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Abstract

This research study investigated the socioeconomic impact of introducing disseminated technologies of development projects on daily farming in low rainfall-prone regions of Rwanda. The study focused on the InnovAfrica Project in Kirehe District. The study found that a significant proportion of respondents had adopted and actively used agricultural technologies promoted by the InnovAfrica Project. The technologies included forage storage, irrigation systems, and drought-resistant seeds. The study also found that the InnovAfrica Project positively influenced food security in the study area. Respondents reported increased access to adequate and diverse food supply, better coping mechanisms during food shortages or adverse weather conditions, and an overall enhancement of food security. Moreover, participation in the InnovAfrica Project also resulted in positive changes in socioeconomic conditions. Respondents reported improved household income, better access to education, and increased access to healthcare services. This positive impact contributed to an overall increase in well-being. Recommendations from the research include enhancing technology dissemination, providing financial support or access to credit for farmers, promoting sustainable food security practices, sustaining and expanding the InnovAfrica Project, and conducting regular monitoring and evaluation.

Keywords: *Socioeconomic, Disseminated Technologies, Development Projects, Daily Farming, Low Rainfall-Prone*

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1.0 Background of the Study

Understanding the socioeconomic impact of development projects in specific contexts is essential for effective planning, execution, and evaluation. This allows effective decision-making, risk assessment, and resource allocation, all core aspects of project management (Smith, 2020). This research study focuses on the socioeconomic impact of disseminated technologies within development projects, specifically in low rainfall-prone areas of Rwanda, with a case study in Kirehe District. This research study is of paramount importance as it sheds light on the challenges and opportunities that arise when introducing technology-driven development interventions in agriculture, a critical sector for livelihoods and food security. Studying the socioeconomic impact of development projects in low rainfall-prone areas, especially in Rwanda, is pertinent due to several factors. Rwanda is an agrarian economy heavily dependent on rain-fed agriculture. Low rainfall can lead to reduced agricultural productivity, exacerbating food insecurity and poverty (Berhane, 2018). By analysing the impact of development projects, we can better tailor interventions to the unique challenges faced by communities in these areas and enhance their resilience (Béné, 2020). Thus, the knowledge generated from this research study will not only enhance our understanding of project management practices in such environments but also contribute to sustainable development efforts in Rwanda.

1.1 Statement of the Problem

The introduction of development projects that disseminate agricultural technologies in low rainfall-prone areas of Rwanda, exemplified by the InnovAfrica Project in Kirehe District, presents both opportunities and challenges. These areas, characterized by limited annual precipitation and a semi-arid climate, face significant obstacles related to agriculture, food security, and poverty. The primary problem that this research seeks to address is the need to comprehensively understand the socioeconomic impact of disseminated technologies within such development projects in order to enhance project management practices and contribute to sustainable development in these regions. Numerous development projects, both in Rwanda and globally, have targeted low rainfall-prone areas with agricultural interventions. These projects have aimed to introduce modern agricultural technologies, sustainable practices, and drought-resistant crop varieties to improve agricultural productivity and alleviate poverty. Examples include the Green Wall of China Project, Rainwater Harvesting Project in Kenya, African Green Revolution initiative, and the InnovAfrica Project in Rwanda. While some of these projects have shown promising results in enhancing agricultural productivity and resilience in similar contexts, there is limited in-depth research that systematically assesses the socioeconomic impact of such interventions, particularly in the case of InnovAfrica Project in Kirehe District.

Despite the existence of these development projects, there is a significant gap in our understanding of their real-world impact on the daily farming practices, livelihoods, and overall well-being of the local communities in low rainfall-prone areas of Rwanda, such as Kirehe District. Existing literature provides insights into the potential benefits of disseminated technologies, but there is a need for a comprehensive, data-driven assessment that evaluates the effectiveness, challenges, and long-term sustainability of these interventions within the specific socio-economic and climatic context of Rwanda. Additionally, there is a lack of empirical studies that explore the implications of these projects on local agricultural practices, food security, and poverty reduction. This research aims to fill this critical gap by conducting an in-depth analysis of the InnovAfrica Project's impact, shedding light on both successes and areas for improvement in order to inform future project management practices and sustainable development efforts in similar regions.

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1.2 Objectives of the Study

i. To evaluate the extent of adoption of disseminated agricultural technologies promoted by the InnovAfrica Project among smallholder farmers' community in low rainfall-prone areas of Kirehe District.
ii. To analyze the impact of the InnovAfrica Project on food security among smallholder farmers' community within Kirehe District.
iii. To assess the changes in the overall well-being of smallholder farmers' community, including income levels, access to education, and healthcare services, as a result of their participation in the InnovAfrica Project.

2.0 Theoretical Framework

The proposed research study on the socioeconomic impact of disseminated technologies of development projects on daily farming in low rainfall-prone areas of Rwanda, with a case study of the InnovAfrica Project in Kirehe District, is grounded in two key theories: Diffusion of Innovations by Rogers and Project Management Theory. According to Mataruka and Muzurura (2023) diffusion of Innovations Theory delves into the propagation and acceptance of novel ideas, innovations, or technologies within a society or a particular demographic. This theory delineates various stages in the process of adoption, encompassing awareness, interest, evaluation, trial, and ultimate adoption. Furthermore, it classifies individuals into distinct adopter categories, including innovators, early adopters, early majority, late majority, and laggards, based on their inclination to embrace novel innovations (Rogers, 2010). In the context of our research, this theory is highly relevant as it helps explain the process through which disseminated agricultural technologies reach and are adopted by farmers in low rainfall-prone areas of Rwanda, such as Kirehe District. It provides insights into the factors influencing the adoption of these technologies and the rate at which they are adopted, which are crucial for assessing the socioeconomic impact of the InnovAfrica Project on daily farming practices. Understanding the diffusion process can inform project managers about the key stages and potential bottlenecks in technology adoption, allowing for more effective project planning and management.

On the other hand, Project Management Theory encompasses various principles, methodologies, and best practices for planning, executing, and controlling projects. This theory is crucial for understanding how development projects, like the InnovAfrica Project, are planned, executed, and monitored (PMI, 2021). In this study, project management theories provide insights into how the dissemination of technologies is organized and managed within the project framework. Specifically, concepts from project management, such as project planning, resource allocation, risk management, and stakeholder engagement, can help analyse the effectiveness and efficiency of the InnovAfrica Project in achieving its objectives. This theory also facilitates an understanding of the challenges faced during project implementation, which may affect the successful dissemination of technologies and, consequently, the socioeconomic impact on daily farming practices. In summary, the Diffusion of Innovations Theory by Rogers and Project Management Theory provide a comprehensive theoretical framework for guiding the research study on the socioeconomic impact of disseminated technologies in low rainfall-prone areas of Rwanda, specifically the InnovAfrica Project in Kirehe District. These theories help in understanding the dynamics of technology adoption, project planning and execution, risk management, and stakeholder engagement, ultimately contributing to the success and sustainability of development projects in such challenging contexts.

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2.1 Conceptual Framework

This conceptual framework visually represents the interconnection among the independent variable, the dependent variable, and any additional or moderating factors that could potentially impact this association

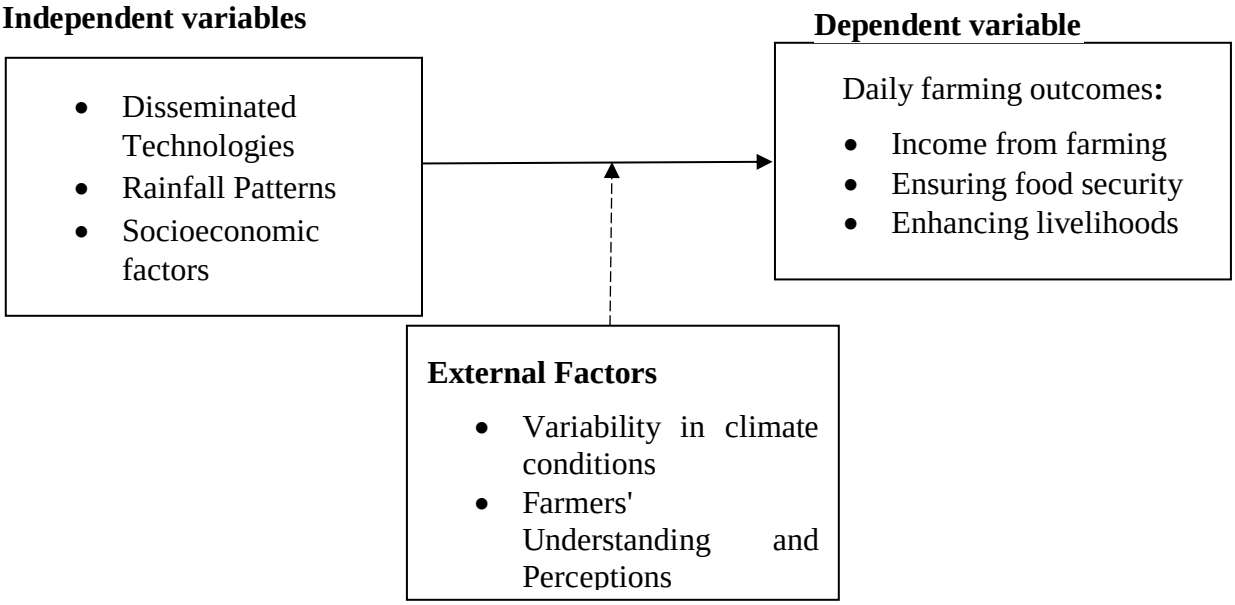

Figure 1: Conceptual Framework

3.0 Research Methodology

The study employed a descriptive research design and a stratified random sampling approach to collect data from 93 farmers in Kirehe District, Rwanda. The farmers were predominantly engaged in agriculture and breeding and were susceptible to the challenges posed by low rainfall and its impact on agricultural productivity. The data was collected using questionnaires, which were selected due to their practicality, ability to gather substantial information from a large sample size in a time-efficient and cost-effective manner, and researcher-administrable nature. A pilot test was conducted with ten (10) participants to assess the clarity of the questionnaire and ensure that it was filled out correctly, comprehended by respondents, and aligned with the research's objectives. The data collected during the pilot test was not included in the final analysis. Following the pilot test, adjustments were made to the wording and instructions of the research instrument based on the feedback received.

4.0 Findings and Discussion

4.1 Descriptive statistics of the Findings on the Adoption of Disseminated Technologies

Findings presented in the Table 1 shed light on the level of acceptance and integration of these technologies into daily farming practices.

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Table 1 Responses on the extent to which respondents agreed and disagreed on the adoption of disseminated technologies

Statements	1 #	%	2 #	%	3 #	%	4 #	%	5 #	%
1. I have adopted and actively use agricultural technologies introduced by the InnovAfrica Project in my farming practices.	0	0%	0	0%	2	1.7 %	60	65.3%	31	33.1%
2. I believe that the agricultural technologies promoted by the InnovAfrica Project have improved the efficiency and productivity of my farming activities.	0	0%	0	0%	1	0.8 %	48	52.1%	44	47.1%
3. I am aware of the various agricultural technologies made available by the InnovAfrica Project	0	0%	0	0%	3	3.3 %	44	47.9%	46	48.8%
4. I have received sufficient training and support to effectively implement the agricultural technologies promoted by the InnovAfrica Project	0	0%	0	0%	9	9.9 %	35	38%	49	52.1%

These findings in the Table 1 indicate the responses on the extent to which respondents agreed and disagreed on the given statements concerning the adoption of disseminated technologies promoted by the InnovAfrica Project. The majority of respondents (65.3%) agreed and 33.1% strongly agreed on the statement that they have adopted and actively use agricultural technologies introduced by the InnovAfrica Project in their farming practices. This indicates that a significant majority of respondents have embraced these technologies. Only 1.7% of respondents fell in range of neutral, suggesting a very small portion of respondents neither agreed nor disagreed with the statement. With the statement that the agricultural technologies promoted by the InnovAfrica Project have improved the efficiency and productivity of their farming activities, 52.1% agreed, 47.1% strongly agreed and 0.8% were neutral. This shows that a substantial majority believe these technologies have positively impacted their farming endeavors. 48.8% strongly disagreed, 47.1% agreed, and 3.3% are neutral with the statement that they are aware of the various agricultural technologies made available by the InnovAfrica Project. This finding suggests that a significant proportion of respondents were not well-informed about the technologies offered by the project. Lastly, 52.1% strongly agreed, 38% agreed and 9.9% are neutral on the statement that they received sufficient training and support to effectively implement the agricultural technologies promoted by the InnovAfrica Project. This indicates that a majority of respondents felt adequately supported in their efforts to adopt and utilize these technologies. Additionally, qualitative interviews with the respondents revealed that they have started to incorporate specific technologies like

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forage storage, irrigation systems, and drought-resistant seeds into their daily farming practices. This shows that they are adopting specific technologies that can help them cope with the challenges posed by low rainfall in their region. However, they also mentioned various challenges faced, such as limited access to information about modern agricultural technologies, best practices, and weather forecasts, risk aversion towards investing in new technologies, financial constraints that hinder their ability to invest in new agricultural technologies, inadequate water resources, with only the Akagera River in their region, and concerns related to climate change and unpredictable weather patterns.

4.2 Impact of the InnovAfrica Project on Food Security

This subsection focuses on the impact of the InnovAfrica Project on food security among the smallholder farmers' community within Kirehe District. The Table 2 present the findings related to changes in food production, availability, and accessibility, and then they are discussed how these changes affect the food security situation in the region.

Table 1: Responses on the extent to which respondents agreed and disagreed on the Impact of the InnovAfrica Project on Food Security

Statements	1 #	%	2 #	%	3 #	%	4 #	%	5 #	%
1. Since my involvement in the InnovAfrica Project, my household has experienced an improvement in access to an adequate and diverse food supply.	0	0%	0	0%	3	3.3%	42	45.5%	48	51.2%
2. The InnovAfrica Project has positively influenced our ability to cope with food shortages during lean seasons or adverse weather conditions.	0	0%	0	0%	7	7.4%	45	48.8%	41	43.8%
3. The availability of nutritious food for my family has increased as a result of participating in the InnovAfrica Project.	0	0%	0	0%	7	7.4%	47	50.4%	39	42.1%
4. Our overall food security situation has improved since we started engaging with the InnovAfrica Project.	0	0%	0	0%	6	5.8%	32	34.7%	55	59.5%

The findings indicate in the Table 2 that among respondents 51.2% strongly agreed, 45.5% agreed, and 3.3% are neutral on the statement that since their involvement in the InnovAfrica Project, their households have experienced an improvement in access to an adequate and diverse food supply. These data suggest that the majority of respondents perceive a positive change in their access to a variety of food since participating in the InnovAfrica Project, indicating an enhancement in food supply diversity. About the statement on that the InnovAfrica Project has positively influenced their ability to cope with food shortages during lean seasons or adverse weather conditions, 43.8% strongly agreed, 48.8% agreed, and 7.4% are neutral. This suggests that a significant portion of the respondents believe that the project has helped them better manage food shortages during difficult times, such as lean seasons or adverse weather conditions. 42.1% of respondents strongly agreed on the statement that the availability of nutritious food for their family has increased as a result of participating in the InnovAfrica Project, while 50.4% agreed and 7.4% are neutral with this statement. This indicates that many respondents feel that

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their access to nutritious foods has improved due to their involvement in the project, suggesting a positive impact on the nutritional quality of their diets. 59.5% of respondents strongly agreed, 34.7% agreed, and 5.8% are neutral with the statement that their overall food security situation has improved since we started engaging with the InnovAfrica Project. The majority of respondents are highly positive about the overall impact of the project on their food security, indicating a general improvement in this aspect of their lives. In addition to these quantitative findings, it's important to note that qualitative data from interviews with respondents further supports these statistics. Respondents reported experiencing an improvement in access to a wider range of crops, including staples like maize and rice, as well as nutrient-rich crops like legumes and fruits. They have also started implementing strategies, such as growing drought-resistant crops, to enhance food security. These qualitative insights provide context and depth to the quantitative findings, helping to understand the reasons behind the reported improvements in food security. These findings suggest that the InnovAfrica Project has had a positive impact on food security in the study area, leading to increased access to diverse and nutritious food, improved coping mechanisms during food shortages or adverse weather conditions, and an overall enhancement of food security. These findings are valuable for assessing the effectiveness of development projects in improving the livelihoods of farming communities in regions with low rainfall.

4.3 Changes in Overall Well-being as result of Participation in the InnovAfrica Project

This subsection assesses the changes in the overall well-being of smallholder farmers within Kirehe District, including their income levels, access to education, and healthcare services, as a result of their participation in the InnovAfrica Project.

Table 4: Responses on the extent to which respondents agreed and disagreed on Changes in Overall Well-being as a Result of Participation in the InnovAfrica Project

Statements	1 #	%	2 #	%	3 #	%	4 #	%	5 #	%
1. Participating in the InnovAfrica Project has positively impacted my household income.	0	0%	0	0%	2	1.7%	56	60.3%	35	38%
2. Access to education for my family has improved due to our involvement in the InnovAfrica Project	0	0%	0	0%	1	0.8%	51	55.4%	41	43.8%
3. Our access to healthcare services has increased as a direct result of our participation in the InnovAfrica Project.	0	0%	0	0%	1	0.8%	55	59.5%	37	39.7%
4. Overall, I feel that my family's well-being has significantly improved since we became involved in the InnovAfrica Project	0	0%	0	0%	3	3.3%	51	54.5%	39	42.1%

The findings related to the changes in overall well-being as result of participation in the InnovAfrica Project are presented in the Table 4 and their analysis will examine how the project has influenced their socioeconomic conditions and access to essential services including education, and healthcare services.

According to these findings, a significant proportion of respondents have seen positive changes in their household income due to their participation in the InnovAfrica Project. Specifically, 38% of respondents strongly agreed, and 60.3% agreed that their involvement in the project has positively impacted their household income. Only 1.7% of respondents were neutral on this statement, indicating that the majority of participants believe their income has improved as a result of the project. The findings also suggest that the project has also positively affected the access to education for the families of the participants. Approximately 43.8% of respondents strongly agreed, and 55.4% agreed that their access to education had improved due to their involvement in the InnovAfrica Project. Only 0.8% of respondents were neutral on this statement. About access to healthcare services, they indicate that the participants have experienced improved access to healthcare services as a direct result of their participation in the InnovAfrica Project. Specifically, 39.7% of respondents strongly agreed, and 59.5% agreed that their access to healthcare services had increased. Only 0.8% of respondents were neutral on this statement.

5.0 Conclusions

The InnovAfrica Project in Kirehe District, Rwanda has had a significant positive socioeconomic impact on the local farming community. Farmers have adopted agricultural technologies, leading to improved farming efficiency and productivity. This has resulted in increased food security, with more diverse and nutritious food options, as well as enhanced coping mechanisms during challenging times. Additionally, the project has had a positive influence on household income, access to education, and healthcare services, contributing to an overall improvement in well-being.

6.0 Recommendations

In light of the conclusions drawn, the following recommendations are made:

Enhance Technology Dissemination: To bridge the knowledge gap, the InnovAfrica Project should invest in more effective communication and training methods to ensure that all beneficiaries are well-informed about the available agricultural technologies. Financial Support: Efforts should be made to provide financial support or access to credit for farmers, especially for investments in new agricultural technologies, as financial constraints remain a significant challenge. Sustainable Food Security Practices: Encourage and support farmers in the adoption of sustainable food security practices, such as crop diversification and drought-resistant crop varieties, to further enhance food security. Sustain and Expand the Project: Given its positive impact, it is recommended to sustain and expand the InnovAfrica Project to reach more farming communities in low rainfall regions Monitoring and Evaluation: Regular monitoring and evaluation of the project's impact on socioeconomic conditions, food security, and technology adoption should be conducted to ensure its continued effectiveness.

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