015). The Luduga Mawindi Rural Water Supply Project was subsequently implemented to improve water access through a gravity water supply scheme and related infrastructure (National Audit Office of Tanzania, 2020). The project was also reported

among water supply projects contributing to increased access to clean and safe water in the district (National Water Fund, 2024; United Republic of Tanzania, 2024). However, available government information mainly documents project implementation and water-service coverage rather than its household-level contribution to economic activities, health status and children's education. This study therefore examines the contribution of the Luduga Mawindi Rural Water Supply Project to these outcomes among beneficiary households in Mawindi and Ipwani wards.

Despite the implementation of the Luduga Mawindi Rural Water Supply Project to improve access to clean and safe water, limited evidence exists on its contribution to beneficiary households. Existing project reports mainly document water infrastructure and service coverage rather than household-level outcomes (National Water Fund, 2024). Previous studies have examined the relationship between water access and household activities, but have not specifically established the contribution of the Luduga Mawindi Project among its 133 beneficiary households in Mawindi and Ipwani wards (Ingram & Memon, 2020; Chingonikaya et al., 2025). Therefore, this study assessed the contribution of the Luduga Mawindi Rural Water Supply Project to household well-being, focusing on household economic activities, health status and children's education in Mbarali District Council, Mbeya Region, Tanzania.

2. METHODOLOGY

2.1 Area of the Study

The study was conducted in Kangaga, Itipingi, Ipwani and Matemela villages in Mawindi and Ipwani wards of Mbarali District Council, Mbeya Region, Tanzania. The villages were selected because they are within the service area of the Luduga Mawindi Rural Water Supply Project and contain beneficiary households. Mbarali District is an important agricultural and livestock-keeping area, while the selected communities depend on water for domestic and economic activities. The study area was therefore appropriate for assessing the contribution of improved water access to household economic activities, health status and children's education.

2.2 Research Design

This study employed a mixed research approach, combining quantitative and qualitative methods. The approach enabled the researcher to collect numerical information from beneficiary households and obtain detailed explanations from key informants and focus group participants regarding the contribution of the Luduga Mawindi Rural Water Supply Project to

household well-being. A cross-sectional research design was used, whereby data were collected at a single point in time. The design was appropriate because it enabled the study to examine the contribution of the project to household economic activities, health status and children's education while integrating quantitative and qualitative evidence.

2.3 Study population and sampling technique

The study involved 100 beneficiary households of the Luduga Mawindi Rural Water Supply Project that determined by using Yamane's formula at a 5% margin of error (Yamane, 1967). The 16 key informants were involved in the study based on their direct roles and knowledge concerning water service delivery and project management. The key informants included were District Water Engineers, Community-Based Water Supply Organization (CBWSO) members, District Health Officer, Head Teachers, ward and village executive officers and health officers at village level. The beneficiary households provided information on the contribution of the project to household economic activities, health status and children's education, while key informants provided complementary information on project management and water service delivery. The beneficiary households were selected by using simple random sampling, and the key informants were selected purposively. The structured questionnaires to the selected beneficiary households to collect quantitative. Semi-structured interviews were used for the key informants. The four FGDs were conducted to beneficiary household members to obtain detailed experiences and explanations concerning changes associated with improved water access.

Quantitative data were checked for completeness, coded and analysed using the Statistical Package for the Social Sciences (SPSS) Version 27. Frequencies and percentages were used to summarize information on household economic activities, health status and children's education, while paired-samples t-tests were used where comparisons of conditions before and after implementation of the project were required. Qualitative data obtained from interviews and focus group discussions were analysed thematically by identifying recurring ideas and organising them into themes and sub-themes corresponding to the study objectives. Findings from the different data sources were compared and integrated during interpretation to provide a comprehensive understanding of the project's contribution to household well-being.

3. RESULTS AND DISCUSSIONS

3.1 Luduga Mawindi Water Supply Project and Diversification of Household Economic Activities

3.1.1 Respondents' main source of water before implementation of the project

Before implementation of the Luduga Mawindi Water Supply Project, respondents reported obtaining water from different sources, including rivers, streams, dams and ponds. Surface water from these sources was used by 93.0% of households, while 7.0% relied on springs (Table1). This situation shows that obtaining household water involved travelling considerable distances in addition to depending on sources whose availability could change with seasons. From the researcher's perspective, travelling several kilometres for water required household members to spend substantial time and physical effort before attending to farming, livestock keeping and other economic activities. Participants across the FGD reported that most households obtained water from rivers, streams and ponds before implementation of the Luduga Mawindi Water Supply Project. They explained that water collection became more difficult during dry periods when water levels declined, forcing some households to travel farther when nearby sources became inadequate. Participants also reported that some of these water sources were shared with livestock, which increased pressure on the available water. The discussions indicated that the burden of water collection was influenced by the type of source, the distance travelled, the time required to obtain water and seasonal changes in water availability. Participants in FGD conducted in Mawindi ward explained:

Before the project, many households depended on rivers, streams and ponds for water. During the dry season, the amount of water in these sources decreased and people had to spend more time looking for water. In some cases, households travelled farther when the nearby sources did not have enough water for their needs.” (FGD with household beneficiaries in Mawindi ward, 15 July 2026).

The findings on longer water-collection distances, unreliable water availability and seasonal difficulties were further supported by the key informant interviews, which provided additional information on the distance, reliability and seasonal challenges associated with the water sources used before the project. A Village Executive Officer explained:

Before the project, most households were depending on the river, streams and ponds. During the dry season, the situation became more difficult because the water sources were far and the amount of water was also reduced. People spent a lot of time looking for water before doing other household activities. This also affected activities like livestock keeping and farming because water was not easily available (Interview with Ipwani Village Executive Officer, 8 July 2026).

The distance and seasonal condition of water sources affected household economic activities. When households travelled several kilometres to obtain water, part of the day could be spent searching for, collecting and transporting water instead of engaging in productive activities. The dependence of 93.0% of households on surface water. The National Water Policy (2025) recognizes reliable water supply as important for social and economic development because it supports households in meeting

their domestic and productive water needs. In this study, the researcher's interpretation is that the high dependence on surface water before project implementation, together with the distance households travelled to obtain water, limited the time and effort available for other productive activities.

3.1.2 Household access to water from the Luduga Mawindi Project

From the finding, most households (86.0%) reported that they had access to water from the Luduga Mawindi Project, meaning that project water had reached and was being used by a large proportion of the surveyed households (Table 1). The situation shows that these households were directly receiving the improved water service provided through the project. The majority of households (14.0%), however, reported that they did not have access to project water, showing that some households remained outside the direct distribution coverage and continued to obtain water from other available sources. However, the differences in household access, as the water distribution system had not reached every household in the same way. This situation shows that, although the project water distribution had reached most households, access was not experienced equally by all households. Murray et al. (2024) similarly found that the availability and functionality of rural water systems influence the extent to which households receive and benefit from improved water services.

Table 1: Access to Water from the Luduga Mawindi Water Supply Project. (n = 100)

Parameter	Frequency (n)	Percent (%)
Main source of water before the project		
Surface water (river, stream, dam, pond)	93	93.0
Water from spring	7	7.0
Total	100	100.0
Household access to water from the Luduga Mawindi Project		
Yes	86	86.0
No	14	14.0
Total	100	100.0
Adequacy of project water for household economic activities		
Very adequate	18	18.0
Adequate	37	37.0
Moderately adequate	25	25.0
Inadequate	15	15.0
Very inadequate	5	5.0
Total	100	100.0

Source: Field Data (2026)

3.1.3 Adequacy of water project to household economic activities

It was found most households (37.0%) considered the project water adequate, meaning that the available water met the requirements of their economic activities (Table 4.1 above). The

majority of households (25.0%) rated the water as moderately adequate, showing that the available supply supported their economic activities but did not always fully meet their water requirements. The majority of households (18.0%) considered the water very adequate, indicating that the project supplied sufficient water for their productive activities. When these three groups are combined, most households (80.0%) rated the project water from moderately adequate to very adequate, showing that the water supply was generally sufficient for household economic activities in the study area.

On the other hand, the majority of households (15.0%) considered the water inadequate, meaning that they experienced difficulties in obtaining enough water for their economic activities. A further majority (5.0%) rated the water as very inadequate, showing that a small group of households faced more serious limitations in using project water for productive purposes. Combined, the 20.0% reporting inadequate or very inadequate water shows that water adequacy was not experienced equally across all households. The situation in the study area indicates that, while the project had improved the availability of water for most households, variations in the amount of water received continued to affect some households' productive activities.

The researcher noted that the availability of project water supported different household activities, although the level of water available differed according to household location and access to the distribution system. Ndyamukama (2023) similarly found that the sustainability of rural water supply schemes in Tanzania is influenced by factors affecting their capacity to provide continued water services.

3.1.4 Contribution of the Luduga Mawindi Water Supply Project to the Diversification of Household Economic Activities

This section presents the findings on the contribution of the Luduga Mawindi Water Supply Project to the diversification of household economic activities. The analysis compares household engagement in selected economic activities before and after implementation of the project. A paired-samples t-test was used because the comparison involved the same households at the two periods. The analysis focused on fishing, water sales, livestock keeping, food sales, brick making and irrigated farming. Qualitative data from Focus Group Discussions (FGDs) was also used to provide explanations for the quantitative findings.

3.1.5 Luduga Mawindi Water Supply Project and Fishing activities

The findings showed that household participation in fishing increased slightly from a mean of 0.08 before the project to 0.12 after the project, as presented in Table 4.2. The change shows a small increase in household participation, with a mean difference of -0.04 and a

standard deviation of 0.240. However, the paired-samples t-test produced a t-value of -1.667 with 99 degrees of freedom and a significance value of .099. Since the p-value was greater than 0.05, the observed increase was not statistically significant, showing that there was insufficient statistical evidence that the project contributed significantly to household participation in fishing. Participants in the FGDs conducted in Mawindi and Ipwani wards reported that only a small number of households were involved in fishing. Participants explained that fishing depended mainly on the availability of suitable rivers, ponds and other fishing areas. They also reported that project water was used more directly for household needs, farming, livestock keeping and other productive activities requiring water close to households. This findings aligned with Chingonikaya et al. (2025) who also reported that water-related conditions influence rural livelihood activities.

3.1.5.2 Luduga Mawindi Water Supply Project and Water sales activities

It was found that household participation in water sales increased from a mean of 0.05 before the project to 0.15 after the project (Table 2). This increase shows that more households became involved in selling water after the project was implemented. The mean difference was -0.10, with a standard deviation of 0.302. The paired-samples t-test produced a t-value of -3.311, with 99 degrees of freedom and a significance value of .001. Since the p-value was below 0.05, the increase was statistically significant, providing evidence that participation in water sales increased after implementation of the project. Participants in the FGD conducted in Ipwani Ward reported that water was mainly sold by households and individuals who had easier access to project water or were involved in transporting and supplying water to other community members. The participants identified buyers as households located farther from water distribution points, households without direct access to project water and people requiring additional water for domestic or productive purposes. Participants further reported that some households purchased water to reduce the time spent travelling to and queuing at water points. The price charged depended on the quantity of water purchased and the distance involved in transporting it, meaning that households requiring delivery paid more than those collecting water directly. Magbondé et al. (2024) found that improved rural water infrastructure creates opportunities for household income generation through productive uses of water. The statistically significant increase from a mean of 0.05 to 0.15 shows that improved water availability was associated with increased household participation in water sales and created an additional economic activity for some households.

3.1.5.3 Mawindi Luduga project and livestock keeping activities

Table 2 shows the contribution of Mawindi Luduga project to the livestock keeping activities in the study area. The findings show that the livestock keeping activity increased from a mean of 0.68 before the project to 0.76 after the project. Showing a higher level of household participation in livestock keeping after improved water access. The mean difference was -0.08, with a standard deviation of 0.401. The paired-samples t-test produced a t-value of -1.995, with 99 degrees of freedom and a significance value of .049. Since the p-value was below 0.05, the change was statistically significant, showing that household participation in livestock keeping increased significantly after project implementation.

In addition, participants in the FGDs conducted in Mawindi and Ipwani wards reported that livestock keeping involved households maintaining animals for household consumption, sale, breeding and other income-related purposes. They explained that regular access to water reduced difficulties associated with providing drinking water for livestock, particularly cattle and other animals requiring large quantities of water. Participants further reported that, before the project, livestock owners depended on rivers, ponds and other natural water sources. A participant in the FGD conducted in Mawindi Ward stated:

“Before the project, keeping cattle was difficult because animals had to be taken to rivers and ponds for water. After the project, water became easier to access, which reduced the distance and time spent looking for water for livestock.” (FGD 1, Mawindi Ward, 18 July 2026).

Which required additional time and effort, especially during periods of water scarcity. The improved availability of project water made it easier for households to maintain their animals and encouraged some households to strengthen their livestock activities. Chintalapati et al. (2022) found that reliable water services are important for supporting rural households and activities that depend on regular water availability. The statistically significant increase from a mean of 0.68 to 0.76 shows that improved water access was associated with increased household participation in livestock keeping.

Table2: Paired-Samples t-Test of Household Economic Activities before and After Implementation of the Luduga Mawindi Water Supply Project. (n = 100)

Paired Variables	Mean Before	Mean After	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Fishing	0.08	0.12	-0.04	0.240	0.024	-1.667	99	.099
Water sales	0.05	0.15	-0.10	0.302	0.030	-3.311	99	.001
Livestock keeping	0.68	0.76	-0.08	0.401	0.040	-1.995	99	.049
Food sales	0.18	0.29	-0.11	0.384	0.038	-2.864	99	.005
Brick making	0.11	0.21	-0.10	0.385	0.039	-2.598	99	.011
Irrigated farming	0.14	0.31	-0.17	0.408	0.041	-4.167	99	<.001

Source: Field Data (2026)

4.6.5.4 Luduga Mawindi Water Project and Food sales activities

The study findings showed that the household participation increased from a mean of 0.18 before the project to 0.29 after the project, as presented in Table 4.2 above. This increase shows that more households became involved in preparing and selling food after the project. The mean difference was -0.11, with a standard deviation of 0.384. The paired-samples t-test produced a t-value of -2.864, with 99 degrees of freedom and a significance value of .005. Since the p-value was below 0.05, the difference was statistically significant, showing that household participation in food sales increased significantly after project implementation.

To explain this increase, participants in the FGDs conducted in Mawindi and Ipwani wards reported that households sold different prepared foods depending on the availability of food products and customer demand. They explained that water was needed for food preparation, washing food and utensils and maintaining cleanliness at places where food was prepared and sold. Participants further reported that improved water availability reduced the difficulties previously experienced when households depended mainly on distant water sources. A participant in the FGD conducted in Ipwani Ward stated:

Water is important when preparing and selling food because it is needed for cooking, washing food and utensils and keeping the selling place clean. Before the project, getting enough water was difficult because the sources were far away (FGD 2, Ipwani Ward, 15 July 2026).

3.1.5.5 Luduga Mawindi Water Supply Project and Brick making activities

Brick making was one of the economic activities that increased after households gained improved access to water from the Luduga Mawindi Project. Household participation in brick making increased from a mean of 0.11 before the project to 0.21 after the project, as presented in Table 4.2 above. This change shows that more households became involved in producing bricks after the project. The mean difference was -0.10, with a standard deviation of 0.385. The paired-samples t-test produced a t-value of -2.598, with 99 degrees of freedom and a significance value of .011. Since the p-value was below 0.05, the difference was statistically significant, showing a significant increase in household participation in brick making after project implementation.

Providing further insight into this pattern, participants in the FGDs conducted in Mawindi and Ipwani wards reported that brick making involved collecting suitable soil, mixing it with water, moulding the bricks and leaving them to dry before sale or use in construction. They explained that water was particularly important during the mixing and moulding stages. Participants further reported that improved water availability reduced the difficulty and time previously involved in obtaining water for brick production, making it easier for households to undertake brick making when there was demand for construction materials. FGD 3 conducted in Mawindi Ward explained:

Brick making needs enough water for mixing the soil and moulding the bricks. Before the project, getting water for brick making was difficult because the water sources were far away. With water available nearby, brick making has become easier for households.” (FGD 3, Mawindi Ward, 25 July 2026).

Mwangi et al. (2025) found that improved rural water access was associated with increased opportunities for productive activities and income diversification among rural households. The significant increase from a mean of 0.11 to 0.21 indicates that improved water access supported greater household participation in brick making.

3.1.5.6 Irrigated farming

Irrigated farming showed the largest increase among the household economic activities examined, reflecting the importance of water availability for crop production. Households engaged in small-scale irrigation of crops and vegetables, using the available water to continue production beyond dependence on rainfall. Household participation in irrigated farming increased from a mean of 0.14 before the project to 0.31 after the project, as presented in Table 4.2 above. The mean difference was -0.17, with a standard deviation of 0.408. The paired-samples t-test produced a t-value of -4.167, with 99 degrees of freedom

and a significance value of less than .001. Since the p-value was below 0.05, the difference was statistically significant, showing a substantial increase in household participation in irrigated farming after project implementation.

Reflecting on this change, participants in the FGDs conducted in Mawindi and Ipwani wards reported that many households previously depended mainly on rainfall for crop production, which limited farming activities during periods of low rainfall. They explained that improved water availability enabled households to undertake irrigation and maintain crop production more regularly. Across the discussions, participants reported that project water was mainly used for irrigating crops and vegetables, particularly among households engaged in small-scale farming. Participants in the FGD conducted in Mawindi Ward explained:

Before the project, most farming depended on rainfall and this made it difficult to continue growing crops when rainfall was low. After the water project was introduced, some households started using the available water to irrigate their farms and vegetable gardens. This has helped farmers continue producing crops even when rainfall is not sufficient.” (FGD, Mawindi Ward, 15 July, 2026)

Fisher et al. (2022) emphasized the importance of reliable water services in supporting rural livelihood activities that depend on water for productive purposes. The increase from a mean of 0.14 before the project to 0.31 after its implementation, representing a 17-percentage-point change, provides strong evidence that improved water availability was associated with increased household participation in irrigated farming.

3.1.6 Contribution of the Luduga Mawindi Water Supply Project to Changes and householdmonthly household ncome

This section examines changes in monthly household income generated from economic activities before and after implementation of the Luduga Mawindi Water Supply Project. The analysis compares the mean income of the same households before and after the project using a paired-samples t-test. The analysis covers fishing, water sales, livestock keeping, food sales, brick making and irrigated farming. FGD findings are integrated with the quantitative results to explain how improved water availability may have influenced income generation among beneficiary households.

3.1.6.1 Fishing income

From the study, fishing income increased among households following the implementation of the Luduga Mawindi Project. Mean monthly income from fishing increased from Tshs 7,200 before the project to Tshs 13,200 after the project, as presented in Table 4.3. This represents an average increase of Tshs 6,000 per month among the households included in the analysis.

The mean difference was Tshs -6,000, with a standard deviation of Tshs 23,050. The paired-samples t-test produced $t = -2.603$, $df = 99$ and $p = .011$. Since the p-value was below 0.05, the increase in mean monthly fishing income was statistically significant.

This increase was reflected in the FGD discussions, where participants in Mawindi and Ipwani wards explained that fishing was mainly undertaken by a small number of households with access to rivers, ponds and other water bodies where fish were available. Participants reported that improved water availability supported households already involved in fishing and related activities by reducing difficulties associated with obtaining water for household needs. The discussions also showed that fishing was less common than other economic activities because it depended on the availability of suitable water bodies and fish. Although fishing involved fewer households, participants reported that those engaged in the activity were able to continue their income-generating activities with fewer difficulties related to household water access. Participants in the FGD conducted in Ipwani Ward explained:

Fishing is not done by many households in this area because it depends on where fish are available. Some households involved in fishing also need water for their other household activities. The availability of project water has reduced the time spent looking for water for domestic use, allowing those involved in fishing to continue with their activities more easily (FGD 2, Ipwani Ward, 16 July 2026).

Similar views were shared by participants in the FGD conducted in Mawindi Ward:

“Only a few households engage in fishing because suitable rivers and ponds are not available everywhere. Those who depend on fishing still need water for household use and the project has made access to domestic water easier. This has helped them continue their fishing and other activities without spending much time looking for water (FGD 1, Mawindi Ward, 15 July 2026).

3.1.6.2 Water sales income

Water sales recorded a substantial increase in mean monthly income after implementation of the Luduga Mawindi Project. Table 4.3 below indicates that mean monthly income from water sales increased from Tshs 3,500 before the project to Tshs 15,000 after the project. This represents an average increase of Tshs 11,500 per month. The mean difference was Tshs -11,500, while the paired-samples t-test produced $t = -2.932$, $df = 99$ and $p = .004$. Since the p-value was below 0.05, the increase in income from water sales was statistically significant.

Providing an explanation for this change, FGD participants reported that improved availability of project water enabled some households to sell water to people who did not have direct access to the water service or required additional water for their daily activities.

Participants explained that water sellers obtained water from available project sources and supplied it to other users, particularly households facing difficulties in collecting water themselves. The availability of project water created an income opportunity by making water easier to obtain and distribute to customers. Magbondé et al. (2024) found that improved rural water infrastructure can increase opportunities for household income generation through the productive use of water. The significant increase from Tshs 3,500 to Tshs 15,000 indicates that improved access to water was associated with increased income earned from water sales.

3.1.6.3 Livestock keeping income

Livestock keeping generated higher monthly income for households after the implementation of the Luduga Mawindi Project. Table 4.3 below indicates that mean monthly income from livestock keeping increased from Tshs 74,800 before the project to Tshs 106,400 after the project, representing an average increase of Tshs 31,600. The mean difference was Tshs -31,600 and the paired-samples t-test produced $t = -3.984$, $df = 99$ and $p < .001$. Since the p-value was below 0.05, the increase in income from livestock keeping was statistically significant.

Adding practical experiences to this result, participants in the FGDs conducted in Mawindi and Ipwani wards explained that livestock keeping depended on regular water availability because cattle, goats, sheep, pigs and other animals required water every day. Across the discussions, participants reported that improved access to water reduced the time and difficulty previously involved in obtaining water for livestock. They explained that households were able to provide drinking water to animals more easily and maintain livestock with fewer difficulties. The discussions also indicated that improved water availability supported the continuation of livestock keeping as an economic activity and strengthened the benefits households obtained from selling animals and livestock products. Participants in the FGD conducted in Mawindi Ward explained:

Keeping livestock requires water every day, especially for cattle and other animals kept by households. Before the project, livestock owners had to travel to rivers and ponds to obtain water for the animals, which took time and was difficult during dry periods. After the project, water became easier to obtain and households were able to care for their livestock more regularly (FGD 1, Mawindi Ward, 15 July 2026).

These findings complement the quantitative results, where the mean monthly income from livestock keeping increased significantly from Tshs 74,800 before the project to Tshs 106,400 after the project. The findings indicate that improved water availability supported regular

livestock care and was associated with increased economic returns from livestock keeping among beneficiary households.

Table 4.3: Paired-samples t-test of monthly household income before and after implementation of the Luduga Mawindi Water Supply Project. (n = 100)

Household economic activity	Mean Before (Tshs)	Mean After (Tshs)	Mean Difference (Tshs)	Std. Deviation of Difference	Std. Error Mean	t	Df	Sig. (2-tailed)
Fishing	7,200	13,200	-6,000	23,050	2,305	-2.603	99	.011
Water sales	3,500	15,000	-11,500	39,216	3,922	-2.932	99	.004
Livestock keeping	74,800	106,400	-31,600	79,318	7,932	-3.984	99	<.001
Food sales	14,400	31,900	-17,500	52,258	5,226	-3.349	99	.001
Brick making	8,250	22,050	-13,800	39,360	3,936	-3.506	99	<.001
Irrigated farming	12,600	40,300	-27,700	62,839	6,284	-4.408	99	<.001

Source: Field Data (2026)

3.1.6.4 Food sales income

This parameter examines changes in mean monthly household income from food sales before and after implementation of the project. Food sales generated higher monthly income among households after the implementation of the Luduga Mawindi Project. The comparison in Table 4.3 above shows that mean monthly income from food sales increased from Tshs 14,400 before the project to Tshs 31,900 after the project. This represents an average increase of Tshs 17,500 per month. The mean difference was Tshs -17,500, while the paired-samples t-test produced $t = -3.349$, $df = 99$ and $p = .001$. Since the p-value was below 0.05, the increase in income from food sales was statistically significant.

Water became easier after the project, allowing households involved in selling cooked food to continue their businesses with fewer difficulties. Antidius et al. (2023) found that improved rural water interventions support household productive activities where water availability is important for daily economic operations.

The researcher observed that food-selling activities were carried out mainly by small household businesses, including the preparation and sale of cooked food to local customers. Ready access to water reduced the need for business operators to spend long periods collecting water before beginning food preparation and cleaning activities. The increase in

mean monthly income from Tshs 14,400 to Tshs 31,900 shows that improved water access was associated with increased earnings from food sales among beneficiary households.

3.1.6.5 Brick making income

Brick making generated higher monthly income among households after the implementation of the Luduga Mawindi Project. Table 4.3 above indicates that mean monthly income from brick making increased from Tshs 8,250 before the project to Tshs 22,050 after the project. This represents an average increase of Tshs 13,800 per month. The mean difference was Tshs -13,800, with a paired-samples t-test result of $t = -3.506$, $df = 99$ and $p < .001$. Since the p-value was below 0.05, the increase in income from brick making was statistically significant. Brick making required considerable amounts of water during the mixing and moulding of soil. Easier access to water reduced the time and physical effort previously spent collecting water for brick production. This enabled households to produce bricks more regularly when construction demand was available. Mwangi et al. (2025) found that improved rural water infrastructure can support productive activities and household income diversification.

Brick making was carried out through small-scale household production, where locally available soil was mixed with water, moulded into bricks and left to dry before being sold or used for construction. Ready access to water made this production process easier to organize and reduced interruptions caused by the need to search for water. The significant increase in mean monthly income from Tshs 8,250 to Tshs 22,050 indicates that improved water availability was associated with greater economic returns from brick making.

3.1.6.6 Irrigated farming income

Irrigated farming contributed to the increase in mean monthly income after the implementation of the Luduga Mawindi Water Supply Project. Table 4.3 above indicates that mean monthly income from irrigated farming increased from Tshs 12,600 before the project to Tshs 40,300 after the project. This represents an average increase of Tshs 27,700 per month. The mean difference was Tshs -27,700 and the paired-samples t-test produced $t = -4.408$, $df = 99$ and $p < .001$. Since the p-value was below 0.05, the increase was statistically significant. This result also recorded the strongest statistical evidence of change among the six economic activities examined.

Households previously depended heavily on rainfall for crop production. When rainfall was inadequate, farming activities and crop production were affected. After the project, households increasingly used available water to irrigate crops and continue production during periods of limited rainfall. Irrigation as an important activity because it enabled households to produce crops and vegetables beyond the normal rainfall periods. Fisher et al. (2022) reported

that reliable rural water services strengthen livelihood activities where households depend on water for productive purposes.

Irrigated farming had become an important productive activity among some beneficiary households, particularly in areas where crops and vegetables were grown near accessible water sources. Water from the project supported regular crop watering and reduced dependence on rainfall alone. The increase in mean monthly income from Tshs 12,600 to Tshs 40,300 reflects the stronger economic position of irrigated farming among the activities examined.

3.1.7 Project increased the number of household economic activities

The expansion of household economic activities was one of the changes reported after implementation of the Luduga Mawindi Water Supply Project. Table 4.4 below shows that 80.0% of respondents agreed that the project increased the number of household economic activities. This included 42.0% who agreed and 38.0% who strongly agreed. The remaining respondents included 8.0% who were neutral, while 7.0% disagreed and 5.0% strongly disagreed. The finding shows that most households experienced an increase in the range of economic activities after gaining improved access to water. The responses also correspond with the earlier results, which showed increased participation in fishing, water sales, livestock keeping, food sales, brick making and irrigated farming.

Improved water availability enabled households to add economic activities that had previously been difficult to undertake. Irrigated farming, food sales, brick making, livestock keeping and water-related activities. The extent of diversification differed among households because access to land, labour, capital and skills was not the same for every family. The views from respondents were further supported by an interview with a key informant. A Village Executive Officer and CBWSO member explained the same:

The project has helped households to add activities that were difficult before because water was not reliable. Some families are now doing irrigation, livestock keeping, food selling and brick making alongside their other activities. The change is not the same for every household because families have different resources, but the range of activities has increased (Interview with Matemela Village Executive Officer and Edmund Mpandaloni member of CBWSO, 23 July 2026).

Economic activities among households were not limited to a single source of livelihood. Some households combined farming with livestock keeping, while others combined these activities with food sales, brick making, or small water-related businesses. This situation

showed a visible expansion in the ways households obtained income following improved water availability.

Mgonja and Massawe (2024) reported that community-based water initiatives in Tanzania contributed to household livelihoods and socio-economic activities. Mmasa (2023) also found that water projects were associated with increased livelihood opportunities among communities in Gairo District. The present finding adds to this evidence, with 80.0% of beneficiary households reporting an increase in the number of economic activities after implementation of the Luduga Mawindi Project. The result, together with the increased participation recorded across the six economic activities examined earlier, shows the contribution of the project to the diversification of household economic activities.

3.1.8 Water project and beneficiaries household income

The cultivation of crops and vegetables, livestock keeping, food sales, brick making, water sales and other small economic activities became important sources of income among beneficiary households after improved access to water. Table 4.4 below indicates that 79.0% of respondents agreed that the Luduga Mawindi Water Supply Project increased household income-generating opportunities. This included 44.0% who agreed and 35.0% who strongly agreed. In contrast, 9.0% were neutral, while 7.0% disagreed and 5.0% strongly disagreed. The finding shows that most households experienced increased opportunities to earn income through different economic activities following improved water availability.

Adding experiences from the FGDs, participants in Mawindi and Ipwani wards explained that households used the available project water for different economic activities. These activities included irrigating crops and vegetables, providing water for livestock, preparing food for sale, moulding bricks and conducting other small businesses. Participants also explained that the benefits differed among households because access to land, livestock, capital, labour and skills influenced the type and level of economic activity each household was able to undertake. Participants in the FGD conducted in Mawindi Ward explained:

The water is being used for different activities depending on what each household does. Some households use it for farming and vegetables, while others use it for livestock, food preparation and brick making. Households with enough land, animals, labour or capital are able to use the water for more activities than households with fewer resources (FGD 3, Mawindi Ward, 15 July 2026).

Similar views were expressed by participants in the FGD conducted in Ipwani Ward:

Project water has helped households engage in different activities, including irrigation, livestock keeping, food selling and brick making. However, not every household benefits in

the same way because some have land, livestock and money to invest, while others have limited resources and labour. The type of activity depends on what the household already has (FGD 4, Ipwani Ward, 16 July 2026).

The findings show that improved water availability supported a range of household economic activities, while the extent of benefit differed according to the resources available to individual households. Households combined crop cultivation with livestock keeping, while others combined farming with food sales, brick making, or other small income-generating activities. This situation showed that improved water access supported different forms of household economic engagement, although households did not benefit from the available opportunities in the same way. Theodory and Kitole (2024) reported that improved access to productive resources and livelihood opportunities was associated with household economic improvement in Tanzania. The present finding reflects this relationship, as 79.0% of respondents associated the Luduga Mawindi Water Supply Project with increased income-generating opportunities. The result also corresponds with the earlier findings, which recorded statistically significant increases in income from fishing, water sales, livestock keeping, food sales, brick making and irrigated farming.

Table 4.4: Luduga Mawindi Water Supply Project to Diversification of Household Economic Activities. (n = 100)

Parameters	Frequency (n)	Percent (%)
Project increased the number of household economic activities		
Strongly Agree	38	38.0
Agree	42	42.0
Neutral	8	8.0
Disagree	7	7.0
Strongly Disagree	5	5.0
Total	100	100.0
Project increased household income-generating opportunities		
Strongly Agree	35	35.0
Agree	44	44.0
Neutral	9	9.0
Disagree	7	7.0
Strongly Disagree	5	5.0
Total	100	100.0
Project reduced time spent collecting water for productive activities		
Strongly Agree	40	40.0

Agree	43	43.0
Neutral	7	7.0
Disagree	6	6.0
Strongly Disagree	4	4.0
Total	100	100.0

Source: Field Data (2026)

3.1.4 Water supply Project and time spent collecting water for productive activities

Before the implementation of the Luduga Mawindi Water Supply Project, households travelled longer distances (approximately 2 to 5 km) to rivers, streams, ponds and other water sources and considerable time was spent collecting and carrying water for both domestic and productive purposes. The introduction of nearer project water points reduced the distance that households travelled to obtain water. Table 4.4 above indicates that 83.0% of respondents agreed that the project reduced the time spent collecting water for productive activities. This comprised 43.0% who agreed and 40.0% who strongly agreed. In contrast, 7.0% were neutral, while 6.0% disagreed and 4.0% strongly disagreed. The finding shows that most households experienced a reduction in the time required to obtain water, while the 10.0% who disagreed or strongly disagreed indicate that the reduction was not experienced equally by all households.

Location of water points closer to households reduced the physical burden associated with water collection for many beneficiaries. The movement of people carrying water over long distances was less evident around households with easier access to the project water supply. This situation provided household members with more time to concentrate on their daily productive activities. Aunger et al. (2024) reported that the distance and time required to access water remain important factors influencing household daily activities, particularly in communities where people depend on distant water sources. The finding in this study reflects this relationship, with 83.0% of respondents reporting reduced time spent collecting water for productive activities. The shorter distance to project water points reduced the time and physical effort involved in water collection and gave household members more time for irrigated farming, livestock keeping, food sales, brick making and other productive activities.

5. CONCLUSION AND RECOMMENDATIONS

The study concludes that the Luduga Mawindi Rural Water Supply Project contributed to the diversification of household economic activities among beneficiary households in Mbarali District Council. Improved access to water reduced the time and effort required to obtain

water and enabled households to engage in or strengthen activities such as irrigated farming, livestock keeping, food sales, brick making and water sales. The findings further indicate that improved water availability created additional income-generating opportunities by supporting activities that previously faced difficulties due to inadequate and distant water sources. However, the extent of the contribution varied among households depending on access to land, labour, capital and other productive resources. The reliable rural water supply can contribute to household economic well-being by creating conditions that allow beneficiary households to diversify and strengthen their economic activities. The Mbarali District Council and relevant water authorities should strengthen the reliability and accessibility of the Luduga Mawindi Rural Water Supply Project so that more beneficiary households can consistently use water for productive activities. In particular, efforts should focus on maintaining water infrastructure, ensuring adequate water supply and improving access for households that continue to experience limitations. The Council and agricultural and community development authorities should also support beneficiary households with practical guidance on productive uses of water, particularly irrigation, livestock keeping, food processing and other small-scale activities, while facilitating access to complementary resources such as agricultural inputs and entrepreneurship support. These measures would enable households to make greater use of improved water access and strengthen the project's contribution to diversification of household economic activities and income-generating opportunities.

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