

FULL-LENGTH ARTICLES

A Review of Success Factors Behind Community Action Research Program (CARP): A Case of Experiences From Smallholder Dairy Farmers of Lushoto in Tanzania

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This article details steps, strategies, methods, and tools used during the project formulation, implementation, monitoring, evaluation, and closure of a livestock CARP conducted in the Lushoto district of Tanzania's Tanga Region. According to the study, CARP is a successful approach to managing agriculture-related community projects because it allows for the active participation of community members and all stakeholders, resulting in a sense of ownership and assurance of project success and sustainability. However, this work established that in order for the CARP to produce desirable results, a robust framework for organization and implementation must be in place; optimal methods of involving multiple stakeholders must be used; and strategies to ensure its sustainability must be set and agreed upon by all implementers during the implementation period.

Introduction

Tanzania is one of the countries in Africa's eastern region. The country is rich in natural resources. In terms of economic growth, the country has averaged 6.3 percent real GDP growth during the last decade (2010-2019), making it one of the fastest-growing economies in both Africa and the world. Tanzania Invest (2022) considers agriculture to be the most important economic sector, which, along with forestry and fishing are three of the most important economic sectors, accounting for 28.9% of total GDP. Agricultural partners from across the country, including academics from higher learning and research institutions, are striving to improve agriculture productivity and livelihood for smallholder farmers through a variety of methods, including applied research focused on the dairy farming value chain.

The Nelson Mandela African Institution of Science and Technology (NM-AIST), a post-graduate-only, research-intensive university focusing on the application of science, engineering, technology, and innovation for sustainable development in sub-Saharan Africa, implemented a Community Action Research Program (CARP) in Lushoto and Korogwe districts (2015 to 2019) in collaboration with Sokoine University of Agriculture (SUA), The International Livestock Research Centre (ILRI-Tanzania), and Tanzania Livestock Research Institute (TALIRI)-Mabuki Research Centre, Mwanza. A

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cohort of Ph.D. and Master's students were trained and worked with other program participants to improve the productivity of smallholder dairy farms through the application of innovative technologies for animal feeding, health management, and manure utilization as part of the research-intensive training program, which included multidisciplinary community engagement and mutual participation.

Dairy farming in Tanzania has been mainly adopted by smallholder farmers in densely populated high rainfall areas, including highlands, whereby crops, livestock, and trees are integrated into limited units of land (Kavana & Msangi, 2005). The dairy sector struggles for a variety of reasons: approximately 97% of Tanzania's dairy cattle are low-yield breeds; poor management practices are prevalent; and there are seasonal fluctuations in the availability of forage and feed. This prevents many smallholder farmers from accessing affordable extension or veterinary services (Brett, 2019). Nevertheless, the sector is acknowledged for its contribution to household food security, employment opportunities, and as a regular source of income for farmers (Swai & Karimuribo, 2011). Further, most Tanzanian smallholder dairy farmers rely on on-farm resources such as grasses, legumes, crop residues, cereals, and oilseed byproducts for feeding their livestock. These feed resources, in particular pasture and crop residues, often fluctuate seasonally, both in terms of quantity and quality. For example, pasture tends to be plentiful in wet seasons but becomes very scarce in dry seasons. This fluctuation affects both feed amount and quality, and hence results in a reduction of over 40% in milk yield during the dry season (Maleko et al., 2016; Maleko, Ng, et al., 2018; Maleko et al., 2019). Thus, for sustainable livestock development, smallholder farmers require innovative feeding technologies and practices, as indicated in Maleko et al. (2018).

On the aspect of manure management and utilization, Rukiko et al. (2018b) demonstrated that the majority of smallholder farmers in Lushoto, as well as the rest of East Africa, are poorly managing cattle dung such that its quality is impaired. Common practices include exposing the dung in an uncovered heap and applying it directly to the crops. This raises the need for special effort in dung management from production to final use, including sustainability of the knowledge, readable materials, an appropriate intervention of biogas plants, manure storage (shade structure), and decomposition process that will create awareness from production to farm application (Rukiko et al., 2018a). Improper manure management and utilization practices might contribute to the low levels of potential nutrients, making appropriate manure management and utilization even more critical (Rukiko et al., 2018b).

Thus, the research gaps addressed by the current project include the establishment of a platform along the dairy value chain and integration of productivity-enhancing technologies related to animal feeding, control of diseases, management and utilization of manure as an organic fertilizer for staple food crops, fodder and pasture production, and biogas production (Jackson, 2005). In addition, the feasibility of optimizing the utilization of bio-

slurry from biogas plants for feeding monogastric animals such as pigs, fish, and poultry, and serving as an input in compost making in the study areas was also a priority.

Consequently, this paper reviews the literature on success variables in community action research programs (CARP). The review is expanded and integrated by the shared, untold successes of a CARP conducted in Tanzania's Tanga Region. The successful CARP implementation reports, as well as those from project monitoring and evaluation tasks, highlight the need to document the process, share the experience, and identify the success factors that can be adopted and/or customized by other research groups when implementing similar programs in the future. Because stakeholders during program implementation agreed that livestock CARP will be based on three critical principles—namely participatory layout, stakeholder engagement, and sustainability strategies—three research questions are posed: 1) What is the best way to organize CARP?; 2) What is the best way to involve multiple stakeholders?; and 3) What are CARP's long-term sustainability strategies? The answers to those three questions are expected to shed light on the surrounding project decision-making complexity in terms of six dimensions: technical, social, financial, legal, organizational, and time, as outlined in the comprehensive framework by Shi et al. (2020).

The structure of this work is divided into five sections. The first introduces the research topic as well as the rationale behind it. After that, it moves on to a review of the relevant theoretical and empirical literature. During the literature review section, aspects of project management, Community Action Research Program (CARP), Community Action Program (CAP), and Participatory Action Research (PAR) are identified. In the third section, the research methodology is summarized, encompassing information on how the study region was strategically selected, the project conception meeting, the baseline survey, data collection methods, and how the livestock CARP objectives were implemented. The fourth section also includes major findings and discussions, beginning with the Livestock CARP's key outputs and lessons learned, and then moving on to the three research questions of the best way to organize the CARP, the best way to involve multiple stakeholders, and long-term sustainability strategies. The conclusion and recommendations are presented in the final section.

Literature Review

Project Management

Any successfully-implemented agricultural program requires initial plans on what will be done, who will be involved and how, what types of resources will be required, and strategies on how to best achieve the program objectives. This can be linked to the concept of project management with or without complex project management tools and techniques. Project management is the practice of leading the work of a team to achieve goals and meet success criteria at a specified time. According to the Project Management Institute (2008), project management is linked to the application of knowledge, tools, and skills to

actively achieve the project goal. The primary challenge of project management is to achieve all of the project goals within the given constraints (Phillips, 2003). Thus, management approaches for projects require the development of distinct technical skills and management strategies (Cattani et al., 2011). In view of that, Oliver (2017) advocated that the success of any project depends on how well four key aspects (plan, process, people, and power) are aligned with the contextual dynamics affecting the project.

The understanding of project management is based on three theories: management-as-planning, the dispatching model, and the thermostat model. In management-as-planning, management at the operations level is seen to consist of the creation, revision, and implementation of plans. This approach to management views a strong causal connection between the actions of management and the outcomes of the organization. The dispatching model assumes that planned tasks can be executed by a notification of the start of the task to the executor. The thermostat model is the cybernetic model of management control and consists of the following elements: there is a standard of performance; performance is measured at the output; the possible variance between the standard and the measured value is used for correcting the process so that the standard can be reached (Koskela & Howell, 2002).

The current study adopted the management-as-planning theory, in which all project management phases were based on translating the planning of the CARP into actions. In an effort to make that a reality, the project gathered all the information necessary for the goal's accomplishment, assuming that clear directions and stakeholders' involvement are the keys to success. Koskela and Howell (2002) showed that the present evidence is strong enough for the claim that a paradigmatic transformation of the discipline of project management is needed. The transformation required implies that a more intimate relationship between theory and practice must be created in project management—in fact, they need to be developed concurrently. The implementation of this argument requires the right approach and methodology, especially for smallholder farming communities. Various approaches and methodologies have been used for project management to reflect the different ways projects can be carried out. The choice of the right approach is a very crucial aspect as it may affect the project's success. The current study chose the community action research program to implement the project.

Community Action Research Program

Different sorts of viewpoints or paradigms were used in the implementation of research, which differed in how researchers and other stakeholders observed, described, and understood the phenomenon, as well as how they approached the research problems or challenges ahead. Recent literature has focused on Community Action Research (CAR) and Participatory Action Research (PAR), which place a greater emphasis on the involvement and participation of all collaborators during the research or project implementation process, as well as their level of commitment. CAR is an alternative research method that uses the community as the unit of analysis. This approach forges research alliances

with relevant stakeholders in the community to explore and develop solutions to local problems (Ozanne & Anderson, 2010). In all project management aspects related to planning, community and project members handled processing, people, and power consultatively. According to Elliot (1991), action research is a model of inquiry in which the primary goal of the researcher is to enhance his or her ability and subsequent practices rather than to produce theoretical information—hence enhancing the quality of the process and outputs.

On the other hand, the Institute of Development Studies (2022) describes PAR as a method of investigation that has been employed since the 1940s. It entails academics and participants collaborating to better understand and alter a problematic situation. There are numerous definitions of the approach, all of which have some aspects in common. PAR is context-specific, often targeting the needs of a specific group; it is an iterative cycle of study, action, and reflection; and it frequently tries to liberate participants to have a fuller understanding of their position in order to take action. PAR employs a variety of qualitative and quantitative techniques. In line with Whyte (1989), the primary purpose of participatory research is to establish an environment and process in which context-bound knowledge emerges in order to build an understandable and actionable local theory.

In most cases, the organization of interest, such as research institutions or local communities, is the one that initiates this kind of research, whereby the researcher and participants work together to examine and change their social reality in a loosely defined social and community process. Furthermore, Vaughn and Jacquez (2020) show that participatory research refers to research strategies, methods, and frameworks that use systematic inquiry in direct collaboration with individuals affected by a problem being examined in order to take action or effect change. Participatory research involves people who are not necessarily trained in research but who belong to or represent the interests of the people being studied. In most cases, researchers that use a participatory research approach frequently select research methodologies and tools that may be conducted in a participatory, democratic manner that emphasizes true and meaningful participation in the study process.

The current study adopted the CARP paradigm, which has the combined effect and benefits of both CAR and PAR. During implementation, CARP and PAR are similar in that they both use a qualitative research methodology that involves researchers and participants working together to understand social issues and take action to effect social change. However, despite being community action-oriented research, CARP, like most PAR, focuses on improving the quality of service by means of a self-reflecting process of exploring and solving problems, as evidenced in both McNiff (1988) and Wallerstein and Bernstein (1994). CARP is also regarded as an approach that combines both research and action, designed to enhance the quality of life of the participants. While traditional social and health psychology approaches are often individualistic in their orientation, CARP works with communities

to identify collective opportunities for change (Murray, 2012). According to Osiru et al. (2012), the framework of this type of approach includes interaction between universities, students, and communities in terms of knowledge creation and aspiration; institutional and personal development; livelihood enhancement; experimental learning; and interaction between students and communities in response to the needs of small farm holders.

With reference to the current study, livestock CARP was an initiative of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) that works with universities in Africa to better support rural communities to improve their production systems by targeting their knowledge and expertise to the needs of the rural communities and contributing to the targets of the Comprehensive African Agricultural Development Programme. This also challenges universities' ability to respond to the needs of smallholder farmers (Osiru et al., 2012). Bringing together key partners from the private and public sectors across research, extension, market, and government institutions in an iterative co-learning cycle allows communities of practice to share knowledge created from the implementation of action research (Nganga et al., 2019).

Thus, livestock CARP's interest in social justice aligns with the growing interest in socially responsible and sustainable business practices of smallholder dairy farming, as also evidenced in Shultz (2007). From the conceptualization of the program in 2015 to implementation in 2015–2019 as well as evaluation in 2020–2021, CARP works with smallholder dairy farmers from the seven program villages, district executive directors of Lushoto and Bumbuli, and respective extension officers, researchers from the two higher learning institutions, livestock research centers, as well as financiers, input suppliers, cooperative and community groups, buyers, and transporters, to name a few.

To eliminate power imbalances and ensure program goals are effectively and efficiently attained, all members of the program community are invited to engage in all aspects of the program, including design, execution, and assessment. The program ensured that participants have the desire and resources to participate and play active roles in defining the problem, selecting data collection techniques, analyzing the data, preparing results, and taking action. As a result, the holistic approach, led by the principal investigator, aids in self-organization, ensuring that activities are collaboratively carried out in accordance with task distribution and that outcomes are jointly prepared and presented, as depicted in Elden (1981). Furthermore, CARP, like the majority of participatory research, is a collaborative and empowering process for a number of reasons, as it: 1) Brings isolated people together around common needs and problems; 2) Validates their experiences as the foundation for understanding and critical reflection; 3) Presents the researchers' knowledge and experiences as additional resources upon which to critically reflect; and 4) Contextualizes what may have previously felt like personal, individual problems or weaknesses, as also reflected in Sohng (1995).

Additionally, CARP can be classified as classic project management because it involves the application of procedures, methods, skills, knowledge, and experience to achieve specific objectives within agreed-upon criteria, constraints, and time. It does, however, depart from the usual top-down strategy by focusing more on action-oriented activities that emphasize community participation and mutual cooperation throughout the program's life cycle, from inception to final evaluation. Community ownership and empowerment are always desirable outcomes in the process, in addition to the achievement of the main purpose.

Methodological Approach

The livestock CARP, like most community action research processes and methods, was customized and applied according to the emergence of the precise problem to be addressed, the specific needs of the community, and the capacities of the researcher, as depicted in Koch and Kralik (2006). In line with Julie, Ozanne, and Anderson (2010), the project team members adopted the guiding principles, focusing on: developing community partnerships and identifying needs and resources; agreeing on a focal problem; collecting additional data on the problem; presenting findings to community members so that they can participate in dialogue; and developing a specific program of action and the evaluation of this intervention.

Within the context of community participation, action orientation research, flexibility during implementation, and innovative research approaches, the livestock CARP used the following steps, critical approach, and processes as part of the research methodology:

- Conduct a primary need analysis to identify existing gaps and develop research questions.
- Determine the resources needed and make an effort to mobilize them through research grant applications both in financial terms and in-kind donations from various stakeholders.
- Sign grant agreements with all project collaborators and the research funder (RUFORUM).
- Select the study sites and locations carefully.
- Train the research facilitation team on the expected CARP procedures and processes.
- Informing the community about the agenda and their interest in collaborating to overcome the current challenges.
- Hold a project kick-off meeting to design the research plan, discuss challenges and priorities with community members, and establish preliminary answers to the research questions.

- Carry out the baseline survey using questionnaires, interviews, observation methods, focus group discussion, and available secondary data.
- Hold stakeholder consultative meetings to provide survey feedback.
- Agree on research methodology, community action to be taken, specific activities to be carried out, and how decisions will be achieved in a participatory way.
- Develop the strategic action plan with clear timelines and responsibilities of all players.
- Act together with the community and the established District Innovation Platform in CARP implementation in an effort to support and enhance the strategic action that leads to community transformation and social change.
- Involve local leaders and influential people within the community with the project.
- Carry out the training and capacity-building activities throughout the implementation period as per plan and when deemed necessary.
- Hold consultative meetings with stakeholders to discuss the closing phase, CARP output, and key takeaways.
- Analyze results and evaluate them together in the form of participatory monitoring and evaluation.
- Develop the interventions in line with community and research findings and suggestions.
- Prepare the scale-up plan, link the initiative with the university outreach initiatives, and assist in the mobilization of funds.

The following are the specifics of the methodological approach used.

Preliminary Activities

Researchers from various relevant disciplines that support smallholder dairy farmers conduct a primary need analysis to identify existing gaps and develop research questions. This involves a literature review of past research and reports. The team also established the magnitude of the research that may be required and hence tentatively estimated the necessary resources and applied for various research grants as a process of resource mobilization. After winning the research grants from RUFORUM, the team worked on all contractual requirements, including signing the grant agreements with all the research funders and all participating institutions.

Strategic Selection of Study Location

The selection of the study site was clearly and strategically done to ensure the achievement of the program results. The study was conducted in the district of Lushoto, located in the West Usambara Mountains in the Tanga region in northeastern Tanzania. The district covers an area of 3,500 km², equivalent to 12.8% of the Tanga region. It is bordered by the Same district in the northwest, the Republic of Kenya in the northeast, and the Korogwe district in the south. Administratively, the district has eight divisions, which are divided into 44 wards and 176 villages. Based on the national population and household census of 2012, the Lushoto district had a population of 492,441 people (United Republic of Tanzania, 2013). The major economic activities of the district are agriculture, tourism, and forestry, with crop production, livestock husbandry, and forestry as the main sources of income.

Preparations of the Research Team

Because CARP is not a common approach in Tanzania, the principal investigator held a three-day seminar shortly after receiving the research grants to familiarize the team with the fundamental principles of community participation and action research. The event was helpful in training key researchers and the facilitation team on expected CARP procedures and processes, as well as how the team could collaborate with the community to refine the research agenda and questions. This also included the official introduction of livestock CARP to local government authorities and community members. The project team, through the main institution NM-AIST, wrote the official letter to district and local government officials. Following that, information was directed to all wards and villages chosen to carry out the CARP initiatives. The goal was to inform the community about the research agenda and to express interest in working with local communities to tackle existing challenges using the CARP approach. The introductory letters were accompanied by physical visits, which secured project approval and local government commitment.

Project Inception Meeting

One of the key issues in CARP, just like in Roby et al. (2003), was how all key stakeholders could be involved and become partners in research projects, as common understanding among stakeholders and their respective involvement assurance is vital before starting the CARP. This brings the need for an inception meeting, also known as a kick-off meeting, and a series of consultative sessions. The purpose of that meeting was to introduce the team, understand the project background, understand what success looks like, understand what needs to be done, and agree on how to work together effectively. It's a chance to level up and get the team and client on the same page (Digital Project Manager, 2016). The meeting also engaged stakeholders to deliberate on the constraints; prioritize research objectives and interventions; assign tasks and roles to various actors; and prepare the initial project monitoring and evaluation framework.

Baseline Survey

Soon after the inception meeting, the livestock CARP commenced the baseline study to obtain useful knowledge of the existing status of the subject matter before starting the project. A cross-sectional design was employed whereby a structured questionnaire was administered to respondents, representing 150 households picked from the three wards (Maleko, Ng, et al., 2018). Every student had access to baseline information about the study areas. Various tools developed by the previous related programs, namely the International Livestock Research Institute (ILRI) under the “Maziwa Zaidi” project (meaning “more milk” project), were also utilized. Mwanja (2015) argued that without a baseline, it is not possible to know the impact of a project. Accordingly, along with other strategies such as the use of control groups, it also helps in attributing change in the target population to the project.

Strategic Implementation Planning of the CARP

The principal investigator held stakeholder consultative meetings soon after the baseline survey was completed to provide survey feedback. During that meeting, all participants had the opportunity to discuss the current situation and reach an agreement on research methods, community action, and specific tasks to be carried out. Furthermore, with the assistance of researchers, participants developed a strategic action plan with clear timelines and responsibilities for all actors. The team specifically discussed and agreed on the process of setting goals, deciding on steps to attain those goals, and mobilizing additional resources required to carry out those activities in addition to the RUFORUM grant. Because the project was executed in the manner of community action research, all stakeholders were included, and where appropriate, the CARP utilized local leaders and significant people within the local community as an advisory body to increase community engagement, particularly during data collection. Within the CARP team, both researchers and participants work together to achieve the objectives while also learning. When the need arose, one researcher within a team assumed an expert role and engages in the change process, steering the discussion in the proper direction.

Data Collection Methods and Tools

A mixed methods technique was adopted to collect both primary and secondary data. Primary data, according to Kothari (2004), are those collected for the first time, whereas secondary data are those collected previously. For the key informant interviews and focus group discussions, the primary data was obtained using a structured questionnaire comprised of open-ended and closed-ended questions, as well as a checklist. Before distributing the surveys to the intended respondents, a researcher pretested the questionnaire with ten people to see how they responded to the questions and make any necessary changes. Then, 210 people were given questionnaires to fill out. In addition, key informant interviews were conducted using a checklist to gather more information about the dairy industry, value chain, innovation platform (IP),

and dairy producers' association. District cooperative officers, district livestock and fishery officers, IP chairpersons and secretaries, village extension officers, cooperative chairman and secretary, and farmer's association chairman and secretary were among the key informants. Each interviewee was chosen because they had first-hand experience and information about the dairy industry in the study area.

Moreover, the principles of Eliot and associates (2005) guided a focus group discussion (FGD) with ten participants in each of the seven project villages. Participants involved in the discussions were members of the existing Innovation Platforms, members of dairy farmers' associations, and other smallholder dairy farmers. During discussions, a researcher guided the discussions while a rapporteur recorded all the participants' views. In addition, a digital recorder was used to record the participants' views during the focus group discussions. Furthermore, all students collected secondary data and reviewed literature as well as carried out laboratory work as per the specific request of each study area. Maleko et al. (2018) showed that the systematic search of publications was done using internet-based search engines. Procedures for the systematic search of literature described in detail by Phiri et al. (2010) were followed. Only peer-reviewed journal articles, theses, conference papers, book chapters, and project and government reports were downloaded and reviewed. The references of the referenced papers were screened to identify relevant papers that might have been missed by the search engine search. Facts, evidence, and key messages, were extracted from the papers and included in this review.

Implementation of the Livestock CARP Objectives

A review of the Project Management Body of Knowledge (PMBOK) guide reveals that activities and tasks are the units of analysis in the core processes of project management, like scope management, time management, and cost management, and that their management and control are centralized (Koskela & Howell, 2002; Morris, 1994). Stakeholder engagement has become one of the most important factors for this to be done effectively and efficiently. Effective project management necessitates the involvement of numerous stakeholders as well as the division of work and responsibilities. The majority of the research in the livestock CARP was conducted on-farm, so the key stakeholders in the livestock CARP included one Ph.D. candidate, five MSc students, and four BSc students who collaborated with farmers on specific research problems that were identified and contributed to the project's success. Aside from the study team, there were nine mentors and supervisors from four universities: NM-AIST (based in the Arusha region), Sokoine University of Agriculture (based in the Morogoro region), Mzumbe University (based in the Morogoro region), and Tanzania Open University (based in the Dar es Salaam region).

In addition, the team includes researchers from the Livestock Research Institute (TALIRI)-Mabuki Research Centre in Mwanza, as well as one from the International Livestock Research Centre (ILRI-Tanzania). In terms of the

local community, the CARP team enlisted the help of 210 small-scale farmers from the seven project villages; three District Executive Directors from Lushoto, Bumbuli, and Korogwe; and their livestock, agricultural, and cooperative extension staff. In addition, CARP works with three microfinance banks, input suppliers, farmers and farmers' organizations, credit providers, milk traders, milk transporters and processors, non-governmental organizations, and media reporters. Thus, despite the fact that CARP researchers and mentors originate from different regions in Tanzania, they all work together with local communities to achieve the common goal of improving the dairy industry.

The CARP was established in such a way that all students were enrolled at the NM-AIST and supervised by staff from the partner universities and livestock research centers. Despite this, the entire community and stakeholders within the study sites took part in the program, and students championed the following four CARP objectives.

First, one Ph.D. student carried out animal feed characterization, formulation, and feeding studies with assistance from one MSc and one BSc student. A study of the varieties and seasonal availability of animal feeds (pastures, forage, or concentrates) was undertaken, as well as an examination of nutritional value based on season and farmer preservation methods. Existing feeding practices were evaluated and reported in terms of the amount and quality of feed given to various animal species. The chemical makeup of the available feed resources was investigated. For chemical composition, standard analytical procedures outlined by AOAC (1990) and Van Soest et al. (1991) were utilized. Feeding trials were conducted on-farm utilizing feeds produced with locally available feed resources and pasture, fodder, and leguminous fodder trees planted on the farms during the research, and appropriate feeding regimes for various animal categories were identified.

Second, one MSc student and one BSc student worked together to estimate the amount of manure produced per animal per day using the manure and bio-slurry management knowledge. Farmers' manure processing and management practices were studied. On-farm demonstrations for manure management were conducted in order to improve its value as an organic fertilizer and to demonstrate its application in the establishment of home pastures, fodder gardens, and leguminous fodder trees. Alternative uses of manure for biogas production were examined, as well as the use of the by-product (bio-slurry) as a feed for monogastric animals such as pigs, poultry, and fish. Farmers were trained in manure processing techniques in order to reduce nutrient losses and health risks to farmers and livestock. Six biogas plants were installed at one household in each village in the Lushoto district, functioning as a training center for biogas technology to upgrade the technology of manure management and utilization. Selected farmers were urged to pay between 20% and 50% of the installation costs by purchasing construction materials or giving labor where it was needed in the cost-sharing and mutual participation arrangement.

Next, regarding the determination of animal disease problems and interventions, one MSc student, assisted by one BSc student, carried out the research on animal disease problems. A cross-sectional study was undertaken using epidemiological, clinical, and pathological examinations and laboratory procedures to establish the prevalent diseases as recommended in Kusiluka et al. (2006). Disease records accumulated over the years by the extension offices supplemented this information. Insights on indigenous knowledge on the diagnosis and management of endemic diseases were documented. Based on the results of the cross-sectional studies, a one-year longitudinal study was designed to determine the epidemiology of the diseases, which informed the design of animal health interventions. Laboratory analysis of clinical samples was carried out at NM-AIST and SUA.

Finally, with respect to the innovation platforms and farmers' linkages to the market, one MSc student assisted by one BSc student characterized the existing market constraints and opportunities in the dairy production system in the project area. Different market segments were identified and characterized; demand and supply patterns for dairy products at various seasons were documented to inform farm-level planning. The students worked with the existing farmers' networks, associations, private entrepreneurs, and non-governmental organizations to identify business opportunities and feasible market segments for increased and new products resulting from the above interventions. The costs of technological interventions were evaluated against the benefits accruing from the investments in milk and animal feed, thereby informing on the production efficiency of the farms. The students and project members facilitated the formulation of an innovation platform at the district level in line with the marketing and sales value chain to foster interaction and learning among dairy stakeholders, as well as worked on sustainability strategies for IP, including linkage with the living laboratory initiative and outreach program of the universities.

The engagement of various actors was intended to create a platform for scaling up innovation and provoking meaningful changes in livelihoods, organizations, business and market relations, and policy configurations that impact dairy production at regional and/or national levels. The CARP recognizes that partnerships are essential for scaling up innovations and research; and as a university, acting alone in the design and implementation of scaling up innovations is not effective in sustaining engagement with communities. During implementation time, livestock CARP added more stakeholders—especially dairy farmers' networks, associations, and processors—compared to the original design and expanded the area of coverage in order to involve more stakeholders and increase the sample size and geographical coverage. Because the project team members and partners have diverse experience that aligns with the study objectives, project team members and stakeholders who have worked in the region where the project is being

implemented both provided mentorship. Throughout the CARP implementation period, various types of training were conducted both in theory and in practice, as per the action plan, when deemed necessary.

Regardless of the team members' variations in gender, age, income status, education level, political perspective, and so on, the team discussed and agreed from the start on equal respect and engagement. However, the process faces several challenges related to subjectivity, dynamics, and tensions stemming from multistakeholder involvement and competing values over the project life cycle, as also revealed in Martinsuo (2020). The CARP team used more discussion and consultative meetings to address these types of challenges.

Monitoring and Evaluation of CARP

Regarding the evaluation of CARP, as part of the monitoring and evaluation framework, the CARP techniques were assessed using a variety of methods, including the defined deliverables and key performance indicators. Consultative sessions were held to discuss the actions required for each phase of the program, as well as to discuss and document the outputs, successes, and issues. As a result, each member had the opportunity to assess the CARP's work. Under the supervision of the CARP Principal Investigator, the researchers wrote the observations in an agreed-upon manner. However, post-program evaluation was carried out after the completion of the CARP between 2020 and 2021. Therefore, the CARP team analyzed results and evaluated them together in the form of participatory monitoring and evaluation.

Closing of CARP

Following the project's successful execution, the CARP team held consultative sessions with stakeholders to address the project's closure phase. The CARP outputs and main takeaways were among the key topics covered. Furthermore, the team of researchers, community members, and other stakeholders addressed the core interventions that would be developed in response to community recommendations and study findings. Additionally, the CARP team worked on the scale-up strategy, connecting the community project with university outreach activities, discussing the modalities of technical support, and funding mobilization framework.

Results and Discussion

The results and discussion section has been organized into two main subsections. First, it summarizes the key outputs and lessons learned from the livestock CARP. Then, it provides a perspective on the three research questions posed at the beginning of the paper: the optimal way to organize the CARP; the optimal way to involve multiple stakeholders; and the strategies for the long-term sustainability of CARP.

Key Output and Lessons Learned from Livestock CARP

The findings indicate that smallholder dairy production is an important undertaking that, if adequately supported by appropriate policies and adaptive research technologies, can significantly contribute to the household economy,

milk self-sufficiency, and national GDP, as evidenced by Swai and Karimubo (2011). The identified challenges facing smallholder dairy farmers in Lushoto were incorporated into the Livestock CARP implementation time. CARP managed to come up with a number of useful outputs. With respect to animal feeding, the project increased the understanding of dairy cow feeding patterns, such as feed rations, and helped the CARP identify specific areas for intervention to enhance output. Seasonal diet changes in dairy cows were quantified and qualitatively assessed. Fodder demonstration plots were constructed, and on-farm training took place on these plots.

Further, in health management, animal health risk factors were identified and reported. The prevalence of common subclinical infections in smallholder dairy cattle was determined and documented. Animal health management procedures were demonstrated (spraying, deworming, subclinical mastitis tests, and milking practices). Moreover, smallholder dairy farmers were educated on manure management and utilization, differences in nutrient storage practices, soil nutrient availability, and the use of manure for alternative energy options (biogas). Six biogas plants were installed in six villages to serve as demonstration and training areas. Ultimately, the CARP was successful in establishing a stakeholder characterization matrix, value chain strength, weakness, opportunity, and threat (SWOT) matrix, and an innovation platform at the district level.

Optimal Way to Organize the CARP

The first method of CARP organization entailed carefully selecting and involving multidisciplinary project partners. Since the program aimed to improve animal productivity in smallholder dairy farms through the use of innovative technology for animal feeding and health management, CARP focused on partners who could assist in technological interventions such as feed conservation for dry season feeding and the establishment of fodder gardens; control of major animal diseases; manure management for fertilizer and biogas; and enhancing farmers' linkage to markets. According to Braun and Sydow (2019), partner selection is crucial for the success of inter-organizational projects, and choosing the wrong partner is one of the most common causes of projects and strategic partnerships failing.

A consortium of public and private sector partners, as well as farmer groups and community-based organizations, worked together to implement the livestock CARP. In collaboration with the SUA, the ILRI-Tanzania, and TALIRI-Mabuki Research Centre, Mwanza, NM-AIST was the principal institution. Martinsuo (2020) explores the challenges of subjectivity, dynamics, and tensions that arise from multi-stakeholder involvement and competing values throughout the project life cycle, and finds solutions to the management of values by looking at values as beliefs to supplement their treatment as values. Thus, the livestock CARP team took all necessary precautions while involving all collaborators who possessed expertise that contributed substantially to the accomplishment of the program.

The second way of organizing CARP involved understanding the research problem to be addressed. Both researchers and stakeholders worked together to identify the problem and understand its root causes at the early beginning. The dairy industry is among the important components of the livestock sector in Tanzania and has great potential for improving the living standards of the people and contributing to the reduction of poverty (Njombe et al., 2012). This sector contributes about 30% of the total milk produced in the country. Although a slight increase in milk production has been documented in recent years (Mdegela et al., 2009), this is mainly due to an increase in herd size rather than in productivity per animal.

In addition to available farm resources, the main problems causing low productivity in smallholder dairy farms are low uptake and utilization of productivity-enhancing technologies, such as animal feeding technologies like conservation of surplus pasture and forage during the rainy seasons, the establishment of leguminous multipurpose trees (and use of its leaf meal, which is rich in crude protein), and the establishment of home fodder gardens near homes. Other causes of low productivity include the high prevalence of animal diseases such as tick-borne diseases, mastitis, and helminthiasis; the low genetic potential of the animals; and poor animal husbandry practices. As a result of limited use and integration of productivity-enhancing technologies, optimal performance of animals in smallholder dairy farms is not realized. Besides, the research gaps addressed by the project include the establishment of a platform along the dairy value chain and integration of productivity-enhancing technologies related to animal feeding, control of diseases, management and utilization of manure as an organic fertilizer for staple food crops, fodder and pasture production, and biogas production, as revealed also in Jackson (2005).

Third, the CARP learns from previous similar and associated projects. For instance, Crosby (2017) pointed out that many projects fail on a yearly basis, and thus a lot of effort is put into analyzing what the problem is. However, failure can be used as a sound opportunity for learning, so inter-project learning is highly recommended. The livestock CARP complements the projects, including the Programme for Enhancing the Health and Productivity of Livestock, supported by the Bill and Melinda Gates Foundation and hosted by NM-AIST, which involves Ph.D. training in livestock-related disciplines. Two SUA-based projects, namely Up-scaling and Out-scaling Technologies for Enhancing Integrated Dairy Production Systems in Njombe District and Enhancing Adoption of Conservation Agriculture in selected villages in Njombe District, were also used. These projects have developed technologies, some of which have been up scaled in the livestock CARP. Those projects identified priority gaps for research to improve the Tanzania dairy value chain. For effective management of any CARP and related project, the team should set firm project objectives and ensure all stakeholders are aware of them.

Optimal Way of Involving Multiple Stakeholders

The following methods were adopted to ensure that all stakeholders were optimally involved during the implementation of CARP. First, the team established transparent information and financial management systems to allow request processing, expenditure, retirement, and audit. This allowed all CARP members and affiliated institutions to easily access all relevant technical and financial information about a program. The financial reports were carried out every six months, and the audited financial audit, also known as the accountability report, was carried out yearly. Moreover, the teams within specific work packages addressing different objectives met every three months to discuss the research and project implementation progress. At the end of each project year, the annual general meeting was organized and held to discuss progress and strategize for the coming year.

Likewise, for effective implementation of the agreed objectives, CARP set a stable framework for program support, monitoring, and evaluation. This was accompanied by the funders' scheduled and non-scheduled expert visits to work or evaluate what has been done in terms of achieving some aspects of development. The visits involve meeting with host institution management, principal investigators, team members, and students. The coaching sessions were also scheduled to ensure CARP goals are on track and address emerging challenges. Apart from that, CARP had monitoring and evaluation exercises at the field sites. Prior to field evaluation sessions, the expert team visited other key stakeholders such as District Executive Directors and their Livestock and Fisheries Officers. Following each monitoring and evaluation visit, the team gathered to discuss issues that arose and strategize on how to address them.

Furthermore, the CARP capitalized on strong student recruitment and enrollment. The available training opportunities were advertised through the university website and information was sent to other training and research institutions, including project partners. Interested students applied for sponsorship by submitting concept notes of research projects aligned to specific research objectives as specified in the call for applications. Students were first selected on the basis of satisfying the admission criteria for Master's and Ph.D. programs at the university and, secondly, on the basis of the quality of concept notes that were endorsed by host schools. To accomplish the research objectives, the livestock CARP required a Ph.D. student with a background in animal nutrition or range management and Master's students with backgrounds in environmental sciences/animal sciences, agricultural extension/economics/rural development, or animal health. Throughout the study, students were closely followed in terms of both academic and research progress.

During implementation phases, the CARP focused on on-farm and field experiences and relies on community education and empowerment. This encouraged participants to learn new skills, reflect on their social and economic conditions, and act in their own self-interest. Thus, community members coproduced not only the research but also the programs of social intervention,

as reported in Reason and Bradbury (2001). Soon before the harvesting period, 80 farmers and Lushoto district livestock officials, led by the District Executive officer, were invited to visit the fodder and food-feed experimental/demonstration plots for awareness creation and to strategize further on the adoption, scaling up of the technology and its sustainability. In addition, under the guidance of the farm owner, a group of students and women from a local women's group dealing with horticultural and bean farming visited the trials and were trained on meal preparation. Another optimal way of involving stakeholders was capitalizing on stakeholders' evaluations. To make sure that farmers were learning throughout the process, the CARP gave farmers and stakeholders the opportunity to evaluate the output of all farm research activities. Each activity was jointly executed by key stakeholders within the established agricultural platform at the district level in Lushoto as well as within the developmental outreach activities of Lushoto, Bumbuli, and Korogwe District Councils.

Apart from that, CARP sets strategies and implementation plans for innovative technologies for adoption. For the case of improved Napier varieties, extension officers at the respective project villages who were involved in the entire activity of the pasture establishment trials employing the sunken seed bed technique were requested to register interested farmers to enhance adoption during the onset of the rainy season. The farmers were instructed to plant the materials and ensure that they were available since access has been expensive in the country. The extension officer spread the knowledge to other farmers in the project village.

Likewise, livestock CARP makes use of households and on-station feed trials. Schulz et al. (2003) found that one of the largest motivations for community members to participate in community action research is gaining new skills to effect changes in their communities, such as skills in problem-solving, organizing, public speaking, and leadership. Farmers were involved and trained on how to formulate a homemade supplementary ration. At the end of the experiment, the specific amounts of the supplements and their respective qualities for improving milk production were recommended to farmers, particularly to the smallholders. Farmers were also advised to establish leguminous multipurpose trees, which can be used as a meal rich in crude protein, and establish home fodder gardens near their house. These, in addition to the available farm resources, were advised in case the leucaena leaf meal was not readily available to improve milk protein concentrations.

In all the experiments, CARP ensured that there was an objectively selected group of farmers. For instance, to achieve the CARP's specific objective on effective utilization and management of manure, the project selected farmers whose households were used as demonstration biogas plants. Initially, ten families that had a minimum of two dairy cows were selected. Among these ten, two families were selected that had sufficient dairy cows to feed the biogas digesters daily (at least three dairy cows). The meeting for selection was held and supervised by extension officers who submitted the names to the CARP

team who later visited the smallholder farmers' farms at their homes. Clear and relevant criteria were used, and during the selection of dairy farmers for Biogas, installation visits to their households were made. Generally, the smallholder farmers were excited and motivated to try the new form of energy in the selected villages. The smallholder farmers themselves made the selection of who had to be the recipient of the installation and were also made aware prior to the exercise that they should be able to contribute to the installation costs.

Additionally, CARP created a clear cost-sharing mechanism for different stakeholders and beneficiaries. All the required materials were obtained through a cost-sharing approach. For biogas digester plants, the exercise started with clearing the allocated land, followed by measurements of the areas where the digester could be constructed, construction, and finally user training on how to feed the digesters until it started to generate biogas. The families contributed toward the construction; all families contributed water during the whole period of construction and some contributed capacity building, like site digging to a level of 1.5 meters. Some households contributed stones and labor during the construction. This was not only used as an effective sharing of resources, but also created a sense of ownership. Working on the unit cost of achieving an output is also crucial. In terms of cost estimations, details of unit cost for all ingredients were calculated and considered during the costing exercise.

Following results from a baseline survey and other data collection methods, the need for the establishment of IP was identified and communicated among stakeholders (Putaa et al., 2019). The process included the following steps: capitalizing on stakeholders' consultative meetings for strategic issue discussion and decision-making; involving local government authorities in the discussion and shaping of resolutions; learning from professionals and best practices such as the District Cooperative Officer, Tanga Region Dairy Platform representative, and Tanga Fresh Limited; and setting guidelines for all decisions to be made and indicators of expected output/opinion. For the establishment of the IP, the CARP identified, assessed, and characterized diverse actors from the dairy value chain based on their interests, roles, extent of interaction, impact, and influence in the dairy value chain for the sake of co-finding solutions to the challenges.

It was then possible to identify and set up numerous engagement strategies and techniques that would enable all actors to be effectively and efficiently engaged in the IP. This promoted interaction and communication among diverse actors in the value chain, which helped to identify and analyze their problems and discover solutions (Putaa et al., 2019). The key actors identified are: farmers and farmers' organizations; input supply; credit providers; extension service providers; local government officials; milk traders; milk transporters and processors; researchers; non-governmental organizations; and policymakers.

The findings show that when each actor involved in the platform plays a specific role in co-finding solutions to the problem, the strength and sustainability of IPs will then be assured. For instance, farmers and farmers' organizations with an interest in securing access to training on animal husbandry practices, access to credits at low interest rates, access to affordable inputs, and access to collective market work together will be motivated to pay all statutory fees and attend meetings with the goal of solving their existing challenges jointly with other actors, as also evidenced by Birachi et al. (2013) and Fatunbi et al. (2015). Moreover, it was established that research institutions have high impact and influence in the IP because of their role in the facilitation of interaction among the actors, the provision of technical support like capacity building to the farmers and other actors, and the undertaking of research for the purpose of understanding the challenges facing farmers and coming up with solutions to the challenges. Based on their role, they will be regularly interacting with other members of the IP (Putaa et al., 2019). According to Makini et al. (2013), the interest of the researchers and extension agents is to ensure technologies and innovations in the platform are relevant to the needs of the farmers and make sure that farmers adopt and utilize them for the aim of improving production.

Strategies for Long-Term Sustainability

The key strategies for ensuring the sustainability of the outputs and initiatives initiated by the livestock CARP include building the capacity of the stakeholders; recording and strategically disseminating project information and output; and building and supporting strong linkages and collaborations among internal and external partners.

One of the aims of the Livestock CARP was to train farmers on improved dairy farming practices and control of diseases, building participants' capacities. This is in line with the third project objective, dealing with establishing animal health programs for enhanced prevention and control of animal disease constraints at the farm level. In this respect, the Livestock CARP, in collaboration with three district councils of Lushoto, Bumbuli, and Korogwe, conducted three days of farmer training at LITA Buhuri in the Tanga region. Participants included two representatives selected from each of the identified project villages and one district livestock officer, the motive being to train farmers who can then train other farmers and community members in their own villages. Community members are collaborators in the research project because effective interventions require the consideration and respect of the social and cultural constructions of the people involved (Reason & Bradbury, 2001). For the effectiveness of the training of trainers program, all key stakeholders must prepare a consultative training program based on the identified gaps and needs of the trainees.

The training package covered calf-rearing, feeding, disease management, milking, manure management, and housing. The morning training session was reinforced with intensive practicals in the afternoon. Furthermore, the entire classroom and practical sessions were recorded for future use. The records were

made available at the district offices, NM-AIST, and all partner institutions for further dissemination of the training. Additionally, the participants were provided with hard copies of the training materials for revising and sharing with other farmers in their respective villages. The participants were therefore directed to share the knowledge with other farmers or undertake some sort of farmer-to-farmer training back in their villages. In this respect, the knowledge would therefore reach a larger number of farmers as intended by the livestock CARP. Certificates of participation were issued to all participants. All participating farmers were required to hold the farmers' feedback meeting with the help of extension officers and disseminate what had been learned at Buhuri. All such efforts are meant to ensure the farmers continue training themselves even after the completion of the CARP.

In terms of records and strategic dissemination of project information and output, the project managed to share its research status and progress with its stakeholders through a variety of channels from 2015 to 2020, including radio, television, newspapers, leaflets, training manuals, social media, documentaries, exhibitions, ten publications in reputable peer-reviewed journals, conferences, and seminar presentations. As a result, it is predicted that the knowledge gained and amassed will be available for many years to help smallholder dairy farmers as well as researchers who want to contribute more to addressing the challenges facing agriculture and the dairy industry in general.

Above all, by linking the intervention output of livestock CARP to the university, the NM AIST, and other universities, it expanded its network by working with smallholder dairy farmers. The relationship has been incorporated into community outreach programs as well as a research platform, where more students and researchers will work on remaining gaps and opportunities. The CARP managed to link the benefit of the research outputs and outcomes to the targeted stakeholders. The smallholder dairy farmers have participated in many research and practical aspects of the interventions through this project. This includes providing farms used to demo plots for animal feeds, training farmers to raise fodder, providing feedback to farmers such as how to feed animals using existing farm resources, and management of livestock health and diseases in general. Additionally, biogas plants installed in each of the program villages will be used for training other community members. Moreover, the CARP managed to establish and support the district innovation platform that will continue to serve smallholder farmers and other players within the dairy value chain.

Importantly, links to local and central government offices as well as non-governmental organizations were put in place. The Lushoto District Council, through its involvement in livestock CARP, has dedicated land to plant more animal feed that will be distributed to other wards. Their networks have also been expanded. Farmer's associations will benefit more as additional interested parties will be looking for more opportunities to support the initiative. Others, like local government officers such as Bumbuli District Council and Korogwe District Council, have also benefitted through the livestock CARP, especially

in the capacity building of their extension workers and the private sector involved in the dairy value chain. Regarding the central government, the Ministry of Agriculture, Livestock, and Fisheries supported the promotion and adoption of ouma fodder grass in Lushoto through the distribution of 1.5 tons of ouma cuttings to smallholder dairy farmers in Lushoto. This will increase the number of farmers producing high-quality fodder on small plots of land. Linkages and partnerships established after the completion of livestock CARP are expected to enhance the sustainability of the initiatives established.

Conclusion and Recommendation

The experience of the implementation of the livestock CARP shows that CARP is one of the most effective methods of managing community-related projects and community assessments, like participatory action research. This is evidenced by the obtained outputs and outcomes benefiting all partners using minimum resources, mainly farm resources. CARP's structure allows for participatory implementation of programs and projects throughout the project life cycle, giving participants the opportunity to steer the project themselves by conducting gap analyses, defining problems, posing questions, agreeing on key performance areas, completing tasks, and taking close follow-up actions. Despite that, some community members observed challenges and setbacks during the implementation of CARP, including a lengthy decision-making process, consultative meetings of people who possessed huge differences in age, gender, education level, income, or roles in the community, and a lack of interest. CARP combined the features of CAR and PAR by doing research both on and with the smallholder dairy farms and farmers, thus demarcating the extent of participation while sticking to research principles defined by the program's students. It is worth noting, however, that the students needed close attention throughout the implementation phases. In lieu of principles formally defined by the students, researchers must rigorously embrace principles of mutual cooperation, respect for public ideas, and a robust belief in community empowerment in order to pave the way for responsible and active citizen participation in the various stages of research as depicted by Ahari et al. (2012).

Thus, CARP implementers must allow active participation of stakeholders at all phases of program management in order to foster a feeling of ownership and ensure long-term sustainability, because the success of these types of programs is dependent on collaboration and partnerships. Likewise, for the CARP to produce desirable results, one must ensure that a robust framework is put in place for organization and implementation; optimal ways of involving multiple stakeholders are employed; and strategies to ensure sustainability are set and agreed upon by all participants during the implementation period. Specific recommendations brought forward from the livestock CARP case are as follows:

- Community action research provides a suitable model for engaging smallholder farmers and therefore needs to be practiced and maintained for sustainability of the projects' initiated activities

- Engagement of the beneficiaries since the early stages of the research is quite important to guarantee successful implementation and uptake of any outputs
- Improvement of extension services to smallholder farmers
- Farmers' capacity building programs must embrace a large component of on-farm participatory among smallholder farmers and extension officers that will encourage farmers to practice the appropriate technologies
- Promote usage of dairy farmers' cooperative associations and innovation platforms in order to facilitate smooth access to information, knowledge and skills on dairy feed.

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Conflicts of Interest

I have no conflicts of interest to disclose.

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