



Knowledge and innovation co-creation initiatives between Sokoine University of Agriculture and neighboring farming communities in Tanzania

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ABSTRACT

Participatory approaches can serve as a bridge between science and farm practices for sharing experience and testing new innovation through farmer field schools and training. The study sought to explore the co-creation of agricultural knowledge and innovations between Sokoine University of Agriculture (SUA) and neighboring farming communities in Morogoro, Tanzania. Co-creation theory emphasizes the collaborative process where farmers and researchers work together to develop and refine agricultural innovations. In addition, the theory focuses on examining how smallholder farmers actively participate in the innovation process, ensuring that the technologies and practices developed are relevant and applicable to their specific needs and conditions. The study employed a cross-section research design in this mixed-methods study, using data from questionnaires, surveys, interviews, and focus group discussions with 402 smallholder farmers from nine (9) wards in three districts in Morogoro and respondents selected purposively to identify the types, benefits, and challenges of farmer participation in co-creation initiatives. Moreover, to identify types, benefits, and challenges, descriptive statistical analysis and multiple response were applied. The findings indicate that smallholder farmers contribute traditional knowledge and actively participate in testing and refining innovation or technologies in joint training sessions. Farmer field schools and on-farm demonstrations are the most engaging platforms that increase farmers' skills, productivity, and profitability. Limited engagement opportunities, inadequate access to information, financial constraints, and logistical challenges hinder co-creation participation. The study recommended distributing training centers, leveraging digital platforms, and introducing financial support mechanisms to enhance access and sustainability in driving locally adapted and sustainable agricultural innovations.

Keywords: Co-Creation, Knowledge and Innovation, Participatory Research, Smallholder Farmers, Sokoine University of Agriculture

I. INTRODUCTION

In agriculture, the term "co-creation" refers to the cooperative development of knowledge and inventions by a variety of stakeholders, including farmers, researchers, academics, and the commercial sector. This strategy recognizes the complexity of agricultural problems and the need for teamwork to create long-term solutions (Voorberg et al., 2015). Co-creation has gained international recognition as a crucial tactic for tackling challenging agricultural issues, encouraging reciprocal learning, and guaranteeing that innovations satisfy the demands of farmers and local communities.

The application of co-creation to assist agricultural research and innovation is shown by the European Union's Horizon 2020 initiative. Diverse stakeholders collaborate on this project to create workable ideas for improving agricultural sustainability (Klerkx, 2020). In international agricultural research, the usage of innovation platforms has accelerated significantly, allowing stakeholders to cooperate, exchange knowledge, and jointly develop solutions to agricultural problems (Kenney et al., 2020).

In East Africa, in order to solve the region's problems with agricultural production, co-creation projects have grown in significance. Farmers, academics, and other stakeholders may work together on agricultural innovations that are suited to regional requirements through platforms such as the African Green Revolution Forum. By encouraging the sharing of scientific research and indigenous knowledge, these programs make sure that advancements are pertinent to the



particular needs of farmers. (Nandeesha et al., 2023; Schut et al., 2016). In addition, a more inclusive approach to agricultural growth is promoted by using Participatory Rural Appraisal (PRA) techniques, which make sure that farmers' opinions are heard during the innovation process.

In Tanzania, Various programs that aim to improve agricultural practices and increase production are implementing co-creation approaches. The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification is one such project that collaborates closely with Tanzanian researchers to create agricultural techniques that are tailored to the local environment (Stewart et al., 2020). In order to guarantee that innovations are both practical and pertinent to the setting, these programs highlight how crucial it is to include farmers in the research process. Additionally, the government has encouraged co-creation through policy frameworks like the National Agricultural Policy, which promotes cooperation between farmers and scientific organizations (Wambura et al., 2015).

Sokoine University of Agriculture (SUA) has led the way in co-creation efforts at the local level in Morogoro. SUA closely collaborates with nearby farming communities to pinpoint agricultural problems and jointly create solutions using collaborative techniques. Msuya et al. (2017) observed that farmer field school, farmer-managed experiments, and knowledge-sharing platforms are some of the activities that guarantee innovations are useful and provide to the unique requirements of regional farmers. For example, SUA has worked with Morogoro farmer organizations to create better seed types and pest management techniques that are suited to the region's agricultural circumstances. These initiatives demonstrate the value of community-driven innovation and the necessity of doing research based on smallholder agricultural reality.

Therefore the study of Knowledge and innovation co-creation initiatives between Sokoine University of Agriculture and neighboring farming communities in Morogoro, Tanzania, is very important to assess types, benefit and challenges in relating to participation of smallholder farmers in co-creation initiatives. The contribution of this study is beneficial to the growing body of knowledge on co-creation initiatives in agricultural sector, and to recommendation on how to strength co-creation initiatives among universities and smallholder farmers.

1.1 Statement of the Problem

Despite the university proximity and potential to drive positive change in the Tanzania economy, the farming communities mainly depend on traditional farming techniques, which struggle with low productivity, limited capacity building and weak linkage between the university and farming communities (de Janvry & Sadoulet, 2022; Giller et al., 2021). The existing agriculture universities and research institutions produce knowledge and innovations co-creation initiatives, which hardly reach the needy farmers (Mtega, 2018; Mtega & Ngoepe, 2020) there is significant disconnect between universities and smallholder farmers in Tanzania.

Consequently, to bridge agriculture research with farming practices, participatory approaches such as knowledge and innovation co-creation are promoted to provide agriculture solutions (Chowdhury et al., 2021; Jafari et al., 2024). However, there is low information regarding their implication in the local environment. Thus, assessment of knowledge and innovation co-creation initiatives to bridge agriculture research with farming practices between leading agricultural universities that is SUA and neighbouring farming community in Morogoro, Tanzania is important. This study aims to fill this gap.

1.2 Research Objective

- i. Identify the types of agriculture knowledge and innovation co-creation initiative provided by SUA to smallholder farmers;
- ii. Benefit farmers participating in this agriculture knowledge and innovation co-creation initiative;
- iii. Determine the challenges encountered farmers in participating in the agriculture knowledge and innovation co-creation initiatives.

II. LITERATURE REVIEW

2.1 Theoretical Frameworks Guiding Knowledge and Innovation Co-Creation Initiatives

This study adopts the Agricultural Knowledge and Information Systems (AKIS) framework and Co-creation theory to understand the existing knowledge and innovation co-creation.



2.1.1 Agricultural Knowledge and Information Systems (AKIS) Framework

The AKIS framework emphasizes the interactive and systemic nature of knowledge and innovation co-creation among various agricultural stakeholders, including researchers, extension agents, farmers, and policymakers (Leeuwis & Aarts, 2021). It peaks the importance of integrating multiple actors in the knowledge-co-creation process to ensure effective dissemination and application of agricultural knowledge and innovations. The framework is particularly relevant to this study as it aligns with the participatory approaches currently being promoted in Tanzania's agricultural sector.

In the context of SUA and farmers in Morogoro Tanzania, the AKIS framework underscores the need for strengthened linkages among universities, extension services, and farming communities. The framework supports the use of digital platforms, joint training sessions, and other participatory methods to enhance knowledge co-creation and innovation adoption. This aligns with the study's focus on evaluating the effectiveness of knowledge and innovation co-creation and participatory approaches in agricultural innovation.

2.1.2 Co-Creation Theory

Co-Creation Theory of (Prahalad & Ramaswamy, 2004) ,emphasizes the collaborative process where farmers and researchers work together to develop and refine agricultural innovations .In the Morogoro setting, this framework is used to examine how smallholder farmers actively participate in the innovation process, ensuring that the technologies and practices developed are relevant and applicable to their specific needs and conditions. The theory supports the idea that innovations are more likely to be adopted and sustained when they are co-created with the end-users.

2.2 Empirical Review

Several empirical studies have explored the agriculture knowledge and innovation co-creation initiatives, benefit and challenges different sectors or partnerships. These studies provide insights into how university, private sector and smallholder farmers collaborate to support adoption of innovation and use to improve agricultural productivity.

2.2.1 Types of Agriculture Knowledge and Innovation Co-Creation Initiative and Participation

In conducting the study of the types and participation of agriculture knowledge and innovation co-creation initiatives between SUA and neighboring smallholder farmers in Morogoro Tanzania, several studies was reviewed. For example Dutrénit et al. (2016) who examined multidirectional relationships, such training initiatives and farmers' associations, help farmers and universities share agricultural information through the facilitation of knowledge transmission, these exchanges assist farmers in acquiring the necessary skills to adopt new technologies and increase productivity. This knowledge flow encourages innovation in agricultural practices by making sure farmers are active participants in the co-creation process rather than only passive consumers.

The study by Mgenzi et al. (2021) review that the capacity development through training initiatives is a crucial strategy for empowering smallholder farmers to actively participate in knowledge co-creation processes. Well-designed training programs help smallholder farmers develop technical and managerial skills that improve their ability to innovate. Such programs ensure that farmers possess the necessary skills to adapt to evolving agricultural technologies and practices.

Likewise Gava et al. (2018), the result indicate that knowledge and innovation co-creation initiatives have been established to facilitate project collaboration between farmers and academics. Collaboration with extension service are essential to bridging the gap between academic research and practical farming applications.

Additionally, Utter et al. (2021), their result show that participatory approaches enhance the flow of agricultural knowledge and innovation by promoting collaborative learning and development. These tactics go from the passive dissemination of knowledge to active involvement in the creation of new concepts and problem-solving techniques by promoting an interactive exchange of knowledge. These techniques enable farmers to convert their traditional knowledge, which, when combined with research findings, leads to more practical and sustainable agricultural approaches to university and other farmers.

Additionally, according to Franco et al. (2019), advances in technology have changed the way farmers and institutions share knowledge innovation co-creation, Farmers and universities may now connect more easily to video conferencing and other technology for communication, which promote efficient knowledge transfer and capacity building.

Fieldsend et al. (2021), in their study found that farmers ability to hold the new agriculture practices has increased due to the technology, knowledge and innovation intervention which has made agricultural knowledge and extension services more accessible .However, despite these advancements, challenges remain in developing workable strategies to enhance the dissemination of agricultural innovation and information.



Traditional linear models of information transfer are unable to handle the complexity of modern agriculture. Rather, a systematic approach to science, technology, and innovation policy is required to provide a more integrated and inclusive framework for information sharing. Farmers, lawmakers, technology firms, and academic institutions, would need to work together to develop and implement sustainable agriculture solutions.

2.2.2 Benefits Experienced from Participating Agriculture Knowledge and Innovation Co-Creation Initiatives

Several studies done on benefit of farmer's participation on agriculture knowledge and innovation co-creation with University. Ateka et al. (2019) found that farmers participation in different approaches in co-creation initiatives such as farmer field school in demonstration the best practices and allowing farmers to learn by doing and share experience or local agriculture knowledge to other farmers this increase agriculture knowledge among farmers to improve farming practices.

According to Laurens et al.(2023a) who suggest that farmer readiness of new agriculture practices improved by farmer-university co-creation collaboration in research project, joint training to test, adopt and share experiences. Local and scientific practical knowledge gained through interactions with stakeholders has allowed scientific to learn about local and farmers needs expectations, perceived and challenges. Furthermore, the interlinkages between cross-sectoral stakeholders also increase their willingness to cooperate, awareness and acceptance of new technologies, innovations for sustainable agricultural practices.

Additionally result from Sarkar et al. (2023), indicate that innovation driven agricultural interventions or initiatives it improve agribusiness sustainability and profitability to smallholder farmers to increase living standards. The existing knowledge and innovation co-creation among university and farmers ensure access of new technologies or innovation regularly joint participatory either in research project, testing new technology through farm demonstration, innovation hub and technology development.

2.2.3 Challenges in Participation Knowledge and Innovation Co-Creation Initiatives from SUA

Research done by Yang et al. (2022), a found that the major issue among research, education and farmers weaknesses and lack of some strategic connections in agriculture system , missing links to the relevant stakeholders or ineffective knowledge co-creation which causes a lack of farmers ability their knowledge . Also highlighting the value of financial support systems in raising farmer involvement in co-creation projects to provide agriculture knowledge to smallholder and availability of research project this help farmer involvement.

Similar to Monavvarifard et al. (2019) who found that involvement in agricultural innovation is hampered by a lack of contact between farmers and institutions and Mirra et al. (2020), who propose restructuring forms of engagement to ensure equitable participation and make them more inclusive. Strong link between university, sectors and farmers help to solve agriculture challenges and bring the solution. Also this initiatives should not distance with community house which help farmers to participate without using much money on transport.

III. METHODOLOGY

3.1 Study Area

Nine wards from three councils in the Morogoro Region Morogoro Rural, Mvomero, and Morogoro Municipality were the sites of the research. The chosen wards were Kiroka, Kinole, Nyandira (Morogoro Rural Council); Mzinga, Kingolwila, Mikese (Morogoro Municipality); and Mlimani, Mlali, Dakawa (Mvomero Council). They were specifically picked because of their close proximity to SUA and their participation in a number of agricultural projects supported by the university. These wards offer an appropriate framework for accomplishing the research goals since they reflect a range of farming systems and agro-ecological zones.

3.2 Research Design

The study adopted a cross sectional design, the design is suitable to collect data in a single point of time, also the design is effectively and cost efficiency (Cummings, 2021). Often, cross sectional designs are used to examine and compare single variable across multiple subgroups that are similar in other characteristics. For the study these types of design are commonly used to identify types and activities farmers are participated agricultural knowledge and innovation co-creation



3.3 Sampling Techniques and Sample Size

Non-probability sampling was used to select smallholder farmers, researchers and extension officers. Purposive sampling techniques was used to select 9 wards includes being close to SUA and actively participating in university-sponsored agriculture initiatives and all 402 smallholder farmers from each wards. In addition, 15 SUA researchers and extension officers were also selected purposively as key informants.

3.4 Data Collection and Analysis Methods

Both qualitative and quantitative data were collected from primary and secondary sources. Three primary methods structured questionnaire surveys, key informant interviews, and focus groups were used to gather primary data. 402 farmers were given a well-structured questionnaire were administered for guiding interview methods and a checklist was used for focus group discussion and documentary review. Descriptive statistical analysis was used to summarize demographics characteristics of small holder farmers. Multiple response was used and allowed participant to select more than one answer when responding to certain question particularly those involving types of co-creation initiatives, benefit and challenges experienced in agriculture and innovation co-creation initiatives.

In to identify benefit of farmers participated in SUA agriculture knowledge and innovation co-creation initiative was analyzed which were to answered on five- point rating scale from 1=Very high benefit, 2=High benefit, 3=benefit, 4=Low benefit, 5= None On examine the challenges experienced smallholder farmers from participating in agriculture knowledge and innovation co-creation initiative a scale from 5= Major challenge, 4= Challenge, 3= slightly challenge, 2= low challenge 1= No challenge at all

Table 1

Distribution of the Study Participants

Council and Ward	Frequency	Percentage
Morogoro Municipal		
Mzinga	46	11.4
Kingolwila	29	7.2
Mlimani	18	4.5
Mzinga	46	11.4
Mvomero		
Nyandira	101	25.1
Mlali	86	21.4
Dakawa	37	9.2
Morogoro Rural		
Kinole	38	9.5
Kiroka	32	8.0
Mikese	15	3.7
Total	402	100

IV. FINDINGS & DISCUSSION

4.1 Demographic Characteristics of Respondent

Table 2 delineates the demographic attributes of the study participants, encompassing gender, age, educational attainment, family size, and marital status. The distribution presents an overview of the sample's diversity concerning these key variables, elucidating the composition of the respondents. The demographic analysis is crucial for comprehending the study's findings and guaranteeing the sample's representativeness.

**Table 2***Respondent's Demographic Characteristics*

Characteristics of respondents			Information related to agriculture farming		
Variables	Frequency	Percentage	Variables	Frequency	Percentage
Gender			Farming experience		
Male	242	60.2	1-10	150	37.4
Female	159	39.6	11-20	108	26.9
Total	400	100	21-30	66	16.5
Age			31-40	48	12.0
18-26	31	7.7	41-50	21	5.2
27-35	63	15.7	51+	8	2.0
36-45	102	25.4	Total	400	100
46-55	107	26.6	Farm size		
56-65	68	16.9	0.01-3	256	66.1
66+	31	7.7	4-6	88	22.7
Total	400	100	7-9	18	4.7
Education level			10-12	11	2.8
Primary	309	76.9	12-100	14	3.6
Secondary	64	15.9	Total	400	100
Tertiary	16	4.0	Economic income		
No formal	13	3.2	1-199999	118	29.4
Total	400	100	100000-199999	128	31.9
Family size			200000-299999	67	16.7
1-4	166	41.4	300000-399999	31	7.7
5-8	213	53.1	400000-499999	18	4.5
9-12	20	5.0	500000+	39	9.7
13-16	2	0.5	Total	400	100
Total	400	100			
Marital status					
Single	61	15.2			
Married	281	69.9			
Divorced	17	4.2			
Widow	29	7.2			
Cohabitate	14	3.4			
Total	400	100			

The findings in Table 2 further revealed that, the majority respondent were male (60.2%) and the rest were female, indicating male are more likely to participate in SUA agriculture co-creation initiatives. This is consistent with more general gender variations in agricultural involvement, which are frequently brought about by cultural norms and inequities in resource accessibility. Women's lower involvement, despite men's higher engagement, highlights the need for more inclusive outreach tactics to provide fair access to agricultural knowledge and innovation co-creation initiatives.

Table 2 present sample of characteristics in term of characteristics of respondent and information related to types of agriculture knowledge and innovation co-creation initiatives which smallholder farmers participated. Understanding of this information is crucial because they influence farmers to participate in agriculture knowledge and innovation co-creation initiatives so as to obtain to improve livelihood. The results indicates that most of the respondents (26.6%) were aged between 46-55 years, which means that the participation of agriculture knowledge and innovation co-creation initiatives from SUA to smallholder farmers is done by middle ages farmers, this due to capacity and their active participation implies that are more open to embracing new innovation. Younger farmers' very low participation, however, might point to possible obstacles including restricted access to land or conflicting financial prospects and limited opportunities to participate.

Regarding to marital status results indicate that, the majority of respondents (69.9%) were married, which can be indicative of the importance of labor availability and shared home duties in farming operations. therefore it can be argued that married farmers is highly secured with family responsibility that requires enough time to deal with activities of generating income. The majority respondents (76.9%) had primary education which is the minimum required to complete



basic school, 15.9% having completed secondary school, 4.0% having completed university education, and 3.2% having no formal education, in other words, it does not need special skills or high education to participate in agriculture co-creation initiatives, it rather requires experience or learning by doing. These numbers point to possible obstacles in implementing sophisticated agricultural advances, highlighting the necessity for SUA to use straightforward, useful, and approachable information transfer strategies designed for farmers with less formal education.

On households it is indicated that (53.1%) had between 5 and 8 people, which served as a source of labor for farming. Larger families may provide labor benefits, but they can also result in resource limits, therefore measures that balance household dynamics and productivity optimization are required. The region's smallholder agricultural system was further supported by the fact that the majority of farmers (66.1%) held tiny plots that ranged in size from 0.01 to 3 acres. This demonstrates the need for scalable, reasonably priced solutions that take into account smallholder farmers' financial reality.

Respondents' levels of farming experience varied, with 26.9% having 11–20 years and 37.4% having 1–10 years. Therefore it reveals that most of smallholder farmers have much experience in farming and therefore they can easily participate in agriculture knowledge and innovation co-creation initiatives and deal with farm management. This is supported by (Amara & Bakli, 2022), who found that farming experience enables a farmer to understand the opportunities and enhance productivity. The majority of respondents made between 100,000 and 199,999 Tanzanian shillings per month, which is a low amount. Agro-pastoralism was practiced by 41.6% of respondents, indicating a variety of livelihoods, while farming was the main economic activity for 57.7% of respondents. The cost of new agricultural technology continues to be a major determinant of adoption, given the low earnings.

These results highlight how crucial it is to create agriculture knowledge and innovation co-creation initiatives that are accessible, inclusive, and context-specific in order to increase smallholder farmers' involvement in and adoption of agricultural innovations. To guarantee that technology and training programs are suitably tailored to farmers' requirements and circumstances, SUA's activities should take into account the socioeconomic variety of farmers.

4.2 Types of Agriculture Knowledge and Innovation Co-Creation Initiative and Participation

The results from Table 3 indicate that the majority of smallholder farmers (97.8%) participating in joint training sessions to share experience with other farmers, also providing feedback on innovation, testing and adapting new technologies and farmers participating in joint sessions to contribute local knowledge or practices with other farmers and researchers (Khademi et al., 2024). A key informant noted

“Neighbouring farmers prefer to learn through training and practical demonstrations, which is why we prioritize joint training sessions to help farmers to compare traditional and improved farming practices and share experience with other farmers.” (Key informant 1)

Respondents also point out that they also collaborate in research projects with SUA researchers to share experience with other farmers, to provide feedback on innovation, also to test and adapt new technologies and other contributing local knowledge or practices. This implies that the majority of smallholder farmers participate and collaborate in research projects to share experience and provide feedback and testing on new innovation with other farmers and researchers to improve productivity.

However, several respondents report that they also participate in farmer field schools, on-farm demonstrations and innovation hubs for sharing experience with other farmers, providing feedback on innovation and testing and adopting new technologies but with low involvement or participation in participatory technology development (Charatsari et al., 2022). These indicate that farmers think it's critical to learn and share information by actively engaging in research and training. Moreover, similar results were revealed by a participant in a focus group discussion (FGD). One participant explained:

The researcher will establish a professional farmer field school reflecting their expertise, simultaneously we will participate by implementing or sharing our traditional methods or skills. This approach allows us to observe firsthand where the best outcomes emerge, guiding us to adopt the more effective technology. (Participant 1)

The findings demonstrate that farmer involvement in SUA's co-creation projects has significantly improved economic gains, technology adoption, and knowledge development. Interestingly, model farms and combined training sessions had the greatest participation rates, indicating that farmers gain the most from practical instruction and real-world examples. This is in line with (Fao, 2018), which highlights that in order to ensure practical implementation, successful agricultural extension programs should combine farmer knowledge with scientific competence. FGD participants said that



I attended training from SUA for cultivation of pineapple. In which many farmers in our ward received, knowledge sharing was done through model farms for farmer groups the training was so effective and successful to the extent that the majority of farmers were able to produce pineapples (yields) at higher rates than before (Participant 2)

The high levels of engagement in technology adaptation and information sharing also show that farmers value direct involvement in innovation processes, which is consistent with (Laurens et al., 2023b), who show that co-creation initiatives where farmers actively participate in research and technology development result in farm-ready innovations that are easier to adopt and sustain. Additionally, the data's strong feedback loop supports (Triste et al., 2018), who supporter for increased farmer-researcher-advisor interactions to enhance agricultural innovation. FGD discussion participated said that

Now we can say that we benefit from many thing. First of all, for example I could cultivate ten acres but the harvest was small, but I could use a small amount of land and benefit from many crops. Now by collaborate in research project, attending in joint training to Sharing experiences with other farmers and provide feedback on innovation we have gone from there to the better use of land. Because now if you go to cultivate a lot of acres then what little you get is just destruction.so now we are professional farmers. (Participant 3)

Table 3
Types of Co-Creation Initiatives and Participation

Knowledge and innovation co-creation initiatives	Activities			
	Contributing local knowledge or practices	Testing and adapting new technologies	Providing feedback on innovation	Sharing experiences with other farmers
	%	%	%	%
Collaborate in research project	69.4	86.0	93.4	96.7
Innovation hub	70.4	69.4	76.5	85.7
Participatory technology development	20.2	25.8	27.8	26.3
On -farmer demonstration	67.6	88.8	92.7	93.1
Famer field school	74.1	86.3	94.4	97.4
Joint training sessions	70.2	86.4	92.6	97.8

4.3 Benefits Experienced from Participating Agriculture Knowledge and Innovation Co-Creation Initiatives

Among the benefits that were reported, improved knowledge and skills were the most important, with (86.8%) of participants reported that though agriculture knowledge and innovation co-creation initiatives between SUA researchers it improve agriculture knowledge and skills to improve productivity. This is consistent with Ateka et al., (2019), who point out that co-creation initiatives play a significant role in the dissemination of agricultural knowledge. Additionally, improved farming practices were widely recognized, with (69.4%) sharing experience with other farmers. These findings support, who suggest that farmer-university collaborations improve farm readiness for new agricultural practices. FGD discussion participated said that

“Due to knowledge and innovation co-creation from SUA we get benefits, the first benefit is skills and knowledge have increased due to watching and exchange knowledge with other farmers, visiting fields and testing the technology in our own farms.” (Participant 6)

Respondent also indicating that due to perception of knowledge and innovation co-creation initiatives, (74.7%) of respondent increased turnover and enhanced profitability were the main economic benefits indicating a high benefit and reporting a very high advantage, increased turnover and enhanced profitability were the main economic benefits. This is consistent with the findings of (Sarkar et al., 2023), who discovered that agribusiness sustainability and profitability are increased by innovation-driven agricultural interventions or initiatives.

The findings of Table 4 reveal that (43.5%) were not benefit in term of building community networks though agriculture knowledge and innovation co-creation initiatives between SUA and neighboring. This implies that although there is a great diffusion of knowledge, community-building initiatives would require further support. FGD discussion participated said that

I gain a lot from participating in SUA projects. Firstly, I was able to build a new standard house (local standard) which is good and I still live in today. I was able to travel to different places and learn different



farming practices and techniques across various regions of Tanzania. I became financial good and I gain exceptional agricultural knowledge which I have been using for many years and I still use today. (Participant 7)

Other participate comment that

Right now, as you see us here food production and income increases compared to the previous this because a large percentage of the new agriculture practices. We used to have in the past is different from what it is now. Because when someone changes their agriculture practices and takes various trainings and sharing experience with other farmers their increases turnover and profitability. (Participant 8)

Table 4
Benefits Experienced from Co-Creation Initiatives

Benefits	Very high benefit		High benefit		Benefit		Low benefit		None benefit	
	N	%	N	%	N	%	N	%	N	%
Enhanced access to new technologies	94	23.4	90	22.4	94	23.4	47	11.7	77	19.2
Improved farming practices	173	43.0	110	27.4	46	11.4	28	7.0	45	11.2
Stronger community networks	66	16.4	79	19.7	49	12.2	33	8.2	175	43.5
Enhanced knowledge and skills	293	72.9	56	13.9	24	6.0	10	2.5	19	4.7
New partnerships and relationships	159	39.7	137	34.2	49	12.2	24	6.0	32	8.0
Increased turnover and improved profitability	177	44.5	120	30.2	43	10.8	20	5.0	38	9.5

4.4 Challenges in Participation Knowledge and Innovation Co-Creation Initiatives from SUA

Many respondent about (73.1%) cited limited engagement are the major challenged facing when smallholder farmers participating agriculture knowledge and innovation co-creation initiatives with SUA researchers. This result is consistent with Mirra et al., (2020) who observe that farmer engagement in co-creation processes is frequently restricted by institutional impediments. This is consistent with research by Yang et al. (2022), which highlights the value of financial support systems in raising farmer involvement in co-creation projects. Creating financial choices for farmers, such government subsidies or microloans, might lessen this difficulty and increase participation.

To encouraging outcomes, the study suggests that access to co-creation initiatives has to be expanded. This outcome is consistent with Mirra et al. (2020) who propose restructuring forms of engagement to ensure equitable participation and make them more inclusive. The poll highlights the issue of insufficient communication between SUA and the agricultural communities, since many farmers express ignorance about such efforts. To bridge this gap and foster more collaboration, universities and farmers should employ organized communication strategies like extension agents and digital platforms (Monavvarifard et al., 2019). The result of Table 5 indicate that about (40.0%) of respondent report challenge on the availability of information about initiatives. FGD discussion participated said that

Sometimes, today if mother gets the chance to come here when she returns home then she is beaten, she is told not to go there again there is the face of that person I really don't like. Those are challenge exits there some interrupt the training if they want to come and attend the training they are afraid of her husband. (Participant 9)

This confirms research by Monavvarifard et al. (2019), who found that involvement in agricultural innovation is hampered by a lack of contact between farmers and institutions. Also respondents (33.8%) cited that there is a distance from where the participation of co-creation initiatives are conducted , This is in line with Fao (2018) which emphasizes that logistical limitations are a prevalent problem in extension, Another important issue identified by the survey is the distance to participation places, which many farmers have cited as a major obstacle.

This difficulty is consistent with the findings of Sarkar et al. (2023) who note that effective knowledge and innovation co-creation initiatives impeded by logistical challenges in rural agriculture systems. To solve this issue, creative solutions are required, including decentralized training facilities or mobile agricultural extension services, which would facilitate knowledge sharing among farmers. 91.3% of respondents said that language limitations were not a difficulty at all, making them a low challenge. This implies that SUA and farmers are able to communicate well during



participation of these initiatives to help to understand and improve their agriculture knowledge and skills. .FGD discussion participated said that

Researcher their used a lot of time that the other one has not planned well, but he will tell you tomorrow we will meet but the time does not come until he finishes, another time that he would use for other work and we don't get feedback or result from researcher. (Participant 9)

Another participated said

We still harvest using knives, let's say we use the same old methods, our colleague's areas have various modern machines, even rice Trans planters, they have threshing machines, we do not have because of the destruction of rice scheming infrastructure.(Participant 5)

One Participants noted

There are challenges even when we talk about distance, example, a farmer field school could be in Bamba, but not in Kizia. For farmers from Kizia, being able to reach Bamba a little bit can be a challenge due to the transport infrastructure and the issue of transport cost. (Participant 4)

Table 5
Challenges in Participating in the Knowledge and Innovation Co-Creation Initiatives

Challenges	No challenge at all		Low challenge		Slightly challenge		Challenge		Major challenge	
	N	%	N	%	N	%	N	%	N	%
Limited involvement opportunities	53	13.2	16	4.0	39	9.7	172	42.8	122	30.3
Language barriers	367	91.3	15	3.7	6	1.5	12	3.0	2	0.5
Lack of link between SUA and farmers	101	25.1	91	22.6	74	18.4	89	22.1	47	11.7
Time constrains	244	60.7	61	15.2	47	11.7	41	10.2	9	2.2
Distance to participation venue	204	50.7	80	19.9	36	9.0	70	17.4	12	3.0
Lack of information about initiatives	142	35.3	67	16.7	36	9.0	101	25.1	56	14.9

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The results from a study indicate that SUA's knowledge and innovation co-creation initiatives programs it improve agricultural communities, especially in terms of knowledge and skills expansion, better farming methods, and higher profitability. Farmers have shown a significant preference for experiential learning and real-world demonstrations by actively participating in cooperative joint training sessions, farmer field school, and collaborate in research project. Farmers are essential to the development and use of agricultural technologies, as evidenced by the high levels of feedback and engagement in technological adaption.

To ensure the longevity of co-creation initiatives, should increase large number of involvement participation and enhance communication strategies to optimize impact and ensure long-term sustainability. Future interventions should focus on increasing outreach efforts, expanding opportunities for engagement, and using farmer-led participatory models to promote more effective information dissemination.

5.2 Recommendations

The study recommends that, the government of Tanzania through Ministry of Agriculture should capacitate management of the institutes to provide availability and accessibility agriculture knowledge and innovation co-creation initiatives project to provide knowledge and skills of agriculture production to smallholder farmers.

SUA researcher should facilities training and learning by doing to improve their efficient and participation by align with socio-economic characteristics of smallholder farmers particularly with those have limited land and income. Furthermore, knowledge-sharing may be improved while circumventing geographic limitations by utilizing digital technologies like virtual collaboration platforms and online learning materials. A more resilient and successful farming community will result from SUA's implementation of these tactics, which will also strengthen cooperation, increase the acceptance of agricultural innovations, and guarantee the long-term viability of its co-creation efforts.



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