

CAPACITY BUILDING OF SMALLHOLDER SWEETPOTATO FARMERS IN PAPUA NEW GUINEA

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ABSTRACT

Sweetpotato is the most important food crop in Papua New Guinea. In recent years, it has become an important cash crop for smallholder farmers driven by the need to generate income in a developing market economy. Demand for sweetpotato is increasing, especially in coastal markets, because of income growth and increasing urbanisation. However, meeting growing demand requires a transformation from subsistence to commercial farming. This has been challenging for the smallholder farmers, value chain players and policymakers because the majority of smallholder farmers do not have the resources and necessary technical and business management skills to meet the market requirements for quality and the consistency in supply. Most of these issues may be addressed by equipping smallholder farmers with the necessary skills through education and training. This paper summarises the research, development and extension activities undertaken to identify the training needs and build the capacity of smallholder sweetpotato farmers, as well as the lessons learned and policy implications for further improvement. The main conclusion is that the smallholder farming systems are complex, and are becoming more diverse, a flexible and coordinated national approach to RD&E is required to help smallholder farmers achieve productivity gains and improved livelihoods.

Key words: capacity building, value chain analysis, agricultural extension, sweetpotato, Papua New Guinea.

INTRODUCTION

Papua New Guinea (PNG) is a largely agrarian society. Although the country is richly endowed with mineral and petroleum resources, more than 80% of its population are dependent on agriculture for their livelihood. PNG was ranked 157 out of 187 in the 2013 Human Development Index (UNDP, 2014). Sweetpotato is the most important food crop in PNG, accounting for 43% of all food energy consumed (Bourke and Vlassek, 2004). In recent decades, demand for sweetpotato has increased as a result of economic growth and increasing urbanisation in coastal cities such as Lae and Port Moresby – the two largest cities in PNG. However, the potential to take advantage of the expanding marketing opportunities for improving farm income has been constrained by the high costs of marketing and, at times, by significant product losses. A series of research projects, funded by the Australian Centre for International Agricultural Research (ACIAR), have attempted to address these issues to improve marketing efficiency, postharvest management and value addition of sweetpotato in PNG (Chang et al., 2013; Chang and Mais, 2014). In this paper, we summarises the research, development and extension (RD&E) activities undertaken to identify and address those issues, as well as lessons learned and policy implications for further improvement.

METHODOLOGY

A participatory action research approach was adopted in this research to encourage stakeholder participation and collaboration, and to ensure project sustainability. One key element of action research is “learning by doing”, which results in empowerment and capacity building amongst participants. There were three phases to the research. Phase 1 focused on research, Phase 2 on capacity building and transfer of knowledge, and Phase 3 on stakeholder consultation. In Phase 1, a value chain analysis was conducted to identify constraints to, and opportunities for, improving effectiveness and efficiency in the sweetpotato value chain. This involved implementing

consignment trials to identify where and why product losses occurred, and personal interviews and focus groups of key value chain operators to understand the issues and opportunities facing them. Value chain operators interviewed included women farmers' groups, marketers, truck/bus drivers, managers of trucking and shipping companies, microfinance institutions, and institutional buyers. We also conducted a farm survey in the PNG highlands, and consumer surveys in Lae and Port Moresby. Results from this research were presented to project collaborators at a stakeholder workshop, where feedback was received, priority issues and training needs were identified, and action plans were developed.

In Phase 2, four farmers' groups in the PNG Highlands were selected for capacity building and transfer of knowledge necessary to improve their participation and contribution in their respective sweetpotato value chains. A series of training workshops were provided to the selected groups in: financial literacy, marketing planning, costing and gross margins, postharvest management, and processing. Learning outcomes from the training were then assessed. The assessment, along with lessons learned, were used to fine-tune the training materials and delivery methods. As part of the training and capacity building process, arrangements were made for linking farmers to microfinance institutions and to traders, and for linking traders to supermarkets. In Phase 3, potential development partners were consulted to better understand the current status of the agricultural extension system and support services for assisting smallholder farmers in PNG, and their role in it. The other objective was to identify areas for collaboration with potential development partners.

Phase 4, which is due to commence in April 2015, will involve organising a stakeholder workshop to discuss the results from Phases 1-3, and to develop strategies and action plans for meeting the training needs of smallholder sweetpotato farmers, as well as setting the stage for improving the national RD&E system for the agricultural sector in PNG

Results from the activities completed in Phases 1 - 3 are summarised and discussed in the following sections.

RESULTS AND DISCUSSION

Phase 1. Understanding The Sweetpotato Value Chain In PNG

From the value chain analysis, key aspects of sweetpotato production, consumption, marketing and processing, and other key issues were identified. These are summarised below.

Sweetpotato production

Total production of sweetpotato in PNG was estimated at around 3 million tonnes (Bourke and Vlassek, 2004), of which approximately 75% was produced in the Highlands. The supply of sweetpotato is continuous, non-seasonal and regular to irregular in most parts of PNG (Bourke et al., 2004). Although there is a tendency for sweetpotato to be available in larger quantities at certain times of the year, the supply of sweetpotato does not vary in a regular annual cycle across PNG as a whole, and as such demonstrates no apparent seasonality in production. This stability has been essential in the past for providing food security. However, there is concern that production may have become more variable and unpredictable because of climate change (Bourke and Harwood, 2009).

In the PNG Highlands, women play a significant role in sweetpotato production as it is a staple food crop and is also considered a "feminine crop". That is, sweetpotato cultivation is mainly a "women's job" from planting to harvesting (Benediktsson, 2002). The "men's job" in sweetpotato cultivation is limited to land preparation (clearing the bush, making garden beds and building drains and fences) at the beginning of the production cycle. Women are the main producers (and marketers) of sweetpotato. However, they face significant obstacles both inside and outside their homes. Gender training of household members and value chain operators needs to be put in place to change attitudes towards women. Furthermore, any research, development or extension effort to improve on-farm productivity and marketing efficiency must involve women. Improving facilities

in local markets for women should also be a priority, to encourage greater female participation at the market.

Sweetpotato consumption

Gibson (2001a) estimated the national average annual per capita sweetpotato consumption in PNG to be 260kg. Substantial differences existed in the diet of rural and urban households, with consumption being 299kg in rural areas and 42kg in coastal cities. By contrast, annual per capita consumption of rice in rural areas was 24kg, just over one third of that in urban areas (66kg). These differing consumption patterns occur due to lack of market penetration by imported foodstuffs, especially rice, in rural areas. Similarly, it is difficult to market locally produced foods into urban areas due to high transport costs. Transport and logistical problems have been identified as the number one issue for fresh produce marketing in PNG (Chang and Griffith, 2011). There is also a regional difference in staple food consumption. While sweetpotato is the main staple food for highlanders, banana, taro, sago, sweetpotato and rice constitute a much more diverse diet for people living in coastal cities. Furthermore, the main consumers of sweetpotato in coastal cities are more likely to be migrants from the Highlands (Benediktsson, 2002; Gibson, 2001b). Other coastal residents preferred rice to sweetpotato, on the basis of its convenience and novelty. Ongoing changes to dietary preferences are therefore a potential threat to future demand for sweetpotato.

Sweetpotato marketing

Sweetpotato is a bulky, perishable commodity with a high weight-to-value ratio. Long distance marketing for sweetpotato is challenging, and demands a lot of resources and chain coordination (Chang et al., 2008). Typically, sweetpotato is harvested in the Highlands and packed tightly into white poly bags (weighing 80-100kg each), which are then picked up from the village by trucks or public motor vehicles (PMVs), dropped off alongside the Highlands Highway, reloaded onto semi-trailers going down to Lae, unloaded and re-loaded again onto shipping containers at the wharf, and transported to Port Moresby by sea. Upon arrival in Port Moresby after 2-3 days at sea, the sweetpotato bags are collected by farmers or their relatives at the wharf, and are transported to warehouses near the main market (Gordons Market). This journey from the PNG Highlands to Port Moresby takes between seven and ten days. Marketing can therefore account for up to 75% of total costs, while postharvest losses can be as high as 30-50% if there have been substantial delays in transport (Irving et al., 2011). These delays are caused by the scarcity of PMVs or trucks, bad roads, landslides, roadblocks, and shipping delays from Lae to Port Moresby, as well as lack of organisation on the part of farmers.

These transport problems, and poor chain coordination, result in high risks and high transaction costs. Total marketing costs can account for more than 50% of total costs when sweetpotato is transported from a highland village to Port Moresby (Chang, 2009). Transport costs could be reduced significantly if farmers worked together and consolidated their bags, rather than going to the coastal markets by themselves with only a small number of bags. There were several reasons why farmers chose to market their own sweetpotato. First, the majority of farmers did not understand the various components of costs and prices. Many farmers went to the market without knowing if they could make a profit or not, given the significant price variations from day to day and from week to week. Second, farmers felt unable to trust other people where money was concerned, as misuse of funds was common, and there were few recourses to recoup the losses. Third, some farmers saw marketing to the coastal cities as an opportunity for travel, and associated it with the social status of having conducted a “big business”.

In PNG, most sweetpotato is priced by the bag when it is sold in bulk to wholesalers and retailers, and by heaps of varying sizes and qualities when it is sold to consumers at the open markets. This pricing scheme does not provide a clear price signal, making it difficult for farmers and buyers to compare prices and to assess and respond to changes in demand and supply conditions.

The sweetpotato value chain was fragmented and uncoordinated because farmers did not plan. Most production and marketing activities were unplanned, and there was little or no relationship, communication, or formal marketing arrangement with other value chain players. A well-coordinated value chain requires a marketing plan, as well as collaboration with other farmers and value chain players. Collaboration with others is difficult because of the cultures of opportunism, tribalism and distrust in outsiders.

Sweetpotato processing

Sweetpotato has many potential uses, including as a fresh food, as pig feed and as a raw material for food processing (Fuglie et al., 2006). In PNG, approximately 60-75% of sweetpotato is used as a staple food, and the remainder as pig feed. Sweetpotato is not used for processing. Some attempt to process sweetpotato in PNG was made in the mid-1970s when sweetpotato fries and flour were experimented with at the research station. However, the products failed to be commercialised because of high cost and lack of consistency in the supply of raw material. More attempts were made over the years, but only sporadically, mainly in response to political pressures to reduce reliance on imported potato and wheat, the raw materials for fries and flour processing, respectively.

RD&E for food processing was institutionalised in PNG when the Food Processing and Preservation Unit (FPPU) was established by the Department of Agriculture and Livestock (DAL) in 1984. The goal was to develop a food processing sector in PNG (Cegumalua, 2007). FPPU was used by Fresh Produce Development Agency (FPDA) for product research, development and extension, and by UniTech for teaching food technology students. Several products were developed successfully and a number of entrepreneurs and farmer groups were trained. Many more farmers received basic information and technical assistance over the counter (Cegumalua, 2007).

A review of FPPU in 2007 resulted in its closure, due to low levels of successful uptake of processing technology, lack of technical and management capacity amongst trainees to scale up, and poor management of FPPU facilities (Cegumalua, 2007). Interestingly enough however, the National Agricultural Development Plan 2007-2016, released in 2006, specifically identified “Developing a food processing industry for staple food crops and vegetables” as one of PNG’s development priorities (Ministry of Agriculture and Livestock, 2006).

Key issues

Mapping the sweetpotato value chain indicated that value chain operators faced significant challenges in delivering a bulky and perishable product over long distances. However, the issues and concerns varied amongst operators. Smallholder farmers were most concerned about access to credit, availability and cost of transport, storage facilities and low prices. For wholesalers and institutional buyers, the main issues were quality and consistency of supply. For trucking and shipping companies, the high costs of dealing with a large number of smallholder farmers, who lacked professionalism in their business dealings, was the key issue. Common complaints about the smallholder farmers were: they did not deliver or pick up on a schedule, they used inappropriate packaging, and they lodged unreasonable compensation claims when something went wrong with their produce, regardless of the reasons. For financial service providers, there were also high risks and high costs dealing with smallholder farmers. This was not only because their income was variable and unpredictable due to the biological nature of farming, but also because they were financially illiterate, having a “handout mentality” and a tendency to see loans as grants, rather than as debts that must be repaid. However, all these issues in dealing with smallholder farmers were not a major concern overall to these businesses, because sweetpotato constituted only a small proportion of their total business, and in most cases was unprofitable anyway. The overall result though is that farmers do not receive the services that they require.

The key message from the business sector is that if smallholder farmers want to do business with them, they must become more business-like and demonstrate that they are worthy business partners. For wholesalers and institutional buyers, this means that smallholder farmers must pay more

attention to quality, change their packaging, and carry out proper sorting and grading. They must also honour their commitment to deliver. From the perspective of transport service providers, smallholder farmers must organise themselves and consolidate their sweetpotato bags into full container loads for pick-up from one central location. For credit providers, smallholder farmers need to become financially literate and learn how to manage money and cash flow, as well as change their attitude towards loans. These cannot be viewed as grants, and must be invested in profitable business activities so they can be repaid including interest.

Phase 2. Capacity Building Pilots

From the value chain analysis, it is clear that smallholder sweetpotato farmers faced many issues, and most of these issues may be addressed by equipping smallholder farmers with the necessary skills and knowledge through education and training. In this section, we summarise the activities undertaken to build the capacity of smallholder farmers to improve their performance in the sweetpotato value chain, which started with a needs assessment.

Needs assessment

In the survey of 186 sweetpotato farmers in the Highlands, they were asked to indicate the kind/s of training/information they have received and from whom, and what their training needs were. The majority of respondents believed that as far as the production and marketing of sweetpotato was concerned, it was their own experience and knowledge they relied on the most. However, extension workers and farmer organisations also played an important role in the dissemination of information and skills training on various farming operations, such as nursery making, transplanting, and chemical and fertilizer use for introduced vegetables. About 52% of respondents indicated a need to know more about sweetpotato production in general terms, while 28% needed information specific to marketing and postharvest activities. Forty-seven per cent of respondents indicated they had attended various training sessions, including farming in general, marketing, postharvest, and financial literacy. Thirty-four per cent of respondents wanted to have access to more training to develop their skills in accessing and selling produce to long-distance markets.

Training workshops

A series of training workshops were provided to selected groups of sweetpotato farmers in the following areas: financial literacy; marketing planning; costing and gross margin analysis; and postharvest management. Training materials used included: slide shows of what grading and quality sweetpotato, and other fresh produce, should look like, and powerpoint presentations of basic theory and principles; posters that summarised the main points of a topic, as well as recommendations for change; booklets that explained the reasons for learning and the learning objectives of each topic; and video clips demonstrating the long distance sweetpotato value chain from harvest to arrival at the wholesale market in Port Moresby.

Workshop participants were first exposed to basic theory and principles related to each topic, followed by group exercises to give them the opportunity to work together and learn from each other, with one member elected as a group leader. During the workshop, each group stayed together for all exercises and breakout sessions. They were encouraged to practice what they have learned together after the workshop, for example in developing a marketing plan, bookkeeping, identifying potential buyers, and so on. They were also encouraged to meet regularly to talk about issues they considered important, and to work together to address them, where assistance from research team members would be available if necessary. Working together in a group in this way is similar in essence to a farmer field school, in that it is participatory and demand-driven.

Feedback from the workshop participants was positive. Many were able to use the knowledge gained to improve their marketing practices, which helped in attracting more customers and increasing their income.

Lessons learned from piloting farmer training and capacity building

- It is imperative, within a participatory framework, to discuss and trial potential interventions with stakeholders, rather than attempt to implement interventions based on researchers' technical knowledge.
- PNG has a diverse culture and unique social structure. This means to enact changes in a community, local cultural and political factors need to be taken into account and relationships with the community leaders, and the whole community, need to be established to build trust. This process can considerably slow project progress, and should be factored in future project design.
- Women are keen learners. Since women carry out most production, harvest and postharvest activities, it is imperative to include them in future training workshops, and to target them for dissemination of extension material.
- It is quite clear that the majority of participants had an entrenched idea that whatever the problem may be, it is always someone else, not themselves, who must do something about it. Therefore, it will take more than one workshop or two to change this attitude, or to impart knowledge or a new way of thinking. More time and more resources are also required on the ground for real change to occur. This means that identifying both agents of change and local facilitators is crucial for success.
- Exercises during the workshops and follow-up after the workshop are also crucial to make sure the agents of change have learned what they were supposed to learn, and were actually equipped with the new technology/information, and were also able and willing to pass their new knowledge on to grassroots farmers.

Phase 3. Stakeholder Consultations

Potential development partners were consulted after the pilot training program, including the Department of Agriculture and Livestock, national agricultural research and extension organisations (National Agricultural Research Institute (NARI) and FPDA), provincial governments in Jiwaka and Morobe provinces, primary schools, women's groups, NGOs and private sector service providers. The main objective of the consultation was to understand the current status of the extension system and support services for assisting smallholder farmers in PNG, and their role in it. The other objective was to identify potential areas for collaboration. There was significant interest in building capacity in the business management skills of their staff and of farmers. Included below is a summary of what we learned about the current status of the agricultural extension system in PNG, as well as alternative extension models and projects that were implemented to strengthen the capacity of service providers.

Agricultural research and extension services for farmers in PNG

In PNG, provision and support for agricultural extension is largely a government responsibility. This is shared between the three-tiers of government (national, provincial and district), the national agricultural research system (NARS), statutory commodity boards, and semi- or quasi-government organizations (Sitapai, 2011). The aim is to provide knowledge and skills to farmers to make their farming operations more productive, and to increase production. However, since 2000, several non-governmental organizations (NGOs) and community-based organizations (CBOs) have also become actively involved in the delivery of agricultural services. Most of these organizations are linked to donor and financial institutions, churches, farmer's groups, women's groups, or associations seeking to initiate local area development (Lahis, 2008). These organizations have emerged in recent years in response to the breakdown of government service delivery efforts of the past. Lack of human resource capacity in the national extension service is a major factor affecting the level and quality of service delivery in PNG (Sitapai, 2012). This is most apparent in the provincial extension service, where budget constraints have drastically reduced staff numbers over two decades. The capability and capacity of service providers in the private and quasi-private sector vary considerably. Most are weak in their analyses of community needs and in their formulation of

desired project interventions that deliver real benefits to the people on a sustainable basis.

In addition, there appears to have been changing paradigms in extension in PNG over time, moving from a technology transfer (such as the Training and Visit (T&V)) model to human resource development (such as farmer field schools (FFS)), and from a top-down, supply-driven approach to a participatory, demand-driven approach. These changes reflect the fact that capacity is more important than technology in an increasingly more complex environment in which farmers operate, and recognition that farmers have the local knowledge and experience to contribute to identifying and resolving their own problems – they are not merely recipients of new technology.

These different approaches are complementary rather than mutually exclusive. Resosudarmo and Yamazaki (2011) found that the T&V model, which focuses on technology transfer and is supply-driven, is useful when farmers are less educated and the technology transferred is simple. However the FFS model, which focuses on human resource development and is demand-driven, is more useful for dealing with more complex issues such as integrated pest management and environmental sustainability. The ideal model is one that suits the local context and meets the needs of participants.

Different approaches to agricultural extension to farmers have been piloted in PNG in recent decades, driven mainly by donors (Sitapai, 2012). They include:

The Village Extension Worker (VEW) Program at FPDA. The VEW project, funded by German Development Services, began in 1998. This pilot extension program was targeted at female farmers, in recognition of their involvement in farming and the insufficient support available to them from existing (mostly male) extension staff (Kindiwa and Mullen, 2008). The project aimed to support female farmers with technical information, improved technologies and planting materials, as well as empowering and building and strengthening networks. It selected female leaders from different communities, providing them with basic training to serve as part-time agricultural extensionists (VEWs) in their home communities.

The program started with an introductory training course covering the role of VEW, gender awareness, and basic farm management (record keeping), as well as vegetable production (nursery making, composting, transplanting, and fertilizer and chemical use mainly for introduced vegetables), marketing and processing. VEWs were expected to pass on new skills and information to their contact farmers, normally 10-12 farmers, both female and male. Likewise, contact farmers were expected to pass on the newly acquired skills and knowledge to other farmers. After the introductory training course, further training for VEWs was provided upon demand, depending on community need. Each VEW was visited once a week by an extension officer to monitor the progress, answer questions, and provide technical advice when necessary. Some technical issues were referred to appropriate specialists at FPDA and agricultural advisors from DAL.

The pilot program was tested in the Western Highlands and Eastern Highlands provinces, and was later adopted as a regular program and extended nationwide to include other provinces (Morobe, East New Britain, Central and Milne Bay). With the expansion of the program and a change of focus of FPDA policy, the proportion of women VEWs had fallen from the initial 100% in 1999 to 38% in 2008 (Kindiwa and Mullen, 2008). However, the outreach of the program is limited because there are limited numbers of VEWs in each province (not more than ten), and the turn-over of VEWs is slow as the training program for each cohort of VEWs could go for many years (Chang et al., 2014). Another drawback of the program is the focus on technical skills in farm production, without much attention to marketing and business skills (Kindiwa and Mullen, 2008). Farmers often complain about access to market and oversupply in the local market. The VEW program was modelled after the T&V extension model popularised by the World Bank from mid-1970s to 1990s, except for its initial focus on female farmers and the small-scale operation.

The Smallholder Support Services Pilot Project (SSSPP). This Asian Development Bank (ADB)-funded project commenced in 1999 and ended in 2007. Its aim was to strengthen provincial extension using a mixed model of public funded-private delivery and contracting-out of extension

services to smallholders (Lahis, 2008). The key aspects of SSSPP were as follows: (1) interested communities were assisted to identify their priority needs and formulate action plans through participatory rural appraisal and planning (PRAP); (2) a pool of interested service providers were contracted to deliver services in response to community action plans; (3) farmers participated in the monitoring and evaluation of implementation, supported by external evaluation of contract outputs and outcomes; (4) public private partnerships and joint ventures were promoted in service delivery; and (5) adequate backstopping and capacity building of service providers was ensured. Reviews of SSSPP indicated that there was wide scope for adoption of the contracted mode of extension used. However, it would require a holistic government response to community development needs, beyond agriculture. It needs also to take into account the overall rural development needs on a cross-sectoral level. SSSPP was succeeded by the Smallholder Support Services Extension Project (SSSPP), which ran from February 2010 to July 2012. The future for this program is uncertain.

The Bris Kanda Program. Bris Kanda Inc. is a rural enterprise development organization, established in 2006 under a 10-year program assistance package provided by the New Zealand Government in the Huon District of Morobe Province. The organization's overall goal is to reduce poverty and vulnerability amongst target rural communities through improved and sustained income generation. It uses a participatory approach to identify weaknesses in smallholder production and supply chains, to find appropriate solutions, and to connect smallholders to relevant services. It is the first project intervention in PNG that promotes market-oriented agricultural extension and advisory services. A mid-term review of the program in 2010 rated the approach as the most innovative and timely, given the deficiencies in government efforts to promote rural development in recent years (Mohamed and Sitapai, 2010). The review concluded that strategic partners (who may include private or quasi-governmental service providers) are the pillars underpinning the approach to service delivery. The concept of engaging strategic partners who have a mandate to serve rural communities is expected to strengthen this approach, and fulfills the expectation of the government's public private community partnership policy.

Farmer Field Schools (FFSs). The FFS extension model was trialed by the Cocoa and Coconut Institute (CCI) to encourage farmers to work together as a group to improve farm management practices to control cocoa pod borer (Sitapai, 2010). This group-based learning process is similar to what have been used in several countries to promote integrated pest management (IPM). FFS, which focuses on experiential learning and farmer-to farmer exchanges, have resulted in wider stakeholder participation and stronger commitment from participants because they are allowed to take decisions regarding options and outcomes through interactive processes.

Small and Medium Enterprise Access to Finance Project. This project, funded by the World Bank and GoPNG for 2011-2024, is designed to facilitate access to sustainable credit for Small and Medium Enterprises (SME), and to contribute to employment and income generation. There are four components to the project: 1) establishing a Risk Sharing Facility (RSF) to partially guarantee a portfolio of newly-originated loans to SMEs; 2) providing technical assistance to financial institutions; 3) building capacity for SMEs; and 4) upgrading the capacity of the Department of Commerce & Industry (DCI) to implement and monitor the project, and its capacity to implement an updated SME strategy and policy. It is recognised that SMEs in PNG face significant constraints in terms of business and financial management capacities. Capacity building for SMEs consists of four sub-components: (a) SME management and financial skills training; (b) SME mentoring and coaching; (c) training for women entrepreneurs; and (d) support for provincial government commerce staff. Although farmers have been urged to see farming as a business, capacity development and training programs that aimed at improving business skills normally target SMEs in the urban centres and do not include farmers.

Institutional capacity building for NARS organisations

Several institutional capacity building projects were funded by AusAid, NZAid and the World Bank in the past two decades, with the aim of improving governance of NARS organisations and other

government agencies, and their service delivery to farmers and small to medium sized businesses. Some examples include:

- The Australian contribution to the National Agricultural Research System (ACNARS) for NARI, funded by AusAid.
- The Institutional Strengthening Project (ISP) for FPDA, funded by NZAid.
- Productivity Partnerships in Agriculture (for coffee and cocoa), funded by the World Bank.
- The Agricultural Research & Development Support Facility (ARDSF), funded by AusAid.

ARDSF is worth discussing in more detail here because it has set the stage for an improved RD&E system by the framework it has promoted and the enhanced policy and service delivery capacity of the NARS organisations it has instigated. ARDSF was implemented from 1997 to 2012 to assist the NARS organisations to realign their research strategies to focus on development, rather than merely generating, transferring, and adopting technologies. Adherence to the concept of Agricultural Research for Development (AR4D) is a paradigm shift from a linear model of research-technology transfer to accommodating the integrated and collective actions of stakeholders to improve technologies, policies and institutions (Mbabu and Hall, 2012).

POLICY IMPLICATIONS

Based on the reviews of the research and extension system in PNG (ANZDEC, 1993; McKillop, 1994; GoPNG, 2000; Dekuku et al., 2005; Ministry of Agriculture and Livestock, 2006), it is clear that reforms to the system are needed, in particular, to formulate a comprehensive national extension policy that is inclusive and pluralistic in service delivery and financing. The key challenges to be addressed for designing a new system are outlined in Sitapai (2012). They include: (1) focusing on best-fit approaches that are flexible, relevant, pluralistic and demand driven, rather than best-practices and quick fixes; (2) enhancing pluralism in advisory service provision to capitalise on the comparative advantages of different types of service providers and organisations; (3) increased accountability of rural clients through farmer organisations to ensure extension services are relevant and effective for rural people and their livelihood goals; (4) enhancing human resource development for extension to equip advisors and other rural development actors with the necessary skills to deal with the constantly changing and complex environment in which they operate; and (5) ensuring sustainability by moving beyond pilot projects to institutional development to strengthen policy-making and implementation capacity in the relevant agencies. Despite those clear guidelines, innovative, practical and sustainable solutions are yet to be found. Key issues and the way forward will be discussed in a stakeholder workshop, which is due to commence in April 2015.

The stakeholder workshop will discuss the results from the Phases 1 - 3, and to identify impact pathways (including target locations, communities, organisations, etc, agents of change who can act as catalysts for change, development partners, service providers, and methods of delivery) and to develop action plans for upscaling capacity building and transfer of knowledge activities in the wider farming community. The results from implementing the action plans will then be presented to the policymakers by the end of 2015, and used as a basis for developing a national strategy for improving the RD&E system for the agriculture sector in PNG.

CONCLUSION

This paper summarises the RD& E activities undertaken in a series of projects aimed at improving the PNG sweetpotato value chain. The results indicated that there were serious issues facing smallholder sweetpotato farmers, in the areas of access to credit, transport infrastructure, and support services, as well as issues related to postharvest handling, market institutions, and chain coordination. Given the current stages of economic and human development in PNG, smallholder sweetpotato farmers lacked the necessary resources and skills to tackle many of the problems that they themselves have identified. To take advantage of a growing demand for high quality sweetpotato, smallholder farmers must acquire new skills, change their current marketing and

postharvest practices, and work together in order to access markets more effectively. There is a role for government to provide extension and support services to build the capacity of smallholder farmers so that they can participate and contribute to economic development, as well as improve their livelihood. As the quality of support services is a pre-condition for successful capacity development, more resources are also needed to support extension and business development service providers to improve their service delivery. Therefore, a flexible and coordinated national approach to RD&E is required to help smallholder farmers achieve productivity gains and improved livelihoods.

BIOGRAPHY

Associate Professor Chang has a PhD in Agricultural Economics from the University of California at Davis. Her specialties include subsector analysis and industry planning, value chain and market development, and feasibility studies. Her most recent research focuses on improving marketing, postharvest management and value addition of sweetpotato in Papua New Guinea. This involves identifying and addressing technical and socio-economic constraints using the participatory action research approach, and building the capacity of women's groups, market researchers, and extension personnel in PNG. Her research is funded by the Australian Centre for International Agricultural Research.

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