AARDO International Workshop (2003)
Agricultural Technology Transfer and Its Consequences
255-267

An Integrated Approach towards Sustainable Agricultural Development

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Introduction

The Republic of Mauritius is an island country of 1,865 km^2 in the southwestern Indian Ocean, some 1,800 km from the East Coast of Africa at approximately latitude 20ºS and longitude 57ºE. Agriculture is the third-largest sector contributing 7% of the GDP; 48% of the land is under cultivation, with sugarcane as the main crop (45%) followed by food crops (7%). Annual vegetable production is around 100,000 tons on 6,800 ha.

Technology transfer and research is the responsibility of the Agricultural Research and Extension Unit, an institution which operates under the Ministry of Agriculture. It provides extension support to some 10,000 food crop and fruit tree growers through an extension network disseminated throughout the country. The extension system used is basically a training and visitation system. A participatory approach is ensured through technology review meetings between farmers and research and extension services, as well as through needs assessment workshops and through planters' liaison meetings.

This country's paper presented herewith in the context of this workshop is based on an irrigation project currently being undertaken in the northern region of the island, which is funded by the European Union (EU) and the Government of Mauritius (GOM). In this paper, we attempt to provide participants with insights into the use of an integrated approach for technology transfer with sustainable agricultural development. It highlights how technology transfer need not be limited to technical fields only but also that it can be extended to other fields, such as management and group capacity.

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Northern Plains Irrigation Project (NPIP): Diversification Component

Project Background

This project is related to the Government's general program of strengthening the agricultural sector through improving the irrigation infrastructure. One aspect of the project is the diversification component whose objective is to increase the total area under food crop cultivation to 700 ha. For the purpose of this workshop on technology transfer, this paper addresses only the diversification component.

The project area is located on the Northern Plains of Mauritius, one of the driest regions of the island, with an annual rainfall of 1,500 mm. This region has a relatively large concentration of small sugarcane and/or food crop (both vegetable and fruit) growers. It contributes 25% to national food crop production and some 20% to sugarcane production. However, due to a severe lack of irrigation facilities to date, food crop production in the Northern Plains has yet to attain its full potential. Research has shown that given the good soil fertility in the North, with adequate irrigation and de-rocking works, the agricultural potential of the region, in terms of area under cultivation and crop yield, can be increased.

Beneficiaries

In the project area, the majority of the beneficiaries vary among categories as well as in terms of their professions and opportunities available, which are summarized below.

- The beneficiaries mostly include smallholder operators who own a cultivable plot ranging from 0.4 to 2.0 ha, with an average size of less than 1 ha. Only some 10% of planters have farm sizes larger than 2.0 ha. Approximately 40% of planters are part-time producers.
- The overall educational level of these planters is low, with two-thirds having completed only a primary education.
- Their average annual income is about one-third of the national per capita income. This group is constrained by vulnerability to adverse climatic conditions and a lack of irrigation and operating capital needed for crop production. The net result is low productivity and unstable family incomes.
- Agricultural production is predominantly a male occupation, with approximately only 20% of planters being women. Family labor is an important agricultural input, although it is primarily utilized on an occasional basis.

The main crops grown in the area are tomatoes, potatoes, and chilies. Other crops, such as okra, eggplant, cucumber, and pumpkin, are also grown on a relatively smaller acreage depending on the season. An additional 8 ha is under fruit production, mainly litchis and citrus.

Interventions

In 1997, the GOM and the European Commission signed a financing agreement for the NPIP. The financial agreement was approved on the condition that 20% of the newly irrigated area, i.e., 700 ha, would be permanently taken out of sugarcane production and devoted to food crop and fruit tree cultivation. In this respect, EU funds are being provided for technical assistance to support the executing agency, the Agricultural Research and Extension Unit (AREU). Additional EU funds are also available for equipment, related field activities, and capacity building to enhance support provided by AREU's extension and research activities to the planting community in its endeavor to diversify its agricultural production base.

The main objective of the diversification component is to support the Government's comprehensive diversification strategy to stimulate diversified and sustainable economic development for small and low-income planters. This will be achieved by the following measures.

1) Improving the income of small planters by enabling them to use more cost-effective systems (such as irrigated crop production) and reap the benefits of higher yields and stable incomes.

2) Diversifying into non-sugar crops such as vegetables and fruits, with a view to reducing dependence on imported food items and mitigate the possible negative impact of losses of revenue from sugar exports arising from world trade liberalization. Under the ACP-EU sugar protocol, Mauritius has a guaranteed market for some 500,000 tons of sugar at preferential sugar prices.

3) Strengthening their ability to compete in the local and export markets both to maximize profits and meet evolving consumer demands.

Diversification Component: Work Plan

A. Diversification results as proposed by the EU International Technical Assistance Team

The following results are expected by the end of the project life:

Result DR1 – Farmers' diversification planning and management capacity strengthened;
Result DR2 – Delivery and extent of agricultural support services enhanced; and
Result DR3 – Market information system implemented and operational.*

* Although not directly related to technology transfer, this aspect has been included in this paper to show its relationship to an integrated approach to technology transfer. Improving production should be accompanied by market opportunities.

(1). *DR1 – Farmers' diversification planning and management capacity strengthened*

This result will be achieved through an integrated and dynamic process of motivation and training, based on the participatory and demand-driven approach with a strong accompanying support from the Project Implementation Unit team. Diversification choices will be based on planters' needs and/or demands as they evolve during the project life.

Team spirit will be created and nurtured among farmers, through group formation, while entrepreneur's skills will be developed through training in farm management. Moreover, financial and technical assistance will be provided to specific groups of beneficiary farmers to support particular diversification pilot and micro-projects, which will serve as demonstration units and eventually pave the way for other farmers to follow.

(2). *DR2 – Delivery and extension of agricultural support services enhanced*

AREU support services will be enhanced to beneficiary farmers through the provision of economic information (typical project profiles, and feasibility and market studies) on specific crops introduced or to be promoted in project areas.

AREU support services will also be improved through: (a) strengthening the applied research capacity and streamlining research programs; (b) upgrading training and extension facilities at Mapou; and (c) training research and extension staff in participatory, training, and extension (PT&E) methods and specialized technical fields.

(3). *DR3 – Market information system implemented and operational*

A market information system (MIS) providing horticultural information (such as estimates of harvested areas, areas under new crops, level of production, and market prices for fruits and vegetables) will be set up, covering the entire island. This information will be

made available to domestic operators and to the institutions responsible for agricultural/market development. Different levels and frequencies of analysis, media, and formats will be used according to the nature of operators (producers, traders/wholesalers, retailers, processors, and exporters) and the institutions involved.

Moreover, a trade facility for trading horticultural products and a database for agricultural production inputs will be implemented. In parallel, market research will be conducted on the domestic and international horticultural markets.

B. Diversification activities as proposed by the EU international technical assistance team

(1). *DR1 – Farmers' diversification planning and management capacity strengthened*

- Forming and developing farmers groups;
- Developing farmers' entrepreneurial attitudes;
- Participating in production development; and
- Participating in services development.

(2). *DR2 – Delivery and extension of agricultural support services enhanced*

- Developing AREU agro-economic support services;
- Strengthening AREU applied research capacity;
- Strengthening AREU training, extension, and services delivery systems;
- Training research and extension staff; and
- Increasing the availability of seed, planting material, and other agricultural inputs.

(3). *DR3 – Market information system (MIS) implemented and operational*

- Assessing MIS needs;
- Implementing an MIS system;
- Developing the MIS; and
- Conducting market research.

Project Inception Phase

The project began in March 2003 with a 2-day project implementation workshop where stakeholders comprising support institutions and planters' association were invited to discuss and validate the consultant's logical framework. This was followed by a baseline survey (questionnaire type and focus groups) where farmers' attitudes to diversification and constraints were assessed.

Baseline survey conducted among farmers during the inception phase

Some of the main constraints identified are as follows:

- Aversion to risks and a lack of insurance;
- Market prospects;
- Lack of financing;
- Inadequate know-how;
- Adverse climatic conditions due to cyclones;
- Reluctance to form groups; and
- Costs and availability of labor.

DR1- Farmers' diversification planning and management capacity strengthened by the formation and development of farmers groups

(1) Mobilization campaign

Village meetings were organized to mobilize and sensitize farmers to the project objectives and what opportunities they would enjoy under the project in terms of technical and financial support. This was the first step in creating awareness among planters regarding diversification. Furthermore, project brochures and posters were produced as part of the mobilization campaign complemented with press and radio communiqués.

(2) Diversification planning workshop

Two workshops were carried out to (a) identify the farmers' areas of interest, (b) brainstorm on the viability/feasibility of their proposals, (c) assess the support required by the farmers, and (d) inform planters of the support to be provided under the project. Some 200 planters attended the two workshops, and 150 confirmed their participation in the project.

(3) Formation of farmers' groups

Because of the mobilization campaign, some 110 farmers formed nine Technology Development Groups (TDGs) which focused on the production of tomatoes (two groups), ornamentals, hydroponics, onions, potatoes, spices/herbs, creepers, and fruits.

With respect to Service Development Workgroups (SDWs) whose objectives are to provide support services to beneficiaries of the project as well as other planters in the vicinity of the project area, only one such group was formed: the SDW on mechanization. Another SDW on marketing is now in formation. An SDW on irrigation did not materialize, as planters were not interested in this type of activity. These groups were formed voluntarily by planters in the TDGs.

Group members were invited to participate in specific group meetings during which key issues such as mandates and objectives of the group and the roles and responsibilities of each member were discussed in participation with PIU staff.

Basic items (books, files, etc.) will be provided to TDGs and SDWs to assist them in acquiring/managing common assets. Personalized items, such as caps and satchels, will also be provided to all members of the group to create a group spirit.

Capacity building of farmers' groups in group formation

Four training modules (group development, administrative and financial management, advocacy and governance, and delivery of services) were conducted for two groups of 15 participants (selected from the different groups) with duration of 3.5 days sessions. Course modules were adapted according to the needs of the groups based on discussions held during group meetings. The training consisted of presentations, lectures, case studies, individual and group exercises, and individual and group assignments.

Development of farmers' entrepreneurial attitudes

Three training modules (production management, financial management, and market research and marketing skills) will be conducted for groups of 15-20 participants over 5.5 days sessions.

Participatory production development

(1) Technical assistance to TDGs

The project assists different TDGs in developing diversified production technologies by providing them with information and/or support in the various fields of production. This is achieved through meetings with input suppliers and visits to production sites within and outside the project area.

(2) TDG monthly review and planning meetings

During these meetings the following issues are addressed: (i) definition of the mandate and initial objectives (first meeting); (ii) assessment of training needs (second meeting); (iii) planning the production and other technology development activities to be conducted by the members of each TDG during the coming period; (iv) selection of micro-projects and other initiatives which could benefit from special project support; and (v) selection of existing production activities which could be used for demonstration; and evaluation of results of all past activities carried out with the group.

(3) Farmers' pilot/micro-projects and initiatives

Significant financial assistance will be offered to assist with setting up pilot projects since they involve a relatively high investment for which farmers are not willing to take the risk unless they are shown the worthiness, viability, and sustainability of the projects.

Priority will be given to advanced technology-based pilot projects, with an emphasis on quality, which deserve special attention and financial assistance by the project team. These include model intensive orchards for the production of bananas, pineapples, and litchis;

model hydroponics units for the production of specialty vegetables; and post-harvest units.

(4) On-farm adaptive trials

Numerous on-farm trials will be implemented throughout the regions of the project for producing new vegetable crops under a drip fertilization system, and for applying integrated pest management. Irrigation schedules will be optimized using specific irrigation monitoring equipment.

(5) Demonstrations and field days

Field days (either half or full days) to these demonstrations sites will be organized by the project team at regular intervals. Presentations will cover both the technical and economic bases for success. Demonstration sites will include pilot and micro-projects and on-farm trials, as well as successful projects/enterprises within and in the vicinity of the project area.

(6) Study or conducted tours

The project will organize combined visits to several relevant sites both local and abroad for small groups of farmers so that they can reach a better understanding of the different existing options for the development of their respective technologies.

(7) Farmers' technical training

Short courses will be provided by a short-term specialist (either international or local) and/or AREU staff on the following topics:

- Basic concepts of quality and norms for export (fruits, vegetables and processed products);
- Vegetable production (including fertilization and IPM);
- Fruit production (including fertilization and orchard management);
- Fruit nurseries (including plant propagation, nursery production, and modern nursery management);
- Vegetable nurseries (including nursery production and management);
- Vegetable seed production; and
- Training in water management.

Participatory services development

(1) Technical assistance to SDWs

The PIU team will assist SDWs and other farmers, through visits, meetings, and studies, in the following areas:

- Farm mechanization, including the availability and cost of farm equipment and identification of production operations with potential for mechanization; and

- Marketing, including market research and marketing skills, and group marketing issues.

(2) SDW monthly review and planning meetings

During these meetings the following issues are addressed: (i) definition of the mandate and initial objectives (first meeting); (ii) assessment of training needs (second meeting); (iii) planning of complementary service activities to be undertaken by each SDW during the forthcoming period; (iv) selection of pilot projects and other initiatives which could benefit from special project support; and (v) evaluation of results of all past activities carried out with the work group.

Each group will be guided and followed-up by a specific SDW support team, composed of one specific extension officer, one specific technical resource person, and the concerned STS (international or local) when on mission.

(3) Pilot projects

Financial assistance is provided to assist in setting up of pilot projects since they involve a relatively high investment for which farmers are not willing to take the risk.

It is therefore proposed that technically sound, economically viable, and potentially replicable complementary service pilot projects and initiatives proposed by farmers and/or groups of farmers be financially supported. Examples include four plots of fine de-rocking, plowing, furrowing, or bed forming (of 0.5 ha each) and the purchase of two-wheel tractors, potato lifters, or any other equipment that would enable mechanization of farm activities.

(4) Information distribution to farmer's community

It is proposed to circulate a simple newsletter on a quarterly basis (black and white photocopy), prepared by the beneficiary farmers, to farmers living in villages and hamlets located within and around the project area. In addition, this newsletter or its main articles could be also posted on the AREU/BSU website, in linkage with the MIS.

(5) Farmer' service training

Training courses will be provided to key members and representatives of the SDWs by the respective short-term specialists in the following topics: food crops irrigation, farm mechanization, cooperative use of equipment, production management, financial management, market research and marketing skills, group marketing issues, and use of the MIS.

The selection and extent of training subjects will be demand-driven and based on preliminary training need assessments carried out with the participation of farmers.

DR2- Delivery and extension of agricultural support services enhancement of developing AREU agro-economic support services

(1) Documenting production economics per product

It is proposed that a significant number of field surveys be conducted for different crops currently grown in planters' fields and for those having a potential for development in project areas.

These surveys will be carried out over a 5-month period for some 30 different products (15-20 crops with different varieties and technical scenarios for each crop) with two to three replicates per product in order to secure the accuracy of data.

(2) Support for management of small-scale farms

Typical project outlines will be produced from which feasibility studies for the principal crops identified by the beneficiary farmers can be derived. The first economic crop outline for pineapple is included in the Appendix.

Moreover, a manual on farm management will be prepared for publication. This manual will serve as a basic guide to beneficiary farmers to assist them in the financial management of their farms.

Strengthening AREU's applied research capacity

(1) On-farm trials and experiments

A series of on-farm adaptive trials will be undertaken under different types of irrigation systems, e.g., micro-sprinkler and drip irrigation, for different types of crops.

(2) Establishing a documentation center at AREU Mapou

A documentation center is being set up at the AREU Mapou Demonstration Centre, which focuses on specialized documents for diversification issues, to be used by researchers, extension staff, and farmers.

(3) Extension booklets, leaflets, and videos

Information leaflets on 10 principal crops identified for the project area are being prepared. In particular, information concerning the economics of production (such as investment, production costs, and expected returns) and potential market opportunities will be included. Furthermore, since proper pest and disease detection is a key element to effective pest control, a manual on pests and disease identification is being prepared to complement the information leaflets. These information materials will be pre-tested with local farmers (language, text, illustrations, graphics, etc.) before the resulting material is disseminated on a large scale to farmers in the project area.

(4) Increasing the availability of seeds, planting materials, and agricultural inputs

Local producers are presently using traditional systems of producing seedlings, which is very labor-intensive. To this effect, there is a need to modernize seedling production at the grower's level by introducing appropriate technology and evaluating them under local conditions.

The possibility of initiating commercial production of vegetable seedlings will be investigated with a view to serving the needs of both the local producers in the North and producers of other regions in Mauritius. If the need materializes, a model vegetable nursery will be set up either at AREU Mapou or on a farmer' plot within the project area.

A similar exercise as that proposed for vegetable seedlings will be undertaken for fruit planting material.

DR3- Market information system implementation and an operational

Market information system (MIS)

The MIS will make available to domestic operators and to institutions responsible for sector's development the following information:

- More-precise and timely production information for a wide range of fruits and vegetables (annexed MIS bulletins);
- Additional data on the production performances of four seasonal fruits (litchis, papaya, mango, and citrus fruits), in addition to two other ones (banana and pineapple) whose yields are already regularly being monitored; and
- Specific production information (yields and expected production levels) for six main domestic fruits so as to support their export trade.

The information products and services will be finalized by AREU and circulated by using the most-appropriate media. It is understood that before they are circulated, the products and services generated will have to be adapted to the selected media. Different information carriers will be used to circulate the information.

Market research

(1) Market research to support domestic trade

An investigation among members of the country's Hotels & Restaurants Association (AHRIM) of the tourist industry will be organized so as to better ascertain the systems they currently use for procuring horticultural products, what constraints they face, and the existing potentials for establishing direct linkages with producers inside the project area (through

contracts) and/or for using the trade facilities to be set up by the project to procure horticultural products in a more-efficient and timely manner.

(2) Market research to support horticultural exports

Jointly with selected exporters and in collaboration with the Mauritius Industrial Development Authority (MIDA), an export promotion institution, the project will carry out one to two external market investigations so as to support specific export attempts by domestic horticultural exporters.

Preliminary Observations

Farmers and groups

- The approach adopted by the project for the formation and development of the farmers groups, i.e., bottom-up, needs-driven, and people-centered, will take more time to implement but will produce better results in the end.
- Farmers have not experienced this kind of involvement and participation before. They do not have previous experience in working together on a common problem. Thus, the first steps will necessarily be slower until mutual trust and self-confidence are built up.
- Diversity among farmers as far as farm size, education, and self-exposure in market decisions is also a limiting factor.
- The fact that the farmers do not live in the same community/village area makes group development much more difficult. Also it is more difficult to accept and trust the leadership, at least initially, until the group realizes its devotion and that it does not have a hidden agenda.
- Farmers are invited to canvass as many other farmers as possible from their community to join the group. The geographic factor of the group might prove to play an important role in facilitating group development.
- There is a risk that farmers will lose interest in participating in the group formation if tedious and time-consuming meetings continue without tangible results. For this reason, it is recommended that "small achievable objectives, i.e., tasks" be undertaken so to maintain group vitality.

The importance of the extension team

- The formation of farmers' groups and their operation depend very much on members' behavior and participation. The goal of extension is to develop their skills in group management to facilitate group work.

- The new market environment in the agro-food sector makes farmers more demanding in terms of financial, market, and organizational advice, although technical advice remains very important. These new skills need to be developed among the extension staff.
- The extension team should avoid developing a feeling in the groups that they will do everything. Decisions, commitments, the setting of priorities, implementation, etc. of activities should remain with the group members, while the support team should provide only facilitation and support.
- For substantial progress at this critical phase, extension officers assigned to the groups are to maintain permanent contact with the group.

Conclusions

The project life was originally 4 years, but due to administrative reasons at the European Union, this has been reduced to 2 years. Technology transfer is a slow process which planters need to evaluate and adopt. Hence it is not expected that the project will actually achieve its objective of having 700 ha under food crop and fruit tree cultivation. Project objectives are now centered on enhancing AREU's support capacity and producing a core group of agricultural entrepreneurs who will develop the necessary knowledge and technical skills in the use of modern agricultural technologies and farm management tools. They in turn will pave the way towards improved and sustained crop production. Ultimately by 2007, the following will be achieved:

(a) The welfare of small planters in the northern region will be improved through increased income from agricultural activities; and

(b) The country's dependence on imported fruits and vegetables will be reduced.