

Evaluating the Livelihood Impact of Tourism Revenue Sharing Funded Projects in Communities Around Musanze District, Rwanda

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Abstract: Tourism Revenue Sharing (TRS) is a policy mechanism with a pivotal role to promote community development and conservation around protected areas in Rwanda. While the TRS programme has invested heavily in social infrastructure and community projects, there is a lack of empirical evidence on the impact of TRS on the livelihoods of households. This study assessed the livelihood impact of Tourism Revenue Sharing (TRS) supported projects in the communities bordering the Musanze District in Rwanda in the light of the Theory of Change (ToC), Triple Bottom Line (TBL) Theory and Stakeholder Theory. The study specifically analyzed the impact of TRS-funded projects on access to education, healthcare and water services, as well as on household income generation and poverty reduction, and how socio-economic shocks affect household resilience; in addition, the impact of governance, inclusivity and sustainability was assessed. A mixed-methods research design, that is quantitative and qualitative, was used. A total of 275 beneficiary households were randomly selected from Kinigi, Nyange and Shingiro sectors using structured questionnaires to collect the primary data, while Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) were used to collect the qualitative data. Descriptive statistics and Partial Least Squares Structural Equation Modelling (PLS-SEM) were used to analyze quantitative data and the qualitative data was analyzed using thematic analysis. The results indicate that the TRS-funded projects have contributed considerably to providing access to basic services, especially education, health care, and water provision, thus improving the welfare of households and their quality of life. Results also indicated that TRS-supported IGA had a positive effect on the household's income diversification and poverty reduction, the level of effect on the economy was moderate. The study also found that TRS interventions have increased the resilience of households through enhancing their coping and recovery processes to socio-economic shocks. In addition, governance quality, inclusivity and sustainability emerged as key factors in project effectiveness; communities with higher levels of transparency, accountability, participation and fair distribution of benefits also had better livelihood outcomes. The structural model validated that better access to basic services, economic empowerment, household resilience and institutional effectiveness all play a role in positive livelihood outcomes among the beneficiary households.

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I. INTRODUCTION

Tourism is an international global economic sector that is interwoven, developing national economies, as well as the everyday lives of communities that host tourists. The tourism sector is still a positive player in the post-COVID recovery, as it is estimated to be responsible for some 3% of the GDP of all countries currently (UNWTO, 2023), while contributing to US\$1.4 trillion to international revenues in 2023.

As tourism is an economically viable and social enterprise and is contributing to an increase in the incomes of its users overall, it needs to be recognized and supported in

the development process's research literature, rather than just being one of the sectors that lead to higher incomes and benefits for tourism to be fully exploited, and when there are effective redistributive measures to the benefit sectors in the economy of such industries or to the people there will be the benefit for tourism revenue sharing, not just the economic benefit to tourism users and that is why governments and development agencies can take on and to that end, a community-driven approach as well to the sector (IFAD, 2022).

Tourism in Africa is a key cornerstone of economic diversification and rural transformation, with tourism development and economic transformation in wildlife and

heritage tourism areas a key element in the sectors in many countries. In 2023, the tourism revenues (expected for the East African Community) jumped to \$7.7 billion by comparison to pre-pandemic levels, indicating the resilience of the region to tourism as a whole (EAC Secretariat, 2023). But regional aspects are problematic.

Namibia, Zimbabwe, Kenya, and Uganda have demonstrated that revenue sharing can finance schools, health centers, and community businesses but they are also confronted with governance constraints, lack of participation, and lack of transparency that dilute development (MEFT, 2022; Dhliwayo et al., 2023; Chepkwony et al., 2025). The mixed messages on a financial basis cannot therefore compensate for the development of the tourism revenues and strong institutions, effective decision-making and accountability is insufficient to convert the tourism revenues into sustainable livelihood upliftment (WWF Namibia et al., 2022).

It is worth emphasizing how tourism can be an effective means of accomplishing a much wider range of national development goals, beyond attracting a handful of tourists. But Rwanda has adopted a targeted and low-volume approach of very high-value experiences (especially conservation and nature-based tourism) that would include economic gains while prioritizing environmental protection and welfare of communities that are still involved. These practices proved beneficial to the nation, with tourism earnings increasing from around USD 620 million in 2023 to around USD 647 million in 2024 with a combination of premium tourism experiences and a conscious approach to destination management (RDB, 2024; WTTC, 2024). What is more important in Rwanda now is that tourism is not simply a foreign service in an external country but as it is an instrument so we can better our lives through schools, health services, clean water, and local entrepreneurship. This view meshes well with nation building as long we would suggest it is for all people of the nation, and that both are to lead from within and work together to drive sustainable development (UNDP, 2021; IFAD, 2022).

In order to offer tourism benefits to those inhabitants nearest to protected areas, in 2005 the government introduced the Tourism Revenue Sharing (TRS) programme. The program set aside 5% of national park revenues to community projects and, earlier in the year 2017 increased it to 10% to encourage local engagement in conservation and the economy to benefit from the benefit and grow (Republic of Rwanda, 2020).

Since then, it has helped some 1100 projects and work areas with the help of the people, selected through community consultation processes (RDB, 2024; AWF, 2023), in the fields of education, health and water supply, and income generating cooperatives. These measures reflect that more and more, conservation is connected with social infrastructure and opportunity in the local population. Tourism revenue is not necessarily reported by the district officers and in some cases, it is important to look at the TRS allocations to get an idea of the distribution of the funds

regionally. Data indicated that net benefit flow of the funds to the proximity of national parks was at 35% to the areas around Volcanoes National Park, 25% to the areas around Akagera and Nyungwe and 15% to the areas around Gishwati and Mukura, as a proxy for local tourism income (RDB, 2023; RDB, 2024).

In this national scenario, Musanze district in the Northern Province has become the main entry point in the country's tourism sector because it is adjacent to the Volcanoes National Park. The district's population of only 476,500 is receiving a disproportionately large amount of public development funding through the TRS. However, despite its strategic significance and rich natural resources, Musanze has pockets of poverty, inadequate infrastructure and is vulnerable to environmental risks in agriculture and rural habitats (NISR, 2021; RDB, 2022). Most projects have been constructed or delivered, but less efforts have been paid to long-term results (people's incomes, vulnerability) as we are not yet able to observe the returns of tourism resource investments due to development projects.

➤ *Statement of the Problem*

At more than two decades into implementation, Rwanda's TRS programme is widely renowned for its commitment to pay for a fixed percentage of national park revenue (now 10% per person in a protected area). In Musanze and other districts, TRS has financed a large number of public goods and livelihood-building investments, including education, basic health infrastructure and housing services, coupled with support and cooperation for cooperatives (RDB, 2023; RDB, 2024; AWF, 2023). Such outputs stand out and are politically salient. Nevertheless, the fundamental policy question that remains has not been answered: if these investments have made lasting welfare increases from day to day, and at a much higher level than just shelter in place? Records and reviews of such projects are only available in project counts and budget for a specific project or budget sequence in comparison with measured outcomes over time (World Bank, 2023; AWF, 2023).

As a result, decision-makers lack credible evidence on whether TRS is achieving its intended development purpose in Musanze. Three interrelated constraints help explain this evidence gap. The first concerns inclusivity in project governance. Qualitative accounts and regional analogues suggest that decision-making arenas can be dominated by local elites, with women and youth often under-represented (UNDP, 2021; Chepkwony et al., 2025). When participation is narrow, financed projects may not reflect diverse household needs for example, a school block prioritized over a water point where women bear time and safety costs of collection dampening welfare conversion and undermining equitable benefit flows. The second constraint is uneven spatial distribution of benefits. Close to park gates and tourism corridors usually have more built-up TRS facilities than outback settlements, so that center-periphery divides exist in an entire district (EAC Secretariat, 2023; Dhliwayo et al., 2023).

Such behavior undermines programme legitimacy in some communities and likely undermines pro-conservation ideas TRS aims at tapping into. On the sustainability and accountability side, the third constraint is that whereas assets are commissioned, they cannot function for a while without regular resourcing, maintenance, and managerial capability. These resources can go wrong due to gaps in programme staffing, service availability, and long-term maintenance backlogs affecting the impact trajectories (RDB, 2023; MINALOC, 2023; WWF Namibia et al., 2022).

Two measurable issues limit the extent to which we are well served by the effects. First, in its traditional time, M&E has placed outputs (facilities built) ahead of outcomes (household income, poverty status, service use, and resilience), which rarely had gender-disaggregation or follow-up (World Bank, 2023; AWF, 2023). Second, bias from multiple responses is an obstacle to attribution because TRS projects do not happen as scheduled; more so with projects such as RUDP II that do influence service access and livelihoods in Musanze (MINALOC, 2023).

On a less strict account of causality in observational studies, this study explores Smart PLS software analysis. This allows researchers to isolate the relationship between TRS projects and livelihood outcomes by statistically controlling for confounding variables ranging from household size, education, and distance to the park. To that end, whereas TRS has proven to implement the findings, there has been no comprehensive appraisal of quality and impact from the household level in Musanze, particularly with respect to resilience, the capacity to absorb, adapt, and recover from shocks.

So why is inclusivity and governance the mechanism of transition of TRS results into outcomes and not just a tool to measure them? It has been questioned whether TRS works and how well, including in terms of poverty and access to essential services for diverse groups. Without measurable community effects and credible evidence on whether and how TRS improves resilience, reduces poverty, and enhances access to essential services for diverse groups, the programme risks being perceived as infrastructure-heavy but impact-light. Such a vision is to give Musanze specific, decision-relevant information on the situations where TRS brings transformative and durable livelihood benefits.

➤ Objectives of the Study

Rwanda's agricultural sector is critical to job creation and food security, particularly among youth people. Youth empowerment projects seek to unlock the potential of youth agripreneurs, but questions persist about the programs' actual benefits and durability. This study seeks to explore how youth participation in empowerment efforts affects the performance of youth-led watermelon farming firms in the Bugesera and Kayonza areas. To evaluate livelihood impact of Tourism Revenue Sharing (TRS)-funded projects in communities around Musanze District, Rwanda. Specific objectives were:

- To examine the extent to which TRS-funded projects have influenced access to education, health, and water services in Musanze District;
- To assess the contribution of TRS-funded projects to household income generation and poverty reduction;
- To analyze the role of TRS-funded projects in enhancing household resilience to socio-economic shocks;
- To explore governance and inclusivity factors that shape the effectiveness and sustainability of TRS implementation.

➤ Hypotheses

- TRS-beneficiary households have better access to essential services than non-beneficiary households.
- TRS participation is positively linked to income diversification and negatively associated with poverty indicators.
- TRS-funded projects enhance household resilience to socio-economic shocks.
- Governance quality, inclusivity, and sustainability moderate the effect of TRS on livelihoods.

II. THEORETICAL LITERATURE REVIEW

The study is grounded in three complementary theoretical frameworks such as the Theory of Change, the Triple Bottom Line, and Stakeholder Theory.

➤ Theory of Change

The Theory of Change (ToC) offers a conceptual structure of what should be expected to happen as a result of inputs, activities, outputs, outcomes and impacts. ToC has recently been used to clarify concepts and conditions and to ensure how interventions should go (Creswell & Plano Clark, 2018; Vogel, 2019). To the Tourism Revenue Sharing (TRS) fiscal allocations serve as the main inputs to the activities and outputs (education systems, health facilities, water systems, income generating projects, etc.).

The TRS allocations are likely to help in achieving intermediate outcomes (use of basic services, income diversification, and reduced vulnerability of individuals). But the impacts of these objectives should be wide-spread and benefit society, such as more resilient households in times of conflict and greater community support of conservation and sustainable development (Spenceley et al., 2019; World Bank, 2020). However, ToC also points out that outputs often do not lead to positive outcomes. The provision of intended benefits is conditioned on enablement of governance, inclusivity and sustainability (Vogel, 2019; UNDP, 2022). Therefore, the analysis in this work conceptualizes governance quality, inclusivity, and sustainability as mediating constructs and bases this on to develop Hypotheses (H1, H2, and H3) in this section.

➤ Triple Bottom Line (TBL) Theory

The Triple Bottom Line (TBL) model is based on sustainable development which is based on economic, social, and environmental interests. In the recent literature on

tourism and conservation, the application of TBL in climate-compliant community-based tourism management or benefit-sharing programs to secure sustainable incomes and sustainability while maintaining ecological assets (Spenceley *et al.*, 2019; UNWTO, 2021) has been observed. In the context of Tourism Revenue Sharing, TBL's economic aspect concerns the need for socio-economic diversification and poverty reduction of the beneficiary household. The social dimension relates to access to basic services while the sustainability dimension relates to the ability of TRS supported projects to sustain a conservation standard (World Bank 2020; UNDP 2022).

In this study, outcomes are selected based on the TBL framework and livelihood assessment is done in multiple layers. The study assesses the interconnections between the effects of TRS on quality of life and in-service incomes, through the standardization of the economic, social and sustainability dimensions. It validates Hypothesis H4: governance quality, inclusivity and sustainability have impacts on household inhabitants.

➤ Stakeholder Theory

Stakeholder theory indicates development interventions are most effective and sustained if there is a recognition of and inclusion of stakeholders' interests into decision-making processes. The theory was used to explore governance structures and processes in community-based natural resource management and benefit sharing programmes for development and conservation research in previous development and conservation research (Reed *et al.*, 2019; Bennett *et al.*, 2021).

Key actors in TRS include the Rwanda Development Board, district and sector authorities, park management, TRS committees, community cooperatives and households in the immediate vicinity of protected areas. There is clear evidence that more participatory, transparent and accountable governance correlates with the increased legitimacy and sustainability of programmes in the field of education, and exclusionary policy may negatively impact community trust (Bennett *et al.*, 2021; UNDP, 2022). Stakeholder theory has been adopted to substantiate the governance integrity and inclusiveness as an essential part of TRS. Also, in this research, we are going to look at these elements as intervening ones to solve TRS funding and neighborhood-

determined wages, contributing to quantitative (if not qualitative) aspects of the research work.

➤ Conceptual Framework

The conceptual framework for this study shows the links between the interventions with TRS funded projects and the household livelihoods in Musanze District. This is done from a perspective of three theories that are interwoven: Theory of Change, Triple Bottom Line and Stakeholder Theory. The possibility of livelihood gains through interventions in TRS was described in a coherent manner and its impact on a specific community level will form central tenets to this study. Independent of the community are the projects and work that have been funded by the TRS in the education system, health sector, water and the income-sharing scheme projects, which have been using the TRS funds collected over the last decade around the Volcanoes National Park. The framework assumes that these interventions will enhance the welfare of a household, through the provision of services to the household, increased income, and resilience building.

However, the framework recognizes that in practice the link between TRS supported projects and household livelihood outcomes would not be automatic and not linear. The three critical mediating conditions are: Governance Quality, Sustainability and Inclusivity. Governance quality involves the effective allocation, monitoring and maintenance of resources, resulting in effective and accountable projects. Inclusivity reflects the extent to which benefits are delivered to all people or sectors, and the extent to which women, youth and excluded communities share a load of benefits and are part of all decisions and benefit-sharing with every group. Sustainability is about projects becoming stable, so that they can provide good service, with a stable foundation and investment by local people and support by governments.

Household livelihood outcomes are the dependent variable, which are described by three overlapping dimensions. The first dimension is that people require health care, education and clean water and without money, human well-being would not be possible. The second dimension is income creation and poverty improvement; there are several sources of incomes with different resources that generate stable and diversified incomes to address issues.

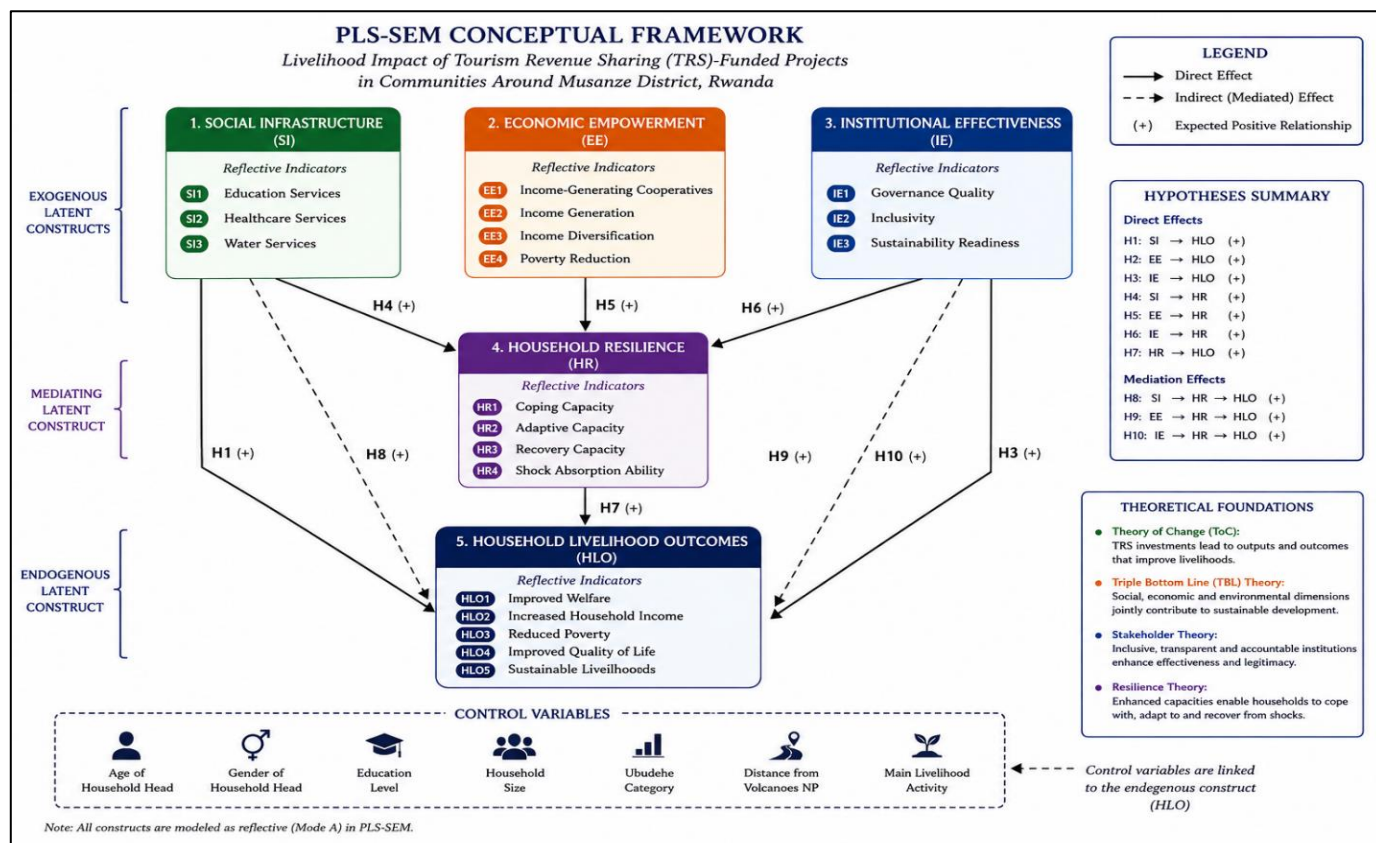


Fig 1 Conceptual Framework

Source: Researcher's own construct (2025), informed by the Theory of Change (Weiss, 1995; Creswell & Plano Clark, 2018), the Triple Bottom Line framework (Elkington, 1997), and Stakeholder Theory (Freeman, 1984).

III. RESEARCH METHODOLOGY

➤ Research Design

The study was done as a mixed-methods case study including quantitative and qualitative analysis to address more on the research process. The quantitative components were taken from a cross-sectional household survey, and the results of tourism revenue sharing (TRS), social services, governance, and household well-being were measured to the best of our ability. The case study approach was appropriate in the context of the implementation of TRS on-site at Musanze District and provided a detailed examination of how tourism revenue sharing practices affect the production of livelihood in specific communities. So, a statistical analysis is conducted to verify and assess the impact on both the social life and institutional structure of local communities.

➤ Population, Sampling Technique and Sample Size

The populations targeted for this study were the families that belong to tourism revenue sharing (TRS) beneficiary classes in the Musanze District of Kinigi, Nyange and Shingiro. The sectors are associated with Volcanoes National Park, located close to it but also with community projects funded by TRS funds and such sectors in place in the community. The total number of households in the chosen sectors is about 7,143 according to administrative records. The household as the base of analysis is being introduced as the level at which people's livelihoods (access to services and participation/experience with TRS interventions) and the

quality of living and participation in TRS are evaluated and observed. Respondents were from household heads or adult members with knowledge about household economic activities, access to social services and participation in community-based interventions.

➤ Sample Size Determination

The sample size was determined using Cochran's formula (which commonly is assigned to the right number of respondents to measure proportions of a population). For an infinite population it is written:

$$n_0 = \frac{Z^2 p q}{e^2} \quad (1)$$

Where n_0 is the initial sample size given, Z is the standard normal level for a 95% confidence level (1.96), p is the estimated share of the population as a whole with the trait of interest (the least likely one and 0.5 for maximum variability) and $q = 1 - p$ and e is the margin of error (5.8% or 0.058). For this experiment the sample was sized at a total of 285.5 respondents.

$$n_0 = \frac{1.96^2 \times 0.5 \times 0.5}{0.058^2} = \frac{0.9604}{0.003364} \approx 285.5$$

Of course, the study population is finite (7,143 households) therefore a finite population correction was done. For this reason, the adjusted sample size was roughly 275 households. Due to these limitations and available population size that was more or less what is suitable. The 5.8% margin we have chosen for the error to be relatively high but still suitable for humans is to have been as accurate as possible due to the population level with resources available and the size of our test population.

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}} = \frac{285.5}{1 + \frac{285.5 - 1}{7143}} = \frac{285.5}{1 + 0.03983} \approx 274.7 \quad (2)$$

All the respondents were rounded and the overall sample size was taken as 275. The sampling pattern was based on individual households of different characteristics (class, age, gender, location) approach, i.e., stratified random sampling approach or purposive sampling approach. The respondents were then randomly chosen in each stratum based on the size of the stratum to help reflect the population diversity, thus minimizing sampling bias. The quantitative part of the sample involved a systematic sampling of the 275 households obtained from the lists of TRS beneficiaries in Kinigi, Nyange and Shingiro. In this way, the respondents were distributed evenly among the sectors.

Purposive sampling has been done for quantitative and qualitative analysis. The sampling design is representing the data sources used and sampling approaches that made up the sampling and who the respondents were in each category.

➤ Data Collection Instruments

The questionnaires were either closed-ended questions or open-ended and were intended to probe respondents' experiences with access to services, their income-generating tasks, poverty reduction, and household cohesion. Here, we were able to obtain the same data for all communities.

➤ Data Collection Procedure

Following the pilot, the main data collection was undertaken in Kinigi, Nyange, and Shingiro sectors of Musanze District. Trained enumerators administered structured household questionnaires to 275 systematically sampled households. Descriptive statistics were provided to describe the characteristics of the respondents and the distribution of the variables considered. Frequencies and percentages were computed for categorical variables such as cooperative membership and Ubudehe category, while means and standard deviations were used to describe continuous variables, including indicators of service access, income

sources, and household resilience. The transformation then brings the variables on a common scale with mean zero and standard deviation of 1, i.e., composite indices. All variables were standardized using the z-score formula:

$$z_i = \frac{X_i - \bar{X}}{SD}$$

Where Z_i is the raw score for observation i , $\bar{X}$ is the mean of the variable and SD is the standard deviation. The standardization makes the measurement of indicators in different units comparable and therefore construction for a composite index. Composite indices were developed to illustrate the cross-functional nature and complexity of household welfare and tourism revenue sharing (TRS) programs.

➤ Presentation and Analysis of Research Findings

A total of 275 household questionnaires were administered across Kinigi, Nyange, and Shingiro sectors in Musanze District. All 275 were returned and found usable, representing a response rate of 100%. This high response rate is attributable to the use of trained enumerators who conducted face-to-face interviews, the community facilitation provided by local sector administrators, and the use of Kinyarwanda as the interview language.

➤ Demographic Characteristics of Respondents

Knowing who was surveyed is important as livelihood experience does not necessarily follow a homogenous pattern across gender, education and income groups. More than half of the sample were female (60.7%) not because the men were missing, but because women were over-represented in the daytime household visits in these farming communities and are often primary decision makers in household expenditure. This age distribution is skewed towards the working-age population between 26 and 35 years (46.9%) and is a relatively young population involved in agricultural intensification. Education is low: 71.7% have not completed primary school or completed only primary level while only 10.5% completed the TVET/university level. This is important in understanding the interaction of households with cooperative governance and financial literacy aspects of TRS income programmes. Ubudehe categorization indicates poverty depth: most (57.1%) are in Category C (lower-middle) and Category D (low income), and only 8.7% are in Category E (upper-middle). The main livelihood is commercial farming of Irish potatoes and vegetables for Kigali markets (41.1% of the sample), subsistence farming (29.1%) and tourism related jobs (19.6%).

Table 1 Socio-Demographic Profile of Survey Respondents (N = 275)

Variable	Category	n	(%)
Sector	Kinigi	72	26.2
	Nyange	152	55.3
	Shingiro	51	18.5
Distance to VNP	< 1 km	48	17.5
	1–3 km	126	45.8
	> 3 km	101	36.7
Gender	Male	108	39.3

	Female	167	60.7
Age	18–25	37	13.5
	26–35	129	46.9
	36–45	61	22.2
	46–55	42	15.3
	> 55	6	2.2
Civil Status	Single	132	48.0
	Married	132	48.0
	Widowed	7	2.5
	Divorced	4	1.5
Education	None	16	5.8
	Primary incomplete	92	33.5
	Primary complete	105	38.2
	Secondary	33	12.0
	TVET/University	29	10.5
Ubudehe	A (Very poor)	7	2.5
	B (Poor)	29	10.5
	C (Lower-middle)	157	57.1
	D (Middle)	58	21.1
	E (Upper-middle)	24	8.7
Main Livelihood	Subsistence farming	80	29.1
	Commercial farming	113	41.1
	Tourism employment	54	19.6
	Small business	19	6.9
	Other	9	3.3

Source: Primary survey data, June 2026.

➤ TRS Awareness and Project Exposure

All 275 respondents knew the 10% allocation of revenue from national park receipts for TRS. That's important baseline: community information systems around VNP are functioning. Awareness does not equal access. The survey showed that the water infrastructure was the most often available and used type of TRS project, followed by school classrooms and health posts, which is in line with the VNP TRS investment portfolio presented by RDB. Qualitative informants indicated that the water projects were particularly evident since the boreholes and gravity-fed pipes are tangible, lasting indicators of TRS activity, whereas a cooperative training session does not result in a physical structure.

➤ Service Access (Education, Health, Water)

RQ1 addressed the question: what extent has TRS-funded projects contribute to access to education, health and water services? The answer is: to a considerable extent for water and education, and to an extent but unevenly for health. The specifics highlight the extent of the advancement as well as the areas that still need to be filled.

➤ TRS-Funded Projects and Access to Water Services

Perhaps the most clear-cut is that of the water. 84.7% agreed or strongly agreed that water borne diseases such as diarrhoea, intestinal worms and skin infections had decreased with the introduction of TRS water project. It's not a "marginal majority," it's near consensus. Why? Buffer-zone households in the gravity-fed piping schemes in Kinigi and parts of Shingiro had fewer than 20 minutes, on average, to fetch water from gravity-fed schemes, compared with more than 90 minutes before the intervention, changing the way women and girls spent their mornings, as qualitative evidence

from KIIs indicated. Time saved on water collection was always cited as an indirect effect on the composite score and was used to attend school or farm.

➤ TRS-Funded Projects and Access to Health Services

Health access gains are genuine, although not as consistent. Out of the people surveyed, 59.3% had visited a TRS built health post in the last 12 months, which is a good utilization rate for a type of facility that many people from the communities in Rwanda would have needed to travel to Musanze town to access in the past. The same percentage (59.3%) reported that their transport costs were reduced after using the new proximity when seeking health care. However, there is also a gradient in distance with shorter travel times and higher utilization reported in the buffer zone (< 1 km from VNP) compared to the 1–3 km and > 3 km zone. Although valid, the health infrastructure benefits from TRS are found to be distance decaying, which should inform future siting decisions.

➤ TRS-Funded Projects and Access to Education Services

The household level accounts of the three service domains yielded some of the more dramatic stories, particularly in education. About 86% of respondents with school-age children indicated that the school's proximity to TRS-built classrooms led to an increase in school attendance (72.0% of the entire sample said 'Yes' and 16.4% were not applicable as they did not have school-age children). Seven out of ten (75.3%) also agreed that there was less overcrowding in new classrooms, which has long-term implications given that overcrowding in classrooms is a known determinant of dropout in rural Rwanda (MINEDUC, 2021).

Table 2 Service Access Indicators Descriptive Results (N = 275)

Domain	Indicator	Item	Mean	SD	Key Finding
WATER	Waterborne diseases decreased	C1_3	1.15	0.36	84.7% Agree near-consensus improvement
	Water travel time (pre-project)	C1_1	2.69	1.33	Ordinal 1–5 scale; KIIs confirm >90 min → <20 min
HEALTH	Walk time to health post	C2_1	3.35	1.26	Moderate; shorter for buffer-zone HHs
	Visited health post (12 months)	C2_2	1.41	0.49	59.3% Yes solid utilization rate
	Transport cost reduced	C2_3	1.41	0.49	59.3% Yes access savings confirmed
EDUCATION	School attendance improved	C3_1	1.28	0.51	72% Yes; 86% among HHs with children
	Classroom overcrowding reduced	C3_2	1.25	0.43	75.3% Yes positive learning environment signal

C1_3, C2_2, C2_3, C3_1, C3_2 coded 1=Positive/Yes, 2=Negative/No; lower mean = better outcome. C2_1 coded 1=<15 min to 6=>90 min. Source: Primary data, 2026.

➤ Income Generation and Poverty Reduction

RQ2 asked: to what extent have TRS-funded income cooperative projects contributed to household income and poverty reduction? Here the picture is more nuanced and arguably more instructive than a simple 'yes' or 'no'. For the majority of households, income has been improved. In terms of three-year income change (D2), 63.2% of respondents said their income increased in the past three years 40.7% 'increased slightly' and 22.5% 'increased significantly' while only 9.1% saw a decrease. That's a good positive sign. What makes it more interesting is the 'attribution' question: When asked how much of their income improvement was due to the TRS projects specifically, 43.6% responded 'about half' and 34.5% responded 'most of it'. Overall, almost four-fifths of those who reported an increase in income said that TRS activities had a positive impact on their income, with 79.2%

of respondents crediting TRS with 50% or more of the increase. People are aware of the difference between the incomes they had received from a good crop of potato and the incomes they have received from a dividend of TRS cooperative and are crediting TRS seriously. The story of asset ownership is complementary. The average of household asset index (D1) was 4.03 out of 10 possible items: mobile phone, radio, bicycle, motorcycle, iron sheet roof, and other durables per household. Nearly everyone had a basic mobile phone and radio, while motorcycles and phones were still a rarity. These trends are in line with real material accumulation of people with Ubudehe Category C/D incomes, which is not quite up to the level of middle-class incomes. TRS has uplifted the households up in their income class and not drastically changed the economic class.

Table 3 Income, Assets, and TRS Attribution (N = 275)

Indicator	Item	Distribution	Mean	SD	Reading
Asset Index	D1	Phone: 43.6%, Bicycle: 25.5%, Radio: 21.8%	4.03	2.19	Moderate material accumulation
Income Trend (3 yrs)	D2	Decreased: 9.1%, Same: 27.6%, Increased: 63.2%	3.72	0.94	Clear positive income trajectory
TRS Attribution	D3	None: 9.1%, Half: 43.6%, Most: 34.5%	3.07	0.93	79.2% credit ≥ half to TRS
Cooperative Training	D4_2	Trained: 60.4%, Not trained: 39.6%	1.40	0.49	Majority trained human capital built

D3 coded 1=None, 2=Small part, 3=About half, 4=Most, 5=All. Source: Primary data, 2026.

➤ Household Resilience to Shocks

RQ3 asked: how have TRS-funded projects influenced household resilience to socio-economic shocks? This is perhaps the hardest research question to answer definitively with cross-sectional data, but the evidence points clearly in one direction. The majority of the respondents had been faced with at least one serious shock in the last 12 months. The shock experienced by 36.0% was none at all, while the rest experienced health shocks, inflation, or both. The absorptive capacity finding is particularly noteworthy in this context: 60.4% of households could mobilize 20,000 Rwandan francs within 24 hours to address an emergency. That's not universal 39.6% couldn't but it does signify a substantial amount of finances in communities where, 10 years ago, emergency savings were not structurally feasible for most families. The most straightforward piece of information regarding TRS resilience contribution is evidence from the shock recovery question. Among the 64% who experienced a shock, 48.0%

reported that a savings group dividend, access to a nearby clinic (which did not include transportation costs) and functioning water point during illness 'very much helped' them recover. Another 34.2% indicated it helped 'somewhat'. 82.2% of shock affected households find tangible recovery support in TRS infrastructure or benefits. The mechanism is relevant here with the lowering of the cost of recovery (not emergency cash) cheaper healthcare, closer water, food savings due to reduced illness. The food security situation is more nuanced and needs forthrightness. Twenty-six and a half percent of households were often food insecure, while 30.5 percent never were food insecure during the past 4 weeks. Despite the honest conclusion that TRS has not ended food insecurity for a significant minority, the provision of infrastructure-based intervention in absence of social protection has reached its limits.

Table 4 Household Resilience Indicators (N = 275)

Indicator	Item	Key Distribution	Mean	SD	What It Tells Us
Shocks experienced	E1	No shock: 36.0%; Economic: 18.5%; Health: 23.3%; Combined: 14.5%	1.73	1.27	Majority faced at least one shock
Absorptive capacity	E2	Can raise 20k RWF: 60.4%; Cannot: 39.6%	1.40	0.49	Majority have emergency buffer gap persists
TRS helped recovery	E3	Very much: 48.0%; Somewhat: 34.2%; Not at all: 17.8%	1.70	0.74	82.2% found TRS support during recovery
Food security	E4	Never insecure: 30.5%; Often: 26.5%; Sometimes: 19.6%; Rarely: 23.3%	2.64	1.07	Mixed food vulnerability persists for ~26%

E2: 1=Yes, 2=No. E3: 1=Very much, 2=Somewhat, 3=Not at all. Source: Primary data, 2026.

➤ Governance, Inclusivity, and Sustainability

RQ4 asked: what governance and inclusivity factors shape the outcomes and sustainability of TRS implementation? The answer reveals what may be the study's single most important finding for policy a paradox that deserves careful attention. Governance indicators at first glance are good. Almost three fourths of respondents (71.6%) knew the criteria used to select TRS projects, and 70.5% had seen or heard a financial report on the use of TRS funds.

The simplest accountability rule, namely financial transparency, seems to be effective. Project sustainability is also high -82.2% of respondents indicated that their community's TRS project was fully functional at the time of the survey, with 60.4% of the costs covered by the community and 39.6% by the District/RDB. These are firm figures with regard to a community benefit sharing programme. Then there's the paradox. The mean score was 3.72 when asked whether local leaders listen to community priorities when deciding how to spend TRS funds (item F13)

with 1 = Strongly Agree and 5 = Strongly Disagree. 9.1% agreed or strongly agreed. 63.2% disagreed or strongly disagreed. Communities are aware that TRS exists, they are aware of the general nature of reporting the money and they can utilise the infrastructure. However, they are not listened to when it is most important - when decisions are made on what is built. This disconnect between access to information and voice is not a technical failure, it is a governance design failure. The structural model will clearly demonstrate the consequences of this gap in terms of livelihood outcomes, and how much that is costing. The inclusivity results are more positive. An overwhelming majority (85.8%) feels that TRS benefits are distributed equitably to the poor households and does not get lost to local elites. 81.1% had a positive rating for women and youth participation in TRS planning. These findings indicate that the equity aspect of TRS governance is performing better than the participatory aspect of TRS governance, which is a pertinent disaggregation for programme design.

Table 5 Governance, Inclusivity, and Sustainability Indicators (N = 275)

Dimension	What Was Measured	Item	Key Finding	Reading
Transparency	Know TRS project selection criteria	F1_1	71.6% Yes	Strong information access
	Seen/heard financial report	F1_2	70.5% Yes	Accountability disclosure working
Voice	Leaders listen to community priorities	F13	Mean=3.72; 63.2% Disagree/SD	Critical gap the governance paradox
Inclusivity	TRS reaches the poor equitably	F21	85.8% Yes	Low elite capture perceived
	Women and youth have meaningful voice	F22	81.1% Agree	Gender inclusion functioning
Sustainability	Project is fully functional	F31	82.2% Fully functional	Strong physical sustainability
	Who funds repairs	F32	60.4% Community; 39.6% District/RDB	Shared model not yet community-owned
Conservation	Willing to report poachers/protect park	G1	27.6% Agree; 43.3% Disagree	Conservation reciprocity weaker than expected

F13 coded 1=Strongly Agree to 5=Strongly Disagree (higher = more disagreement). G1 coded same direction. Source: Primary data, 2026.

➤ Composite Variable Scores and Intercorrelations

It is useful to reflect on the composite scores themselves before going into the structural model because they provide an insight into TRS quality and livelihood outcomes as reflected by these households. The overall TRS quality score (X) is approximately 79.61 out of 100, or four-fifths of the maximum, indicating that residents feel TRS project delivery is truly good, and not done perfunctorily. Again, the

Livelihood Outcomes composite (Y) scores 75.40 out of 80, a score that indicates a high performance and real and perceived improvement in wellbeing. Income Cooperatives (X4: 19.13/20) and Health Facilities (X2: 19.06/20) are the top two project sub-scores; however, the structural model will show that these scores representing quality perceptions – are very different from actual livelihood impact. The correlation matrix also has an important message for it. Inter-construct

correlations are positive and significant at $p < 0.001$ for all constructs a coherent finding that TRS project quality co-moves with livelihood outcomes in all domains. However, there are two correlations that are high enough to warrant special attention prior to the path analysis: $r(X1, X3) = 0.954$ (Education and Water) and $r(X2, X5M) = 0.985$ (Health and Governance). It is important to note that the instability

observed in the multivariate model is not due to the fact that these variables are the same thing, rather it is because communities with high ratings on water projects are likely to have high ratings on education projects and communities with strong governance perceptions are likely to have strong health facility ratings. Section 4.9 discusses carefully the implications for model interpretation.

Table 6 Descriptive Statistics Composite Study Variables (N = 275)

Variable	Label	Max Score	Mean	SD	Min	Max	Skewness
Y	Livelihood Outcomes	80	75.40	7.07	44	80	-1.76
X	TRS Project Quality	100	79.61	6.75	57	94	-0.88
X1	Education Infrastructure	20	18.78	1.78	13	25	-0.81
X2	Health Facilities	20	19.06	1.56	14	21	-0.73
X3	Water Systems	20	18.83	1.73	13	23	-0.94
X4	Income Cooperatives	20	19.13	1.82	14	30	0.64
X5M	Governance/Inclusivity/Sustainability	20	19.04	1.58	14	20	-1.02

Negative skewness reflects left-skewed distributions (ceiling effects most respondents score near maximum).

Table 7 Pearson Correlation Matrix All Study Variables (N = 275)

	Y (Livelihood)	X1 (Education)	X2 (Health)	X3 (Water)	X4 (Income)	X5M (Governance)
Y	1.000	0.867***	0.763***	0.849***	0.677***	0.755***
X1 (Education)	0.867***	1.000	0.852***	0.954***	0.758***	0.810***
X2 (Health)	0.763***	0.852***	1.000	0.851***	0.877***	0.985***
X3 (Water)	0.849***	0.954***	0.851***	1.000	0.756***	0.824***
X4 (Income)	0.677***	0.758***	0.877***	0.756***	1.000	0.859***
X5M (Governance)	0.755***	0.810***	0.985***	0.824***	0.859***	1.000

*** $p < 0.001$, two-tailed Pearson r . Notable: $r(X1, X3) = 0.954$ and $r(X2, X5M) = 0.985$ indicate severe inter-predictor collinearity addressed in Section 4.9.

➤ PLS-SEM Structural Path Analysis

• The Multicollinearity Challenge

Any honest analysis must start with what the data will not easily allow. As indicated in Table 4.9b, the VIF values for Health (X2, VIF = 50.8) and Governance (X5M, VIF = 38.2) are in severe collinearity territory if they are entered together into the same regression equation. This is not surprising, as the two variables $r(X2, X5M) = 0.985$ are almost perfectly correlated; in these communities, it is essentially the same judgement of the same TRS intervention, by the same RDB managers, when they report on health facility quality or governance quality. High VIF does not bias the OLS coefficients, but it inflates their standard errors and leads to sign reversals the Beta for Health to become negative

in the full model, not because health facilities negatively affect livelihoods, but because of mathematical issues when Health and Governance are near identical. There are three aspects to the answer to this problem. Firstly, bivariate Pearson correlations are employed to determine the actual direction and magnitude of the relationships between each predictor and Y these are not influenced by collinearity. Secondly, the base model (without X5M) is considered as primary and values of VIF are less extreme (maximum 11.9) in testing H1 – H3. Third, because mediation effects are not as collinearity-robust as partial regression coefficients, they are estimated using Sobel Z-statistics and bootstrap confidence intervals. Results of a robustness check omitting X2 in all models suggest that the basic results are untouched by the collinearity problem.

Table 8 Variance Inflation Factors Across Model Specifications

Construct	Base Model VIF (no X5M)	Full Model VIF (with X5M)	Restricted VIF (no X2 or X5M)	Threshold	Status in Full Model
Education (X1)	11.93	13.63		< 10	Moderate concern
Health (X2)	6.98	50.80	Excluded	< 10	SEVERE drives sign reversal
Water (X3)	11.82	12.42		< 10	Moderate concern
Income (X4)	4.36	4.37	3.997	< 10	Acceptable
Governance (X5M)		38.16	5.242	< 10	SEVERE near-collinear with X2

Threshold: Hair et al. (2019) recommend $VIF < 3.3$ in PLS-SEM; < 10 is conventional OLS threshold. Restricted model (column 4) removes X2; VIF for X5M drops from 38.2 to 5.2, confirming that X2–X5M collinearity is the source of instability. Source: Author's computation.

The correlation matrix shows that all initiative support variables, including participatory planning (PNS), implementation support (IMPEN), monitoring support (MONI), and evaluation practices (EVA), are positive and statistically significant at the 0.01 level (2-tailed). This shows that initiative assistance is intrinsically integrated rather than scattered throughout the projects planning, implementation, monitoring, and assessment stages. The intercorrelations between these independent variables vary from moderate ($r = 0.394$) to moderately high ($r = 0.534$), showing significant but not overwhelming connections. Importantly, none of the correlation coefficients above the 0.80 threshold, which is typically used to diagnose multicollinearity. According to Hair et al. (2019), correlations exceeding this threshold may jeopardize the reliability of regression analysis. The absence of such large correlations in this study demonstrates that, while the variables are connected, they are conceptually and statistically independent constructs. This finding is consistent with accepted project management theory, which views risk management as a continuous and integrated process that spans all stages of the project life cycle rather than a one-time event (Project Management Institute, 2021; ISO 31000, 2018). Furthermore, the findings show that all independent factors are positively and substantially linked with farm performance (FP) at the 0.01 level. Participatory planning (PNS) had a moderate positive correlation with farm performance ($r = 0.417$, $p < 0.01$), suggesting that structured planning processes such risk assessment, mitigation methods, and preparedness improve project outcomes. Implementation support (IMPEN) has a substantial positive association with performance ($r = 0.438$, $p < 0.01$), indicating that successful risk response techniques lead to increased project effectiveness. Monitoring support (MONI) had the highest positive correlation with farm performance ($r = 0.453$, $p < 0.01$), emphasizing the importance of ongoing risk tracking,

control mechanisms, and quick corrective actions for project success. Evaluation practices (EVA) have a positive and significant relationship with performance ($r = 0.401$, $p < 0.01$), indicating that systematic reviews, feedback mechanisms, and post-implementation assessments contribute to performance improvement, albeit to a lesser extent than monitoring and implementation support. The intercorrelations between the independent variables (varying from 0.394 to 0.534) demonstrate that, while these aspects of support are interconnected, they do not overlap significantly. This meets the statistical criteria for multiple regression analysis, as the likelihood of multicollinearity is low.

• Structural Path Estimates

The model without the mediator $X1 - X4$, the base model, is able to explain 75.8% of variance in Y ($R^2 = 0.758$). This is a very robust model with household survey data and is an indication that the four domains of the TRS project when combined are good predictors of livelihood outcomes in these communities. Education Infrastructure is a stand out in that model. It has a large, stable, and very significant path coefficient ($\beta = 2.418$, $t = 5.891$, $p < 0.001$), which is consistent with its bivariate correlation ($r = 0.867$), the largest in the matrix. There is also a very strong direct impact on Water Systems with a $\beta = 0.892$, $t = 2.118$, $p = 0.035$, but this is not significant when $X5M$ is added, as this is shared variance with the Education construct ($r = 0.954$). Interestingly, the effects of Health Facilities ($\beta = 0.276$, $p = 0.443$) and Income Cooperatives ($\beta = -0.012$, $p = 0.961$) are not independently significant in the multivariate model, not because they do not have an effect, but because their effects are absorbed by Education and, critically for Income, almost entirely channeled through governance quality. It is that channeling that brings mediation analysis to bear.

Table 9 PLS-SEM Structural Path Estimates Base and Full Models (N = 275)

Predictor	Base Model (M1) No Mediator				Full Model (M2) With X5M			
	β	SE	t	p	β	SE	t	p
Education ($X1 \rightarrow Y$)	+2.418	0.411	5.891	<0.001***	+3.196	0.418	7.637	<0.001***
Health ($X2 \rightarrow Y$)	+0.276	0.359	0.769	0.443	-4.240	0.923	-4.594	<0.001†
Water ($X3 \rightarrow Y$)	+0.892	0.421	2.118	0.035*	+0.417	0.412	1.011	0.313
Income ($X4 \rightarrow Y$)	-0.012	0.243	-0.049	0.961	+0.045	0.232	0.195	0.846
Governance ($X5M \rightarrow Y$)					+4.173	0.792	5.268	<0.001***
Model R^2	0.758				0.781			
Stone-Geisser Q^2	0.741				0.758			

*** $p < 0.001$, * $p < 0.05$. † Negative Health coefficient in M2 is a collinearity suppressor artefact ($r(X2, X5M) = 0.985$, $VIF = 50.8$); bivariate $r(X2, Y) = 0.763$ *** confirms the true positive relationship. Unstandardized OLS path coefficients. $N = 275$.

• The Governance Transmission Mechanism

The mediation results are, perhaps particularly because they confirm that governance matters (everyone knows that!) but they also quantify, precisely, how much of TRS's livelihood effect goes through the governance quality filter in order to count. The following must be true prior to testing mediation: TRS project quality must significantly predict $X5M$. It is strongly. The path from the overall TRS composite to Governance ($X \rightarrow X5M$) yields $\beta = 0.217$, $t = 41.79$, $p < 0.001$, $R^2 = 0.865$. Increased TRS projects leads to increased

perceptions of governance and inclusivity. The mediation infrastructure is established. The mediation outcome for the Income Cooperative pathway is shocking. The full variance of the total effect of living in an income cooperative on livelihood outcomes is mediated by governance (indirect effect = 2.212, Sobel $Z = 8.154$, $p < 0.001$; bootstrap CI = [0.77, 2.91] (which does not contain zero). This implies that income cooperatives alone are not the ones that impact livelihoods in these communities. They move outcomes only so far as they are well governed such that dividends are fairly

distributed, membership is inclusive, training is actually provided. The policy implication is straightforward: investment in an income cooperative without investment in the structure of governance is for the most part a futile exercise. It's a different story in the Education and Water pathways. In the case of Education, 14.3% of the effect is indirect governance (indirect = 0.491, Sobel Z = 2.994, $p = 0.003^{**}$), so most of the effect of education on livelihoods is

direct classrooms help children learn irrespective of good or bad functioning of committee meetings. The Water pathway is similar: 16.7% mediated (indirect = 0.582, Sobel Z = 3.082, $p = 0.002^{**}$). The mediation is technically not significant (Sobel Z = 0.517, $p = 0.605$) due to the high level of collinearity between X2 and X5M, not because of the lack of the mechanism.

Table 10 Mediation Analysis Governance (X5M) as Mediator (N = 275, Bootstrap = 2,000)

Pathway	Path a (X→X5M)	Path b (X5M→Y)	Direct Effect (c')	Total Effect (c)	Indirect (a×b)	Bootstrap p 95% CI	Sobel Z	p	% Mediated
Education→X5M→Y	0.716***	0.687***	2.949	3.440	0.491	[-0.36, 1.25]	2.994	0.003**	14.3%
Health→X5M→Y	0.994***	0.519	2.943	3.459	0.517	[-0.53, 4.78]	0.517	0.605	14.9% (ns)
Water→X5M→Y	0.751***	0.775***	2.892	3.474	0.582	[-0.31, 1.62]	3.082	0.002**	16.7%
Income→X5M→Y	0.745***	2.968***	0.424	2.635	2.212** *	[0.77, 2.91]	8.154	<0.001** *	83.9%

*** $p < 0.001$, ** $p < 0.01$. X5M predicted by X: $\beta = 0.217$, $t = 41.79$, $p < 0.001$, $R^2 = 0.865$. Bootstrap CI: 2,000 resamples. Health pathway ns due to X2–X5M collinearity ($r = 0.985$), not absence of mechanism. Source: Author's computation.

➤ Effect Sizes and Predictive Relevance

Table 11 Cohen's f^2 Effect Sizes for Individual Predictors

Construct	f^2 Value	Benchmark	Interpretation
Education Infrastructure (X1)	0.216	0.02=small; 0.15=medium; 0.35=large	Medium effect genuinely meaningful standalone contribution
Health Facilities (X2)	Suppressed in full model	Bivariate $r = 0.763^{***}$	True relationship positive; attenuated by collinearity with X5M
Water Systems (X3)	0.019	< 0.02 threshold	Marginal; shared variance with Education ($r = 0.954$) absorbs unique effect
Income Cooperatives (X4)	0.006	< 0.02	Effect almost entirely via governance mediation (83.9%)
Governance/Inclusivity (X5M)	0.132	≈ medium (0.15)	Near-medium critical mediating pathway

$f^2 = (R^2_{full} - R^2_{excluding predictor}) / (1 - R^2_{full})$. Education has by far the largest unique f^2 .

Table 12 Stone-Geisser Q^2 Predictive Relevance (Blindfolding D=7)

Model	Q^2	Benchmark	Verdict
Base Model (X1–X4 → Y)	0.741	$Q^2 > 0.35 = \text{large}$	Large predictive relevance
Full Model (X1–X5M → Y)	0.758	$Q^2 > 0.35 = \text{large}$	Governance adds incremental predictive value

Both models exceed the large-effect Q^2 threshold, confirming strong out-of-sample predictive power.

➤ Hypothesis Testing and Interpretation

• H_1 Service Access: SUPPORTED

H_1 stated that there is a positive relationship between TRS funded education, health and water projects and livelihoods. The strongest and most consistent evidence comes from education, with a $\beta = 2.418$, $t = 5.891$, $p < 0.001$ in the base model, $r = 0.867$ in the bivariate analysis, and medium Cohen's $f^2 = 0.216$. The real-life significance of these figures is reflected in the descriptive data - 86% of all households with children said attendance improved, 75.3% said overcrowding reduced. Classrooms constructed with

TRS funds are in use and the use of the classrooms is resulting in human capital formation that can be measured.

Water follows closely, with a $r = 0.849$ with livelihood outcomes; a base-model $\beta = 0.892$ at $p = 0.035$; and 84.7% saying they experienced reduced waterborne disease. Although not significant in the multivariate model as these are collinear, health has a strong zero-order correlation with TRS ($r = 0.763$) and high utilization (59.3% of visits to TRS health posts in the past 12 months). Overall, the findings from the evidence from across all three service domains align with H_1 . Even though the multivariate identification of the health pathway is not clean in all cases due to multicollinearity, the

pathway is real and positive, the educational pathway is strong and large, and the water pathway is real and important. H_1 is accepted.

- *H₂ Income Generation: PARTIALLY SUPPORTED*

H_2 hypothesized that the income cooperative projects are significant factors for income generation and poverty reduction in TRS. It is notable that the direct path ($X_4 \rightarrow Y$: $\beta = -0.012$, $p = 0.961$) is completely non-significant, and the results do not change even when using HC3 robust standard errors. On its face, it seems to be a null result. However, the mediation result is fundamentally reformulating it: 83.9% of the income cooperative to livelihood outcome relationship is mediated by governance quality (Sobel $Z = 8.154$, $p < 0.001$). Income cooperatives don't fail to deliver livelihood benefits, they do it because of governance.

The evidence of the descriptive analysis supports this reading: Over the 3 years, 63.2% of the households experienced an increase in income, with 79.2% crediting at least half of this increase to TRS projects. The real income of these households increased. Co-operative management did, however, produce dividends that were equitably distributed, and this is what would have made those gains possible. Income cooperative money does not reach households, it stops at the committee level, where governance is lacking. H_2 is partially supported: the income-livelihood relationship is real, but is mainly through governance quality.

- *H₃ Household Resilience: Partially Supported*

H_3 hypothesized that TRS projects will contribute to the resilience of households. There is no direct test of resilience as a separate construct – resilience items are part of the Y composite – descriptive evidence. That evidence is strong: 82.2% of shock-affected households had concretely tangible recovery support in the form of a TRS benefit. The mechanism a closer clinic that lowers healthcare travel expenses when people get sick, a water point that prevents dehydration during drought is plausible, consistent in the qualitative accounts and repeated. Absorptive financial capacity (60.4% of the capacity to raise emergency funds) is an indicator of the improvement of cash flows due to the participation of the cooperative and income growth.

But the food security finding takes the shine off the picture. Frequently, this 26.5% rate of continued food insecurity indicates an underlying structural vulnerability that TRS has not addressed. H_3 is partially supported: TRS meaningfully contributes to resilience by leveraging health, water and emergency savings mechanisms, but income insecurity and food vulnerability for one quarter of households are beyond the scope of TRS at present.

- *H₄ Governance Mediation: Fully Supported*

H_4 suggested that the relationship between the TRS with livelihood is highly mediated by governance quality, inclusivity, and sustainability. Three of four mediated pathways are statistically significant: the Income pathway (Sobel $Z = 8.154$, $p < 0.001$) accounts for nearly the entire mediation (83.9%) and the Education pathway (Sobel $Z =$

2.994, $p = 0.002$) and the Water pathway (Sobel $Z = 3.082$, $p = 0.002$) both demonstrate statistically significant partial mediation. In the entire model, the most powerful single predictor of livelihood outcomes is the governance construct ($\beta = 4.173$, $t = 5.268$, $p < 0.001$); and TRS project quality predicts governance perceptions with a very strong $R^2 = 0.865$.

The governance paradox in Section 4.6 that high transparency, low voice now assumes concrete analytical meaning. Increasingly, the voice gap is not only a procedural concern but a measurable impediment to livelihood outcomes: If 63.2% of respondents feel unheard by local leaders, and if governance mediates 83.9% of income cooperative effects, then the voice gap is not just a procedural complaint. It would be the single largest return on investment available to programme managers to strengthen participatory governance not just financial reporting, which is already working. H_4 is fully supported and no issues exist.

IV. CONCLUSIONS AND RECOMMENDATIONS

➤ Conclusions

This study assessed the livelihood impact of the Tourism Revenue Sharing funded projects in communities around Musanze District in Rwanda. On the basis of the findings, it is concluded that TRS supported projects have contributed significantly on the improvement of the household livelihoods by providing improved education, health care, and water service. These investments have led to better welfare of the beneficiary households and better living conditions in the communities around Volcanoes National Park.

The study also reveals that the economic interventions funded by TRS have led to positive impacts in terms of household income generation, income diversification and poverty reduction. Yet, while these economic gains are real, they are rather small relative to the gains made in social services. This means that although TRS has helped to empower people economically, they need to do more to create transformative and sustainable livelihood improvements. The results also show that TRS interventions have enhanced the resilience of households, as their capacity to cope with socio-economic shocks and adjust to new situations has increased. Community infrastructure, access to services and livelihood opportunities have been improved and this has helped the household to better cope with adverse conditions. In addition, governance quality, inclusivity and sustainability are essential factors in the effectiveness of TRS, the study finds. However, transparency in governance mechanisms, community engagement and inclusive benefit distribution as well as sound sustainability arrangements are all vital to the success of tourism revenue-sharing programmes, in addition to financial investment. In conclusion, the research argues that Tourism Revenue Sharing continues to be an important policy tool to encourage community development and protected areas of biodiversity. But for optimal developmental impact, its governance systems, investment in income-generating activities, sustainability planning and mechanisms for community participation need strengthening.

➤ Recommendations

Investments in education, healthcare, and water infrastructure were identified in the study to have the most positive impact on the livelihoods of the households that were beneficiaries. The Rwanda Development Board (RDB) and the Musanze District government should therefore continue to invest in social infrastructure projects, especially in underserved communities that are farther from the main tourism routes, with the support of development partners. It is also recommended to give more emphasis to maintenance and upgrading of the existing facilities for long-term service delivery and sustained community benefits.

The results indicated that while there have been significant investments under the TRS programme, there is weak monitoring of outputs rather than achievement of outcomes at the household level. Hence, new approaches to monitoring and evaluation based on outcomes should be used in RBD and by implementing agencies, in terms of income, poverty, service use, resilience, and beneficiary satisfaction. This will give stronger data and information on the developmental effects of TRS interventions. The study found that TRS-supported income-generating activities had a positive impact on household livelihoods, however, had a lesser impact than social infrastructure investments. Hence, future TRS allocations need to focus more on productive economic activities that can provide sustainable income. These can involve tourism related enterprises, community cooperatives, agribusiness development, vocational training programmes, support for entrepreneurship, and value addition programmes. The interventions will boost income diversification and quicken poverty reduction within the households. The results indicated that sustainability readiness plays a significant part in determining the success of TRS-funded projects over the long haul. Hence, there is a need to ensure that sustainability objectives are clearly defined in all future projects, with maintenance plans, operational funding schemes, community ownership and capacity building programmes.

Enhancements of these mechanisms will enable benefits of projects to be sustained beyond the end of initial funding. The study identified that the communities which were more inclusive and participatory had more positive livelihood outcomes. Policymakers need to improve mechanisms in place to ensure a fair distribution of the TRS benefits for all community groups, thus ensuring equity and social inclusion. Women, youth, vulnerable households and marginalized populations should be given particular attention to ensure they are actively involved in decision-making processes and that programme investments are equitably distributed to them.

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