Volume 4 No: 12 (2019)

Policy Makers Engagement in Agricultural Innovation Processes in Ghana: Successful and Unsuccessful Cases of Technology Dissemination

Egyir Irene S. and Ampadu-Ameyaw Richard.

June 2019

ISSN 2550-3359

Citation
Egyir I.S. and Ampadu-Ameyaw R (2019). Policy Makers Engagement in Agricultural Innovation Processes in Ghana: Successful and Unsuccessful cases of Technology Dissemination. FARA Research Report Vol 4 No 12 PP48

Corresponding Author
Ampadu-Ameyaw Richard (r.ampadu@yahoo.com)

FARA encourages fair use of this material. Proper citation is requested

Forum for Agricultural Research in Africa (FARA)

12 Anmeda Street, Roman Ridge PMB CT 173, Accra, Ghana Tel: +233 302 772823 / 302 779421
Fax: +233 302 773676 Email: info@faraafrica.org Website: www.faraafrica.org

Editorials
Dr. Fatunbi A.O (ofatunbi@faraafrica.org) and Mr. Benjamin Abugri(babugri@faraafrica.org)

ISSN: 2550-3359

About FARA

The Forum for Agricultural Research in Africa (FARA) is the apex continental organisation responsible for coordinating and advocating for agricultural research-for-development. (AR4D). It serves as the entry point for agricultural research initiatives designed to have a continental reach or a sub-continental reach spanning more than one sub-region.

FARA serves as the technical arm of the African Union Commission (AUC) on matters concerning agricultural science, technology and innovation. FARA has provided a continental forum for stakeholders in AR4D to shape the vision and agenda for the sub-sector and to mobilise themselves to respond to key continent-wide development frameworks, notably the Comprehensive Africa Agriculture Development Programme (CAADP).

FARA's vision is; "Reduced poverty in Africa as a result of sustainable broad-based agricultural growth and improved livelihoods, particularly of smallholder and pastoral enterprises" its mission is the "Creation of broad-based improvements in agricultural productivity, competitiveness and markets by strengthening the capacity for agricultural innovation at the continental-level"; its Value Proposition is the "Strengthening Africa's capacity for innovation and transformation by visioning its strategic direction, integrating its capacities for change and creating an enabling policy environment for implementation". FARA's strategic direction is derived from and aligned to the Science Agenda for Agriculture in Africa (S3A), which is in turn designed to support the realization of the CAADP vision.

About FARA Research Result (FRR)

FARA Research Report (FRR) is an online organ of the Forum for Agricultural Research in Africa (FARA). It aims to promote access to information generated from research activities, commissioned studies or other intellectual inquiry that are not structured to yield journal articles. The outputs could be preliminary in most cases and in other instances final. The papers are only published after FARA secretariat internal review and adjudgment as suitable for the intellectual community consumption.

Disclaimer

"The opinions expressed in this publication are those of the authors. They do not purport to reflect the opinions or views of FARA or its members. The designations employed in this publication and the presentation of material therein do not imply the expression of any opinion whatsoever on the part of FARA concerning the legal status of any country, area or territory or of its authorities, or concerning the delimitation of its frontiers".

Acknowledgement

The study was initiated by the Science Technology and Policy Research Institute in collaboration with FARA and funding from ZEF. Our sincere thanks go to the research assistants, who supported the data collection, processing and report writing. The research assistants team was led by Stephanie Asafu-Adjaye and supported by Yvonne Tackie and Joseph Bandanaa, all from the University of Ghana. We are indebted to all the key informants in the various ministries' departments and agencies (MDAs), Research Institutes of the Council for Scientific and Industrial Research and University of Ghana as well and non-governmental organisations (NGOs), without whose responses the study would not have been completed within the specified time.

Introduction

Background

Ghana's agenda for shared growth and development considers accelerated modernisation of agriculture and sustainable natural resource management as one of seven key thematic areas (GoG, 2014). Productivity improvement is highlighted, and application of science and technology is an important objective in promoting crops, livestock and fisheries. Innovations in terms of new perceived methodologies, techniques, methods, processes or products have been recognised as important step in the agricultural development agenda. The importance of institutional coordination in the promotion of innovation has not been ignored; "…to strengthen the intra-sectoral and inter-ministerial coordination through the platform for joint planning and review; the development and implementation of a communication strategy to improve institutional coordination; as well as create and strengthen the framework for coordinating activities among the range of diverse stakeholders in the sector" (GoG, 2007). What is not yet well understood is the effectiveness of including different personnel from a wide range of institutions related to agricultural innovation development and dissemination. The issues of who policy makers are, the contribution they bring on board and how they maintain their status in the agricultural innovation process are the concern being addressed.

This study is about the success stories of engagement of policy makers in agricultural innovation processes in Ghana. Mytelka (2000) defined innovation as the 'process by which firms master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to their competitors', their countries or the world. Makini et al. (2013) defined innovation as the process of application of new or existing knowledge in new ways and contexts to do something better. According to Ampadu-Ameyaw, Omari & Essegbey (2017), agricultural innovation includes all kinds of profitable, reproducible/disseminable changes (radical and/or incremental) and/or adaptations that occur in the agricultural sector. It is a process that transforms ideas into outputs by replacing older established products, processes and services with new ones. Agricultural innovation can relate to capitals for production such as land resources, financial resources, human resources and livestock resources at local, national, regional and international levels. It can also relate to inputs such as seeds, breeds, water, fertilisers, feeds, pesticides, extension and advisory services at local, national, regional, and international levels. An innovation can relate to technics/practices, technologies, infrastructure and hard and soft institutions (policy initiation/identification, [re]designing, implementing, monitoring and evaluation organisations and policies), guiding access to, management of, learning from/about, and innovation processes.

In another vein, this study considers an agricultural innovation process as all the steps that lead to an agricultural innovation. These steps essentially include interaction with/among human beings and humans and natural phenomena, learning from interactions, inspiration or perception of innovation idea; taking initiatives for the materialisation of the innovation idea; and the materialisation of the innovation idea. The other steps include the test of the or use of

the innovation; evaluation of the performance of the innovation; disclosure of the innovation to potential users; commercialisation and/or dissemination of the innovation; monitoring and data collection on users' perceptions and additional aspirations about the innovation; and finally, the continuous improvement of the innovation for improved performance based on information gathered from users, or inspirations of innovators. Studying agricultural innovations would therefore come down to researching on changes occurred/induced in agriculture related capitals, inputs, technics, technologies, infrastructures, hard and soft institutions at local, national, regional, and/or international levels, depending on the level concerned with the study.

Context and Justification

Achieving greater strides in the agricultural sector growth requires the innovative use of existing and new technologies and innovations that are directed towards increased land and labor productivity, efficient use of natural resources as well as adopting policies that ensures that producers in general can reach markets that generate greater value additions and sustainable incomes. Ensuring that such innovations contribute to the 'One World No Hunger' initiative of the German Government, the project dubbed "Programme of Accompanying Research for Agricultural Innovation" (PARI) is currently running in 12 different African Countries, each supported by the German Government through BMZ and coordinated in Africa by the Forum for Agricultural Research in Africa (FARA). This project aims at contributing to food and nutrition security through efficient and functional innovation systems research and development in partner countries.

In 2016 the PARI sponsored a study into exploring the factors determining scaling up of innovations and technologies in Ghana to inform policy about the factors needing critical focus in scaling up of agricultural innovations. It is understood that investments in promising agricultural innovations can hardly succeed without the firm contribution of policymakers. Hence, studies that document the conditions relevant for effective engagement of policy makers in agricultural innovation processes become relevant. In 2017, CSIR-STEPRI and FARA expanded their research and development activities to include aspects which focused on policy makers' involvement in the development, implementation and promotion of agricultural innovations in Ghana.

Agricultural innovation development is seen as important tool by which majority of the poor in developing countries, whose livelihoods depends on the agriculture sector can descent out of poverty. Yet despite this understanding most agro based technologies and innovations developed still find themselves on the shelves of the scientific communities. The rate of adoption of these technologies remains low and limited, circulated among a few farmers in most of these countries. It is widely admitted that decisions targeting people in any area are hardly and effectively implemented, when policy makers are not sufficiently and efficiently engaged for the relevant design and effective implementation of the concerned decisions. This is because, all over the world, policy makers are often the people granted with the means and powers necessary for the identification/initiation, (re)design, implementation, monitoring and

evaluation of public policies. This reality applies also for agricultural innovation policies in countries (Jones and Kimura, 2013).

While many studies have addressed adoption of agricultural innovations, there seem to be very few studies focusing on success stories of engagement of policy makers in agricultural innovations in African countries (Ampadu-Ameyaw et al., 2016 & 2017). This study aims at filling this gap and inspiring the success of further agricultural innovation policies. Findings from this study will provide useful inputs for researchers, governments, the private sector, donors, and other stakeholders to improve policy-maker engagement processes for innovations to ensure appropriate development and dissemination of innovation and maximise their socio-economic impacts on the wider population.

In the context of this study, the levels to consider for the study are local and national. Given the need for focus, the study addressed four agricultural innovation processes in the country. These agricultural innovation processes included:

- High quality cassava flour
- Simple Water Control Strategies for Rice Cultivation
- Maako Ntoose, and,
- Utilisation of Azolla as manure in lowland rice cultivation on vertisols.

The four can be grouped under crops development. In the Ghana Shared Growth and Development Agenda (GSGDA II), government's intention to support food crops for food security, export and industry is specified" (GoG, 2014).

Study Objectives and Expected Results

Objectives

The main objective of this study is to examine the success stories of engagement of policy makers in agricultural innovation processes in Ghana. To achieve the stated objective, the following specific objectives that emanate from the topic were addressed:

I. Identify and document two brilliant success cases of engagement of policy-makers/authorities/officials in agricultural innovation processes in Ghana.
II. Identify and document two brilliant failure cases of engagement of policy-makers in agricultural innovation processes in Ghana.

Draw and document lessons about key success and failure factors of engagement of policy makers in agricultural innovation processes.

Expected results

I. Two brilliant successful agricultural innovation process cases are identified and documented.
II. Two brilliant non-successful agricultural innovation processes are identified and documented.

III. Lessons about key success and failure factors of engagement of policy makers in agricultural innovation processes are documented.

Scope and Limitations

The study was planned to discuss four case studies, two successful and two unsuccessful. It was phased in one month. The challenges with rapid appraisal studies are obvious – missing key informants in the relevant institutions. The period slated for the assignment coincided with the 2017 Christmas Break and Leave period (January 3-19, 2017) for many officers in both public (including directors and members of parliament) and private institutions. Persons who had knowledge of the innovations but were not directly involved in the processes, were more likely to be encountered. Many officers who were involved in the specific innovation processes were no longer with the institutions after 2-3 decades. Key target beneficiaries of the agricultural innovations were also to be identified and interviewed on their appreciation of the innovation processes and gains obtained. However, the key target beneficiaries of the innovations were not identified and interviewed due to time and logistical constraints. Evidence of photos, videos and documents online in the World Wide Web and grey literature were sought to triangulate information provided by informants at the institutional level

Organisation of the Report

The report is organised into five sections. Apart from the introduction, section two presents a literature review of conceptual definitions and a brief description of agricultural policy making in Ghana. Section three presents the study's methods, describing the approach for data collection and analysis as well as brief background and perceptions of study interviewees. Section four addresses the results and discussion, presenting the history of each innovation, factors of innovation success and the level and process of engaging policy makers in the innovation process. The study's conclusions, decision and policy implications are described in the last section.

Literature Review

Innovation, Innovation System and Organisation

The challenges of today's world are bringing many pressures to bear on agriculture: population growth; the impact of climate change; the need to reduce greenhouse gas emissions in agriculture; rapid development of the emerging economies and growing instability associated with land; water and energy shortages, etc. This scenario heightens the critical role of innovation to make agriculture more competitive and sustainable**.**

Innovation: In general terms, innovation is a process by which something new is implemented in a given context; it is socially appropriate and provides benefits for the parties involved. It serves as a driver of economic growth and competitiveness in countries (IICA, 2014). In the context of farming, innovations are concerned primarily with increasing production – of food,

fodder, secondary products – and enhancing quality – of products, growing conditions, production process, etc. Agricultural innovations typically involve one or more of the following areas: crops and animals (biological and/or genetic changes), growing conditions, implements and management practices (Evenson, 1974).

Innovation system: The innovation process comes about largely within "innovation systems" made up of organizations and private and public stakeholders interconnected in different ways and possessing the technical, commercial and financial competencies and inputs necessary for innovation (IICA 2013 & Albaiges et. al, 2009). The World Bank (2007a) defines it as a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance. Investments in innovation should reflect all parties' diverse needs for knowledge (World Bank 2007b). The performance of innovation systems depends on the interaction among the different people and institutions responsible for generating and disseminating knowledge and technology (OECD, 2002), stakeholder learning processes and the creation of an innovation-friendly environment.

Agricultural innovation systems (AISs) are characterized by two chief factors: the combination of participants involved, and the dynamic interactions among them. The key participants include farmers and farmer associations, providers of inputs or technical and financial services that promote the development or adaptation of new knowledge, those who encourage an exchange of knowledge and promote learning, those who are engaged in adding value to production, and those who facilitate market access. Research and technology development organizations are an integral part of the AIS, as are public and private extension services that play a critical role in facilitating access to knowledge and capacity building. If the work of the AIS can be improved through better coordination among participants, it will produce a greater capacity for innovation to respond to emerging needs and opportunities (IICA, 2014). It can also encourage the private sector to invest in creating and implementing innovations.

Innovation process: A common classification or categorization of the stages of innovation in the management literature is exploration/invention (which captures the activities of transforming an idea or insight into a specific product/service offering and illustrates the degree of learning and competence building), and exploitation or commercialization (which involves the activities of moving that new product/service through the stage gate process to assess its value in the market place and actually offer it to customers or end users). The innovation process itself has been described by various authors resulting in a high number of different approaches. Gerpott (1999) describes the three phases from an idea perspective: (1) Idea Generation and Selection; (2) Idea Realisation; and (3) Idea Commercialisation. The Stage-gate process of Cooper (2001) consists of five stages of different activities (scoping, building business case, development, testing and validating, and launching) and five gates where the outputs of these activities are assessed/reviewed. Mohanty et al. (2005) summarize the innovation activities into three phases: (1) basic phase; 2) applied phase; and 3) development phase. The basic phase is the stage during which the knowledge concerning the technology and the needed resources is collected through

methods such as surveys, various laboratory studies, process plans of previous products, economic evaluations of different process plans. In the applied phase, the technology is developed, and process plans for the development of the new products are mapped out. Feasibility studies and economic evaluations are also conducted in this phase. During the development phase, the technology developed in the previous phase is used to develop the new product. Design, quality, and procurement issues are considered at this time.

Conditions of innovation: The transfer of new technologies is a complex process and fraught with difficulties, primarily because such new techniques and technologies can function successfully only if they can be embedded within local circumstances (Evenson 1974; Mokyr 1990; Rogers 2003). Apart from the specific characteristics of the innovation, economic, social, cultural, ideological and psychological conditions all play a significant role in the diffusion process and serve as conditions for innovation. Most particularly, sufficient domestic development, institutional and regulatory frameworks, a reservoir of knowledge and human skills, economic and financial conditions, a society that is demanding innovation, and a welcoming regional and global environment. It is therefore important to ensure an enabling environment for innovation, and the government (including the different sectors, ministries and institutions) must play a key role by improving the quality of human resources by means of a sound educational system, health policies, infrastructure and the like (OECD, 2013). There should be agricultural policies that reduce market distortions, and policies for science, technology and innovation, intellectual property rights policies, simplification of regulations whenever possible, and the development of financial and technical services that support innovation processes along the links of the value chains. A basic requirement is the presence of safe, predictable legal and regulatory frameworks with clear government objectives that encourage innovation; innovation systems also need to be developed.

Stakeholder Engagement

Stakeholder platforms engage producers together with market agents and agricultural service providers (including public policy service) in group activities to identify market interests, share market knowledge and develop new business opportunities (Devaux et al., 2008). These forms of collective action should generate commercial, technological and institutional innovation and new market niches and benefits for all actors. Biggs et al. (2010) also referred to stakeholder engagement as the process of engaging people with a stake in a decision in the process of decision making, taking into account their varying perspectives, priorities, and limitations. To sustain stakeholder engagement, Klerkx et al. (2012) suggested innovation brokering (IB). IB is about performing several linkages building and facilitation activities in innovation systems, creating an enabling context for effective policy formulation and implementation, development and innovation. Initiatives that foster environmental awareness and attachment to local ecosystems, develop capacity for social entrepreneurship in the environmental arena, promote dialogue between key stakeholders, and provide institutional support to new institutions may facilitate the emergence of integrated, collaborative ecosystem-management approaches

(Biggs et al, 2010). Neef and Neubert (2011) contended that agricultural researchers engaged in participatory processes with local stakeholders should decide for which issues and in which phases certain participatory elements could be used in a specific research context.

The challenges with engaging stakeholders successfully and for a long time have been identified. A critical challenge in ameliorating the emergence of new problems is the design of ecosystem-management institutions that remain innovative and adaptive over time (Gunderson and Holling 2002; Berkes et al. 2003, Chapin et al. 2009). Broad engagement means more objectives, tradeoffs, and complexity. Various constraints of stakeholder involvement are recognized, with institutional and governance concerns identified as the most severe obstacles to implementation (Sayer, 2013). Failure to engage stakeholders in an equitable manner in decision- making processes will lead to suboptimal, and sometimes unethical, outcomes. All stakeholders should be recognized, even though efficient pursuit of negotiated solutions may involve only a subset of stakeholders. Solutions should encompass a fair distribution of benefits and incentives. Wilsdon and Willis (2004) observed that public engagement in the scientific process can lead to better, more robust funding decisions provided it is used to open up questions, provoke debates, expose differences and interrogate assumptions.

In Ghana, multi-stakeholder platforms for decision making in the agricultural system has been experimented by the International Water Management Institute (IWMI), GIZ, International Institute of Tropical Agriculture (IITA), Forum for Agricultural Research in Africa (FARA) and UG-Led Convergence of Science. For IWMI success was linked to the "flexibility in process facilitation and implementation, supported by the achievement of various outcomes (Amerasinghe et al., 2013). Another factor was the participatory involvement of stakeholders in the decision-making process in iterative steps that allow for shared learning, collaborative planning and eventual interventions with a likelihood of institutionalization, out-scaling and up-scaling.

For GIZ, the success of the value chain platform at the local level was linked to the specificity of issues and benefits derived by both business and non-business actors. A key challenge was linked to the use of ToT Approach to select members who were referred to as "competent to participate". As Sunding and Zilberman (2000) assert private investment in the generation of embodied innovations requires appropriate institutions for intellectual property rights protection. When the gains in engagement were not forth coming some members exited the platform and ceased to make contributions.

A recent review of the Research for Development (R4D) Platforms used by the Africa Rising Project of IITA concluded that the intervention worked because stakeholders shared similar visions, were interested in addressing farmer needs and rollout technologies; joint efforts of active stakeholders could be mobilised and sharing and learning could be supported (Yasabu, 2017). However, private sector could not be engaged, and government officials could not retain their membership. Other unclear issues bothered on time for operation, ownership of platform and budget.

FARA's Dissemination of New Agricultural Innovations in Africa (DONATA) project employed Innovation Platforms for Technology Adoption (IPTA), a multi-stakeholder innovation platform comprising representatives of farmers and farmers' organizations, extension workers, agro-processors, marketers, agribusiness actors, transporters and researchers, policy makers and, in some cases, media practitioners and credit-services providers. In Ghana IPTAs for cassava value chains was implemented from 2011 to 2014. Success of IPTA in Ghana is linked to clarifying relevancy to the community to ensure that proposed interventions are the real felt needs of the community. Others were, resolving the following challenges to sustain the IPTA: Limited skills and competence in setting up a functional IP through training in multi-stakeholder processes and value chain approach, and learning visits in 2012 to Burkina Faso and Gambia IPs, respectively; setting up of effective governance for sustainability of IP; effective integration of M&E on platform activities; presenting a result-based M&E report; changing mindset of research and extension facilitators and other actors and providing regular internet services.
The COS-SIS implemented from 2006 to 2014 helped national, sub-regional and African agricultural research organisations, universities and other public and private sector agencies, including non-governmental organisations (NGOs), to strengthen their programmes. In Ghana, the success of the project in the oil palm value chain was linked to lengthy and thorough exploratory and diagnostic scoping studies before the platforms were initiated; it was recognised that joint learning requires good skills in adult learning and facilitation. Joint learning on platforms is also time demanding for stakeholders.

Policy makers and Agricultural Policy Making in Ghana

The observation that public engagement in the scientific process can lead to better, more robust funding decisions (Wilsdon and Willis, 2004), leads to the question of how policy makers get engaged? Agricultural policy is a public policy. Public policy making refers to action taken by government, decisions that are intended to solve problems and improve the quality of life of its citizens. By implication, policy makers are powerful government officials and others in society. They hold superior positions and can exercise a high degree of control or influence in the agricultural science, technology and innovation system (CTA, 2005).

In Ghana, agricultural policy-making follow the typical cycle with the following elements: (see also Birkland, 2011):

Stage 1- Problem definition or agenda setting,

Stage 2 - Policy formulation,

Stage 3- Policy legitimacy/ adoption,

Stage 4- Policy implementation,

Stage 5- Policy evaluation and

Stage 6- Policy change

There are several types of inputs/ influences that policy makers provide to the process at all stages –idea initiation, coordination, research (basic, applied, baseline or impact assessment studies). Government officials are mandated by rule (embodied in the President) to interrogate key issues in agricultural sector development and thereby provide options for resolving the issues. At stage one of the policy making cycle government officials coordinate the constraint analysis activities involving other political agents (including private consultants, academia, farmer groups and public-sector researchers) (see also FAO 1998). During policy formulation, government officials coordinate the activities to ensure that sectoral objectives, strategies and components of plans align with the broad national agenda. Agricultural innovations are suggested by researchers and discussed by government officials and other political agents. Policy legitimisation/adoption is strictly in the domain of legislators (in Ghana, Parliamentary sub-committees). However, the consultations made with non-state and other civil society groups before adoption is well documented (IFC, 2011). During policy implementation (including baseline studies, piloting and scaling up of innovations), government officials (including public sector research directors) at the national and local level (in Ghana, regional and district), participate as project coordinators, monitors or researchers (Dubbeling et al., 2010). They may partner with private sector and non-governmental organisations to implement innovative or replicated projects and programmes. During policy evaluation, government officials join the review or impact assessment teams as team members/coordinators/ responsible officers. Request for better policy frameworks and outcomes may be initiated by private sector but it is public officials who coordinate the change process and set the agenda for constraint analysis and follow the cycle again.

Sova et al. (2017) admit that some recognised policy stakeholders in climate adaptation policy regimes in Ghana may be more powerful than others. "…several potential cross-level bridging institutions are not considered influential at all operational levels. Farmers, traditional authorities, and the District Assembly, for example, are all considered highly influential from the perspective of local-level respondents, but their counterpart agencies at the national level are not considered influential by policymakers. It is also observed that, in earlier times agricultural policy was presented as the classic case of policy developed by tight policy communities characterized by stability, shared ideology and limited membership (Booterill, 2005). The value of the concept of policy communities in explaining policy development processes and policy change has been demonstrated. The role of farm groups in agricultural policy making in Australia in the early 2000s led to the conclusion that "the combination of ideological and institutional change, particularly in the presence of looser policy networks, can disrupt policy making and lead to network termination resulting in policy change" (Booterill, 2005).

Recent statements on agricultural policy making provide sufficient evidence that policy making is led by the President and officials of the Ministry in Charge of agricultural development (Food and Agriculture, Fisheries and Aquaculture Development, Environment Science and Technology, Trade and Industry) but there are other powers- project financiers, technical advisors and civil society advocates (see Box 1).

Box 1: Statements about Agricultural policy makers in Ghana

"Dr Kwame Nkrumah's agriculture policy started with the establishment of Co-operative and State Farms that were supposed to be run on commercial basis, and by 1962, 26 state farms were established…."
"...the National Liberation Council (NLC) that overthrew the Nkrumah regime in 1966 spelt out its[agricultural] policies as follows: support for farmers by way of marketing, feeder roads, water conservation and irrigation, extension advice and agricultural credit. .."

"…Under the policy, implemented by the Ministry of Agriculture, the State Farms Corporation, Food Distribution Corporation, Settlement Farms, National Investment Bank and private farms, educational institutions were given specific production targets to meet." (IFD, 2007)

"MOFA is the lead agency and focal point of the Government of Ghana, responsible for developing and executing policies and strategies for the agricultural sector within the context of a co-ordinated national socio-economic growth and development agenda. By means of a sector-wide approach, the Ministry's plans and programmes are developed, coordinated and implemented through policy and strategy frameworks…. "
"[Agricultural Policy Support Project] (APSP), which is supporting MoFA to implement [Medium Term Agricultural Sector Investment Plan] METASIP, is being funded by USAID at the cost of approximately US $225 Million up to 2017. The Project is being implemented by Chemonics International Incorporated with Iowa State University (ISU), Centre for Policy

Analysis (CEPA) Ghana and the Ghana Institute of Management and Public Administration as its implementing partners, while the Government of Ghana (GoG), public and private academic and research organizations and Civil Society Organizations (CSOs) are its key counterparts. The five-year Project—December 2013 to September 2018—is expected to strengthen the capacity of policy-makers to identify and implement agriculture policies based on evidence and analysis, strengthen local research capacities to contribute to the policy process and support the efforts of CSOs in their policy advocacy activities" (www.ghana.gov.gh/index.php/).

Study Methods

Method of data collection

Survey instrument

A questionnaire was developed (as part of TOR) as the instrument that was used for the collection of data for this study. The questionnaire consisted of four sections: information on the agricultural innovation stakeholder, understanding of agricultural innovations, policy makers and engagement, history of engagement of policy makers in the agricultural innovation process and the key factors of success and failure of engagement of policy makers in agricultural innovation processes (Appendix 3.1). The histories (about initiation, [re] design, implementation, monitoring and evaluation, and outputs) were documented.

Sample selection

The target population for the study was identified as officers in governmental and non-governmental organisations that were related to the agricultural research and development system. Since no initial list was provided, the plan was to use a snowball sampling approach, and a questionnaire. The snowball sampling will allow surveyors to identify and interview key policy makers and informants. To ensure that the sample for the survey was considered representative of the various policy makers in the agricultural sector, the potential institutions that were considered important in the agricultural innovation process were identified. A listing of government Ministries, departments and agencies (MDAs) and non-governmental institutions that were considered critical in the agricultural innovation process in Ghana was generated. Once the MDAs and institutions were selected, a contacts list was drawn, and a snowball approach was adopted to identify more respondents. A total of 30 contacts were made and given three weeks to respond and complete the questionnaires. Nineteen (19) questionnaires were returned for analysis.

Training of research assistants

In order to ensure that the data collection methods (survey instrument and sampling procedure) were adequate and that collected data were reliable, research assistants (degree holders) were employed and trained. The one-day training session was aimed at ensuring that all field research assistants fully understood what the study sought to achieve and also the rationale for the data collection. The field research assistants were then taken through each question on the questionnaire to clarify and to equip them with a better understanding of the context of every question.

Data collection procedure

The data collection was undertaken over a period of fifteen working days. It started from Wednesday, 3rd January and ended on Friday, 19th January 2018. The survey started from CSIR-STEPRI where researchers helped identify the major agricultural innovations, research institutions and some key informants. Each enumerator was expected to administer at least 5 questionnaires over the period of the data collection. About 70% of the interviews were face-to-face whiles the rest were completed by respondents and returned through email or collected by RAs or through telephone interviews. In all, 19 questionnaires were completed and returned from the Greater Accra and Ashanti regions. A full list of respondents and contacts is attached as Appendix 3.2. The respondents were mainly from academia, research institutions, public administration of ministries' departments and agencies (MDAs) and NGO/specialised group (Figure 3.1). Other groups that were initially targeted but were not able to respond within the limited time were the parliamentary sub-Committee on Agriculture and Cocoa Affairs and political parties. Political Parties have Research and Policy Analysis Units but their involvement in fora that discuss agricultural innovation has been meagre. Other Think Tanks such as The Dankwa Institute, Imani Ghana, Institute of Economic Affairs, Centre for Policy Analysis and Institute for Democratic Governance that discuss economic transformation and food security issues were identified but could not be consulted due to time and logistical constraints. Bringing officers from these institutions in a workshop to include their opinions will be a good way forward.

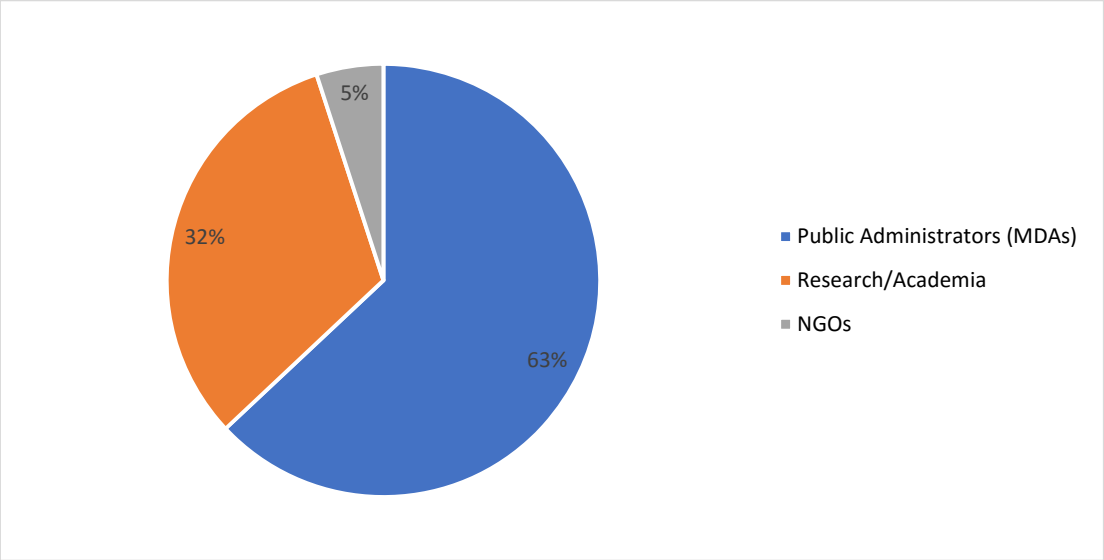


Figure 3.1: Distribution of respondents by category organisation

Method of data Analysis

The study was a rapid appraisal, which entailed the collection of data using a semi-structured questionnaire and application of simple descriptive statistics.

Identifying and selecting most significant agricultural innovations

The agricultural innovations selected for study were included in the Terms of Reference of the study. The "successful" and "non-successful" agricultural innovations were not defined. Hence, the study considered successful innovations as those, which were i) well-known to targeted officers contacted (interviewees) and ii) have documented evidence of continued adoption by farmers. The non-successful innovations were those not known or less well-known and with little or no empirical evidence of adoption success. The four innovations were:

- High Quality Cassava Flour (HQCF) (biology/management);
- Simple Water Control Strategies for Rice (SWCR) (management);
- Maako Ntoose (MNT) (Biology); and
- Utilisation of Azolla as manure in lowland rice cultivation on vertisols (UAM) (Management)

During consultations, the HQCF was identified as the most well-known and successful innovation among policy makers. The other three innovations were mainly known to the relevant CSIR institutes and University Departments only. Among the three, SWCR was the most well-known and therefore termed successful. The evidence of success of MNT and UAM was meagre, so they were considered as the two unsuccessful cases by this study.

Identifying and discussing with policy makers on their engagement in agricultural innovation processes

Policy makers interviewed about the selected agricultural innovations were categorized into two: (1) Those directly involved in the innovation processes (identification/initiation, [re]design/adaptation, implementation, monitoring and evaluation) and (2) Those who were not involved but are competent to contribute to the analyses of the processes. Through relative frequency analysis, the functions and roles performed by interviewees in the national agricultural research and development system were identified. The understandings of interviewees concerning agricultural innovation, policy-making and engagement were analysed.

Determining key factors of success and failure of engagement of policy makers in agricultural innovation processes

Key factors of success and failure of engagement of policy makers in agricultural innovation processes were deduced from the point of views of interviewees, and from the identification of key differences of events/facts between success and failure stories. Success was defined as factors that bring policy makers to engage and failure was defined as factors that prevent policy makers from engaging. The perception of value addition of innovations to livelihoods of producers and consumers as well as other advantages/disadvantages were assessed. Respondents were presented with suggested factors. Rank analysis was employed to understand the most important and least important factors. Comparison with other similar success/failure experiences in other countries (especially in Africa and Asia) planned could not be carried out effectively due to time constraint.

Documentation of the agricultural innovation processes and engagement of policy makers

The full stories of the processes of the selected agricultural innovations (events, stakeholders, and periods of time, locations and outputs) were reported as narrated by interviewees and triangulated with evidence from previous published reports of STEPRI (Obirih-Opareh, 2008; Quaye et al., 2015; Ampadu-Ameyaw et al., 2016 & 2017)). The stories of engagement of policy makers were considered as systematically part of the agricultural innovation processes; a few were isolated in a separate audio document. The contribution through proposal writing, funds and grant searching/screening and disbursement, project coordination, forum/workshop organising, project monitoring, evaluation and technical advising were documented.

Characteristics of the Respondents

In all, nineteen (19) respondents (out of 30 targeted) were interviewed for the four innovations identified. The distribution of the respondents according to the four innovations were: HQCF (53%), SWCR (21%), MNT (16%) and UAM (10%) (Figure 3.2).

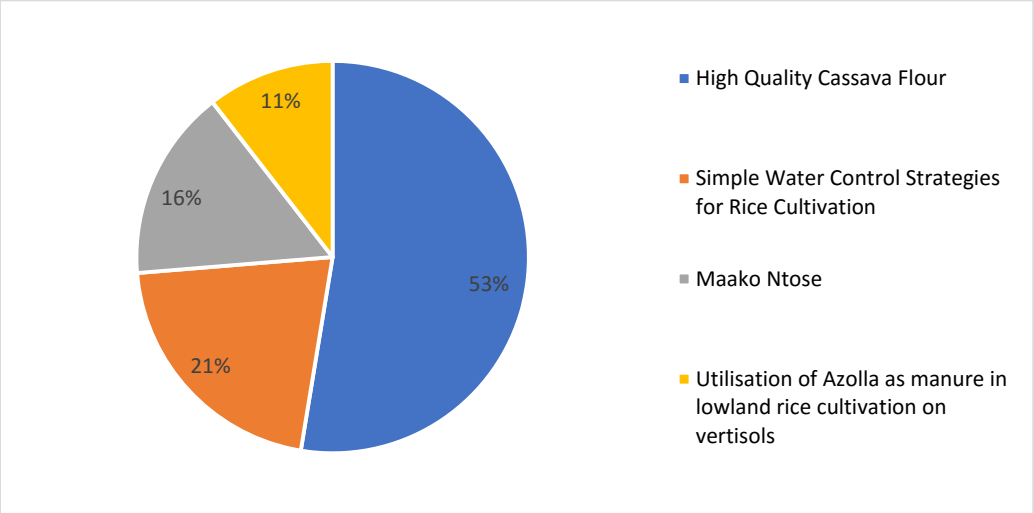


Figure 3.2: Distribution of respondents by innovation

Majority (68%) of the respondents were males; the female respondents were 6 (32%). The age range of the respondents was between 32 years and 63 years with a mean age of approximately 47 years (Standard Deviation=8.87). There is no wonder that more than 40% of public administrators admitted not being involved in the processes. The respondents have attained tertiary education: Degree/Diploma (16%), Masters (58%), and PhD (26%). The professional profile of the respondents revealed, crops/biotechnology specialist (26%), Food and Nutrition specialist (21%), Economist/Agricultural Economists (21%), Engineering (16%), Soil Scientist (11%) and Animal Scientist (5%). The details of organisations represented are as indicated in Appendix 3.3. Apart from the Ministries (including Ministry of Environment, Science, Technology and Environment (MESTI), MoFA, MoH, MoF and Ministry of Trade and Industry (MoTI)), the University of Ghana and NGOs represented by Private Enterprise Federation were covered. Directorates of Crops and Agricultural Extension Services, identified as lead in crop varietal release (for MNT) and innovation diffusion respectively did not respond to the questionnaire.

All the respondents had performed and continue to perform various roles in the national agricultural research development system. The roles previously and currently performed were not significantly different (Figure 3.3). They included professor/lecturer/teacher, project team member, project/programme manager, socio-economist, member of a specialised NGO, project/programme designer, project/programme implementation technician, technical advisor to the Minister and member of a political party.

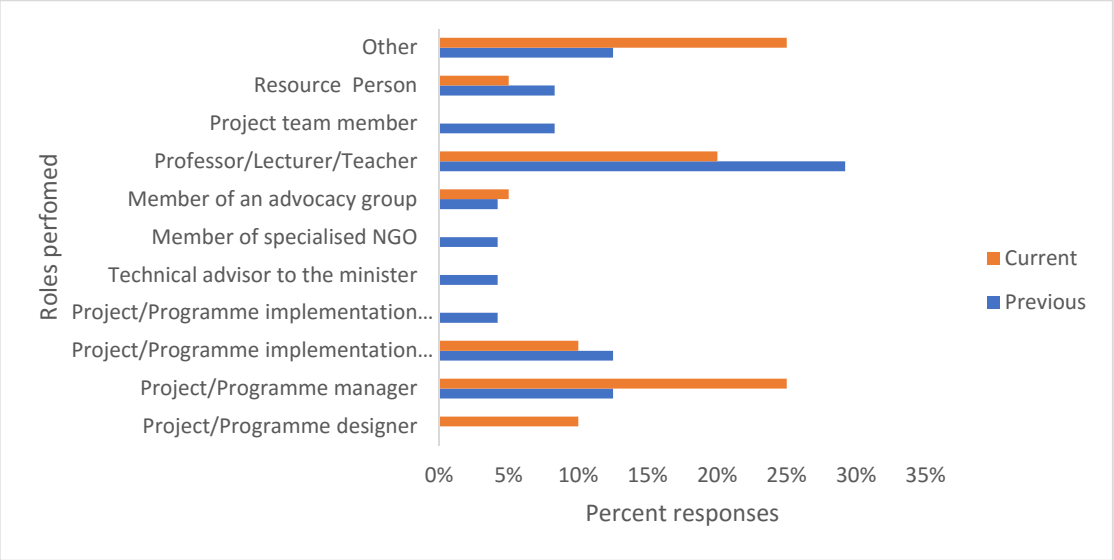


Figure 3.3: Previous and current roles performed in the research and agricultural development system by respondents

Respondents' understanding of agricultural innovations, policy makers and engagement

To enquire how the various actors in the agriculture policy making system appreciated and understood what an agricultural innovation was, the survey asked the respondents to define what an agricultural innovation is from their own perspective. The common themes that were identified in the definitions were mainly: The introduction of new processes, product or method and improving upon an existing process, product or method (Appendix 3.4). The results suggest that, generally the respondents understand what agricultural innovation is.

The existence or the development of policy in the agricultural sector is critical to the growth of the sector. In this regard, the respondents were asked to define what they would consider as an agricultural policy and who is a policy maker. The common themes in the definition of policy were: (i) guidelines, rules/regulations to lead to improvement, enhancement or promotion of the agricultural sector or sections of the value chain; (ii) plans and ideas; (iii) laid down principles and specific goals and objectives and timeframes within which goals and objectives are to be achieved (see Appendix 3.5 for actual statements). The key agricultural policy-makers were identified as the Minister in charge of agriculture, farmer organisation, the President and technical advisors to the minister of agriculture. Others who were less frequently mentioned included heads of research institutions, advocacy groups and members of Parliament (Figure 3.4). In Ghana, the Prime Minister/Ministers represent the President. Hence all technical advisors, directors and officers of MDAs are part of the executive and represent the policy making powers of the President. The formal hierarchy of the key agricultural policy makers could be described as (in descending order): President, Minister (member of cabinet), Chief Director, Director of Policy Planning and other directorates, Regional Directors of Agriculture

and District Directors of Agriculture. The inclusion of farmer organisations, researchers and other advocacy groups confirms the practices adopted in the last two decades during the development of the two Food and Agriculture Sector Development Policies (FASDEP 1&2) and Medium Term Agricultural Sector Investment Plans (METASIP 1&2). Sova et al. (2017) have suggested that Ghana's policy regime would benefit from increased participation from political agents, as well as from traditional authorities and farmers.

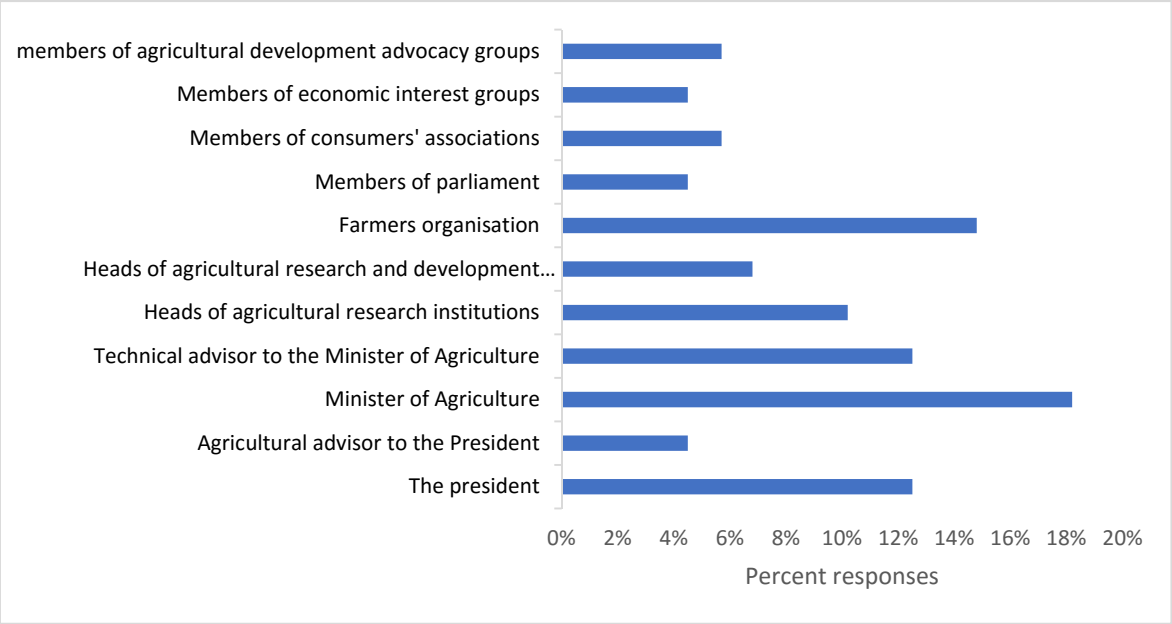


Figure 3.4: Respondents perception of who policy makers are

With regards to when a policy maker is considered engaged in an agricultural innovation process, majority (68%) of the respondents indicated that, a policy maker was engaged when he/she participates at any stage. Only a few (10%) interviewees indicated that participation in 'all the stages' of the innovation process should be termed engagement (Figure 3.5). Yet it is noted that policy makers (particularly representatives of President and Parliament), should be engaged at all stages to set the agenda and coordinate all the activities during project design, implementation, monitoring and evaluation. The President expects the Ministry of Food and Agriculture/Fisheries and Aquaculture Development, its directors and mandate officers to lead/participate at all stages of the policy cycle. Participation at all stages lead to consistently learning about and understanding the challenges of each stage of the innovation process and providing the necessary technical advice and logistical support needed for success. The IITA/Africa Rising Project's R4D platform approach, maintained each stakeholder at all stages of the innovation leading to more effective design, implementation, evaluation of project activities and dissemination and communication of research findings (Yasuba, 2017).

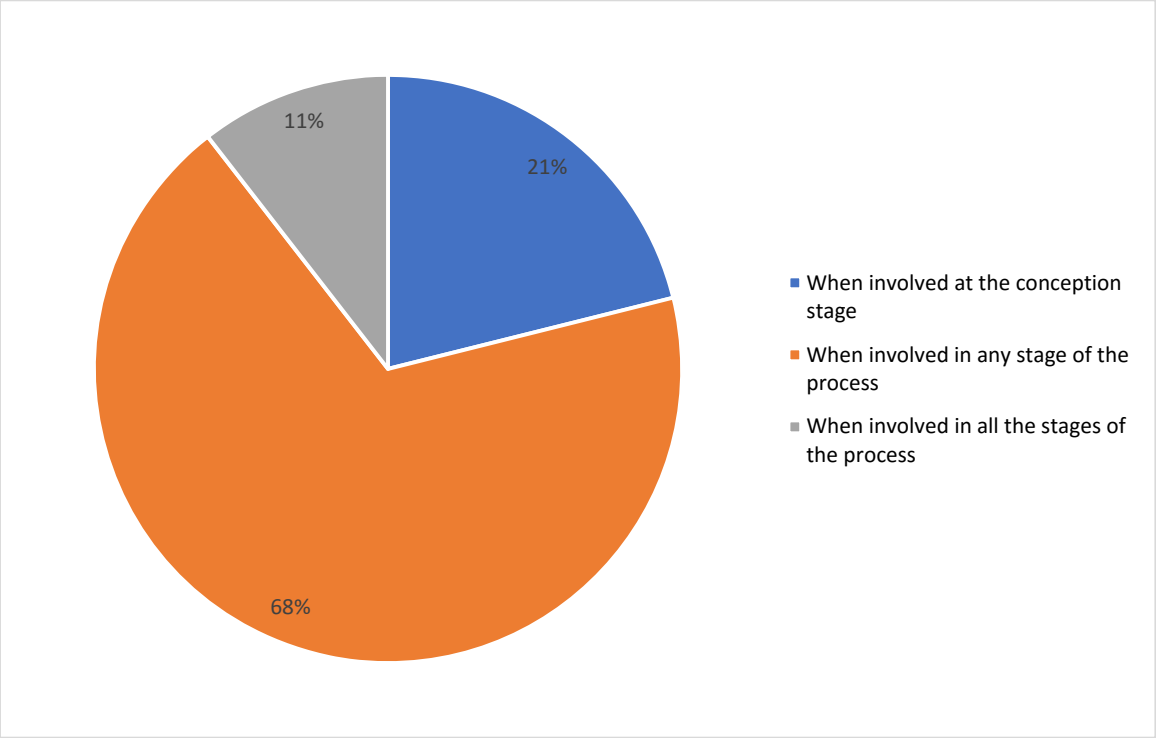


Figure 3.5: Respondents perception of when a policy maker is engaged in the innovation process

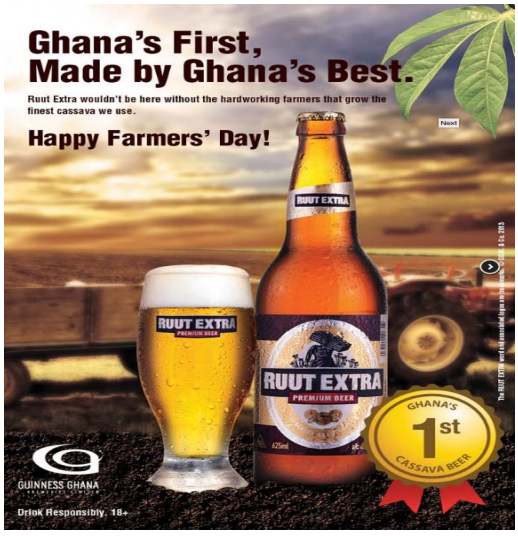
Results and Discussion

High Quality Cassava Flour (HQCF)


Initiation: The narration of the study's respondents suggests that development of HQCF can be traced to the early 2000s. This was when the Root and Tuber Improvement Programme (RTIP) of the Ministry of Food and Agriculture (MoFA) was implemented (1999-2005) (Quaye et al., 2009). In 2007, the phase two of RTIP, named, Root and Tuber Improvement and Marketing (RTIMP) project formalised the inclusion of HQCF as an output. MoFA collaborated with the CSIR-Food Research Institute (FRI); CSIR-Forest Research Institute of Ghana (FORIG); National Board for Small-scale Industries (NBSSI); Department of Nutrition and Food Science at the University of Ghana; and the Natural Resources Institute of the United Kingdom. The Department of International Development (DFID) of UK funded the project, including the publication of training manuals on the production of HQCF and cassava-based bakery products. Together, the collaborating organizations demonstrated that HQCF could be produced at an economic price and incorporated in common snack food items such as biscuits and cakes. The project also demonstrated that products containing cassava flour would be acceptable to a wide range of consumers. Market acceptability studies in Greater Accra showed that consumers would accept substitution levels of 35% cassava flour in soft dough biscuits and 60% cassava flour in hard dough biscuits (Ababio, 1998). In 2009 through The Cassava: Adding Value for Africa (C: AVA) Project, HQCF activities were further enhanced. The aim of C: AVA was to develop value chains for High Quality Cassava flour (HQCF) in Ghana, Tanzania, Uganda, Nigeria and Malawi to improve the livelihoods and incomes of at least 90,000 smallholder households as direct beneficiaries including women and disadvantaged groups, and further promote the use of HQCF as a versatile raw material for which diverse markets exist. Currently, the West African Agricultural Productivity Project (WAAPP) of MoFA is supporting the implementation process by providing funds for field trials of new varieties of cassava. WAAP was launched in 2009 to contribute to increased crop productivity of roots and tubers and cereals (Sam & Dapaa, 2009). The development of HQCF was identified as an important improved product from cassava that WAAPP will contribute to.

Implementation: The technology offered a solution to the needs of a growing number of rural-based bakeries who partially substitute wheat flour with HQCF. Study responses reveal that both technical and policy support were provided to ensure that the training of trainers and knowledge sharing was carried out well and there is complete adoption of products and processes (Appendix 4.1, Q3.9). Field trials of improved varieties of cassava were done among farmers. Training of wheat flour processors to use composite flour was also carried out at various times.

Concrete results: Potential users of HQCF include processors in the informal sector, household users, catering services and manufacturers who use the product as industrial raw material in the industrial sector. HQCF could be import substitute for wheat flour, alternative raw material for plywood and paperboard and bakery industry, expanded and organized markets which generate additional incomes for farmers and processors. The HQCF technology has been shared with small scale processors, SMEs like Cassacoxa, Bredi, AMASA and St Bassah as well as large scale processors such as Caltech Ventures. Horizontal linkages within HQCF processors and vertical integration among HQCF processors and other end-users have been strengthened under the C: AVA project. Cassava farmer groups (out-growers) are linked to SMEs who in turn are linked to larger firms. Community based processors are linked to end-users like educational institutions, hospitals and hotels as well as other SMEs for bulking and onward supplies to industries. The Ministry of Science and Technology and Innovation (MESTI) MESTI has since 2012 initiated processes to develop HQCF policy. It has collaborated with MoFA and FAO to facilitate the work of a technical committee to formulate the national HQCF policy on composite flour production and usage in Ghana (Ampadu-Ameyaw et al., 2016). The study's respondents confirmed the increasing use of HQCF in breweries and other distilling industries and pointed to the situation as evidence that their engagement in the innovation process as policy makers was useful. Guinness Ghana Breweries Ltd (GGBL) started buying High Cassava Quality Cassava Flour in 2012 and by 2013 the company had purchased 3,500 metric tonnes. Of the total 4,741 metric tonnes of cassava purchased for beer brewing in Ghana, GGBL buys over 74% of them (Tawiah, 2015).



Success factors that may have been decisive/most influential in the results of the innovation process:

Seven out of the ten interviewees were involved at a certain stage of the HQCF innovation since 2000; three at inception and four at dissemination. All of them indicated that the project was successful. The major factors that were most influential in the success of the innovation included:

- Adequate number of researchers – The research stations are public institutions and their officers are considered government officials in policy making.
- Laboratory and on-station facilities, and,
- Market opportunities - "Building a market around large processing enterprises is a more effective way of driving the HQCF value chain and ensuring sustainability" (C: AVA, 2016). The willingness of farmers and processing industry to patronize the product is also important.
- Adequate extension services – Government's Department of Agriculture at the district level provided resources to promote the technologies among farmers who could be individual small and large-scale farmers or out-growers of nucleus farms. Technical information was provided by the agricultural extension agents on agronomic practices and use of HQCF. They also facilitated practice demonstrations and workshops.

The collective efforts of different stakeholders whose interest is to improve livelihoods of agricultural production actors (including farmers, processors and traders) and consumers as well as improve the overall gross domestic product, have been highlighted as a key factor in the success of innovation processes. Motivated by these interests, the officers engaged at various stages of the innovation process.

The respondents mentioned the following as limitations to the success of the innovation:

- Lack of investment in large scale cassava processing – There was limited investor interest to engage in large scale cassava processing into HQCF. Most of the breweries and pharmaceuticals companies import their cassava flour and starch.
- Lack of an enabling national policy environment on composite flour production and promotion – A policy that can provide safety and quality standards as well as the legislative framework requirements. The policy will promote the use of HQCF (partly substituting wheat flour) as a composite flour to be promoted by stakeholders. An investment plan supporting the policy will determine specific budget and sources of funds for stakeholder action
- Lack of widespread adoption of the technology among processors of baking products (bread and biscuits) and other pharmaceutical companies.

Study respondents also mentioned inadequate capital, infrastructure and processing equipment as key limiting factors (Appendix 4.1, Q3.11&12). Inadequate capital was explained as limited funds to support activities in the innovation process; money was not readily

available; the infrastructure includes warehouses and transport vessels and the processing equipment include machines for peeling, grating and milling cassava roots into flour. In 2013, firm orders amounted to 1,765Mt but the processors could not meet this, mostly due to insufficient working capital. Small scale processors of HQCF had challenges with high quality specifications particularly with the production of HQCF for the food industry (Ampadu-Ameyaw et al., 2016). The initiative of Ministry of Environment, Science, Technology and Innovation in collaboration with other stakeholders on developing a national policy on composite flour production and usage in Ghana is yet to receive parliamentary accent. In September 2017, a stakeholder validation workshop discussed the draft HQCF policy.

HQCF policy report validation workshop, September 14, 2017; La-Palm Hotel, Accra

Level and process of engagement of policy makers in the innovation process

Engaging different stakeholders in the HQCF innovation process was mainly motivated by the mandate of the institutes they related with. Researchers and project managers at the Ministry level have been engaged in the process at different levels (Appendix 4.1, Q3.2). The Ministry of Environment Science and Technology is responsible for the Council for Scientific and Industrial Research (CSIR). The Council's institutes engaged public research officers who contributed technical information and institutional support at initiation, development, implementation and evaluation stages. The major way by which policy makers are engaged in the innovation process is through consultation and participation in different activities. All the seven participating interviewees mentioned their directors or officers in charge (say, of agronomy/food science) as persons or functionaries who included them in the HQCF project (Appendix 4.1, Q3.3). One respondent was invited by a district director of Agriculture. Two interviewees were involved as breeders or project team members during the early 2000s and others less than ten years ago (2009 and 2015); work on the innovation is ongoing at the research stations. In general, officers are consulted to be part of inception and other project meetings that discussed technical or socio-economic/political challenges (Appendix 4.1, Q3.5) (see some stories in Box 2).

Box 2: Perspectives of how policy makers were engaged in the HQCF innovation

"*A group of scientists conducted a research in cassava with results showing that post-harvest loss of cassava was rising. This research was submitted as a response to a call for proposals by the Bill and Melinda Foundation for funding support"*

"A number of policy makers engaged in the HQCF had previously undertaken some agricultural innovations like the work being done in the project and as such were brought on board to provide their expertise".

"Appointments were made by the FAO as part of their setting up process, for National project coordinators and country manager to oversee all systems and activities nationwide. Nominations were made by the ministry and approved by FAO to attend the TOT meetings; invitations were also extended to other processors of flour products that initially were not part in the first phase to be trained in the use of composite flour (wheat and HQCF) in the development of products. Other policy makers were identified and selected by the consulting team as resource persons in agricultural development and policy".

Validation workshops, training of trainers (TOT) meetings, and user training programs were carried out at the national or local level during implementation. The situation offered a

platform in the innovation process for the dissemination and adoption of improved technologies for cassava production and processing. The researchers at national level (CRI and FRI) provided evidence for policy making by developing and pilot testing a set of integrated best-bet options for HQCF production. Researchers at FRI promoted market access to secondary products (including cassava flours) among other benefits. FRI has a retail outlet at the premises of the institute and engaged sales personnel to distribute packaged flour in other institutions and market places.

Project coordinators are public officials who invite different stakeholders to attend workshops that discuss progress and challenges of innovation. The MoFA has Policy planning and Budget, Monitoring and Evaluation and Agribusiness Units that monitor progress of projects and ensure that their status is communicated to the Ministers in charge of Food and Agriculture and Finance during budget hearing. The Ministry of Finance has an Agriculture and Agribusiness Unit (Real Sector Division) that initiates studies and undertakes project tours to understand innovation processes and make contributions during budget hearing. The role (resource persons during dissemination) that the MoFA's Women in Agricultural Development Directorate (WIAD) and other units played at the national, regional and district levels was highlighted by all the respondents. WIAD officers at the district level organized demonstrations on domestic and industrial uses of HQCF during capacity building sessions for individuals, households and groups. The contribution (finance and technical support) of West African Agricultural Productivity Project (WAAPP) of MoFA in the implementation process was also acknowledged.

Policy makers compile and provide data to show impact of innovation. The Statistical Research and Information Directorate of the MoFA provided data on cassava production. Recent statistics on cassava production point to increased area under cultivation, output and yield. The area has increased from 790,000 Ha in 2006 to 917,000 Ha in 2015. Production increased from 9.6 million metric tonnes in 2006 to 17.2 million metric tonnes in 2015. The yield gap is bridging from less than 12 Mt/Ha in year 2000 to 18.3 Mt/Ha in 2014, achieving 37% of expected yield (MoFA, 2016). In 2015, the top ten districts for cassava production were in Ashanti, Brong-Ahafo, Central and Eastern regions. They recorded yield range of 25.65 (Suhum Kraboa-Coaltar, Eastern) to 41.23 Mt/Ha (Sekyere East, Ashanti). The common cassava varieties planted included *Afisiafi, Ampong, Doku, Botann and Esam-bankyi*.

The study interviewees considered that contribution of innovation to livelihoods of agricultural actors and consumers are the key factors driving the engagement of policy makers in the HQCF innovation process (Figure 4.1). A third factor is the consideration that innovation may contribute to gross domestic product. Respondents also considered that since the HQCF innovation contributed to knowledge, will reduce foreign exchange spent on wheat flour and will enhance career of researchers/public officers, officers were motivated to stay part of the process. Once part, officers provided technical advice or institutional support to the process (Appendix 4.1, Q3.8b). The commitment of stakeholders ensured that innovations are monitored till they are fully commercialised. The contributions of policy makers were deemed

positive since cassava farmers have adopted the improved varieties and companies such as Caltech Ltd and Dadtco are processing the improved cassava varieties in HQCF.

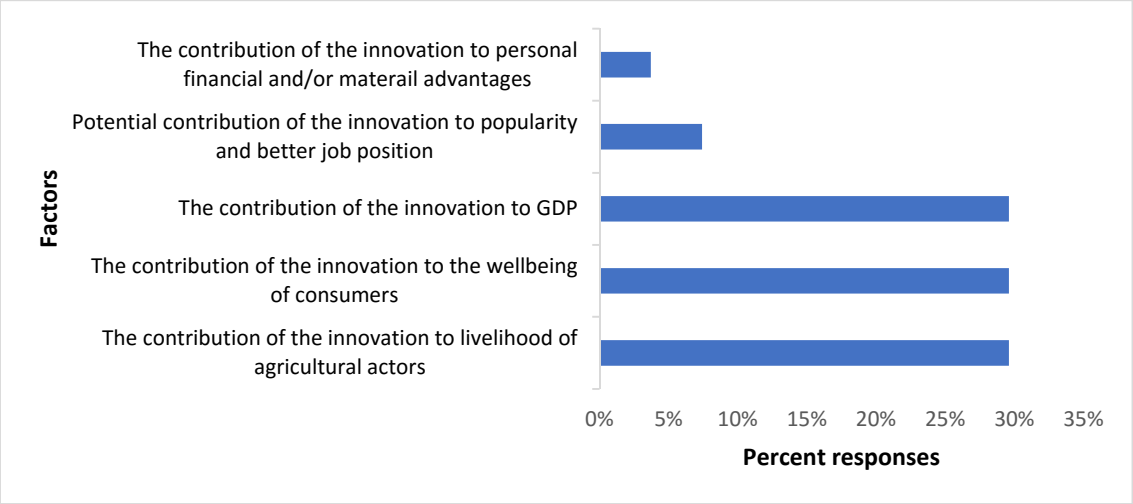


Figure 4.1 Factors that brought policy makers to engage in the HQCF innovation

Interviewees suggested that important strategies for the successful engagement of policy makers in further agricultural innovation processes should include: i) Broad consultation before start of projects (60%); ii) adequate and timely information given to policy makers (20%); iii) involvement of relevant MoFA directorates (10%); and, iv) proper needs assessment among stakeholders (10%).

Conclusion

The implementation of the HQCF innovation process begun in the early 2000s. A combination of activities including field trials of improved varieties of cassava, training of farmers in good agronomic practices, and training of wheat flour processors to use composite flour as well as involving large scale industrial users during commercialisation has been key in its success.

History of Simple Water Control Strategies for Rice Cultivation (SWCR)

Initiation: This innovation began in the 1990s as an integral part of a multidiscipline research project into producing rice and reducing poverty while cutting down on the cost of fertilisation. Rice is produced by both large- and small- scale farmers. It is characterized by high costs of inputs and low yields, key factors that reduce farmers' income/ profit margins. The SWCR concept was introduced by Japan International Research Centre for Agricultural Service to the Ministry of Food and Agriculture under the name Eco-innovation. Its aim was to ensure sustainability, help create employment, and reduce food insecurity for both locals and the country. The innovation was a collaborative effort between West Africa Rice Development Association (WARDA); the Agricultural Services Sub-Sector Investment Programme (AgSSIP); the Adapted Social Security Strategy and Action Plan (ASSAP); Soil Research Institute (CSIR-SRI); Water Research Institute (CSIR-WRI), Japan International Research Center for Agricultural Services (JIRCA) and the Crop Research Institute (CSIR-CRI). CSIR-CRI was the main body in charge of the project in Ghana. The CSIR-SRI conducted research into the type of soil to use for cultivation and the CSIR-WRI supported the farmer capacity building activities. The funding for the project was provided by WARDA and JIRCA. Regional sectors in the country were identified and selected for the implementation of this innovation and rice farmers in the selected areas were trained.

Implementation: The government of Ghana through the Ghana Irrigation Development Authority (GIDA) of MoFA acquired about 5000 hectares of land in 5 selected regions (Ampadu-Ameyaw et al., 2017). The SWCR innovation employed locally available materials in the construction of dams, micro-reservoirs and spillways and relied on natural resources such as hills and rain water in lieu of the irrigation system for the rice crop. The simple water control innovation included cheap and easy-to-construct terraces that can be replicated by farmers in many places. The innovation enabled reduction of production costs and improvement of farm management practices. It aimed to minimise use of fertilisers and chemicals and hence increase profits. Through several sub-projects, the innovation targeted all rice farmers in the country throughout the ten regions particularly the small-scale resource poor rice farmer. The project introduced the communities in the targeted areas to water management as well as the use of sand bags to repair a spillway of main reservoirs.

Concrete results: The SWCR was implemented in all the 10 regions of Ghana. Evidences of the innovation can be found at Nwogu in the Northern region, Biemoso No2 in the Ashanti region and Ashiaman Irrigation Development Authority farms in the Greater Accra region. The Northern Rural Growth Project (NRGP) communities in the Northern, Upper East and Upper West regions benefited from the technology. Rice is cultivated in Ghana both as a food crop and cash crop. Input dealers have stocked and sold small implements needed for the simple water control strategies promoting widespread adoption by farmers and continued engagement of stakeholders.

Success factors that may have been decisive/most influential in the results of the innovation process

This initiative succeeded due to effective engagement of policy makers. The government of Ghana through the Ghana Irrigation Development Authority (GIDA) of MoFA acquired about 5000 hectares of land in 5 selected regions. The land was acquired for use in the programme to train prospective farmers in agronomic practices related to the use of the innovation. Apart from the dissemination efforts organised through scientific platforms, the factors deemed most influential in the results of the SWCR included funding. Government guaranteed funds allowed all stakeholders to play their part well; regional level GIDA personnel were involved from the onset of the process. They coordinated the training of private firms who were contracted to complete activities in land preparation, and ensured timely release of funds, recruitment of adequate number of staff, timely engagement of contractors and ensured that members of the team stayed together for longer period (Appendix 4.2, Q 3.13i). When the project started experiencing inadequate human resource (staff and contractors), capital (funds and equipment) and natural environment problems (receding water during dry season), its success started declining (Appendix 4.2, Q3.11&12). Lack of finance to mobilise contractors and stakeholders to project site limited implementation of good practices demonstrated by the SWCR innovation.

Level and process of engagement of policy makers in the innovation process

All the four interviewees were engaged in the process of innovation. Three were policy makers from MoFA (Directorate of Crop Services, Agricultural Engineering and Ghana Irrigation Development Authority). One was a researcher from CSIR-SRI. The policy makers' engagement in SWCR innovation process was mainly motivated by the mandate of their institution and JIRCAS (Appendix 4.2, Q3.3). Researchers and project managers were engaged in the process at the research and monitoring levels. At the research level, policy makers contributed technical information and institutional support. Project managers were selected by MoFA-GIDA to coordinate project activities; others were monitoring and evaluating the different activities at the community level. Farmer groups participated in innovation trails and gave feedback during project implementation and evaluation. The study's interviewees considered that policy makers were concerned and participated in the process due to the contribution of the innovation to livelihoods of agricultural actors (farmers, processors and traders) and consumers (Figure 4.2).

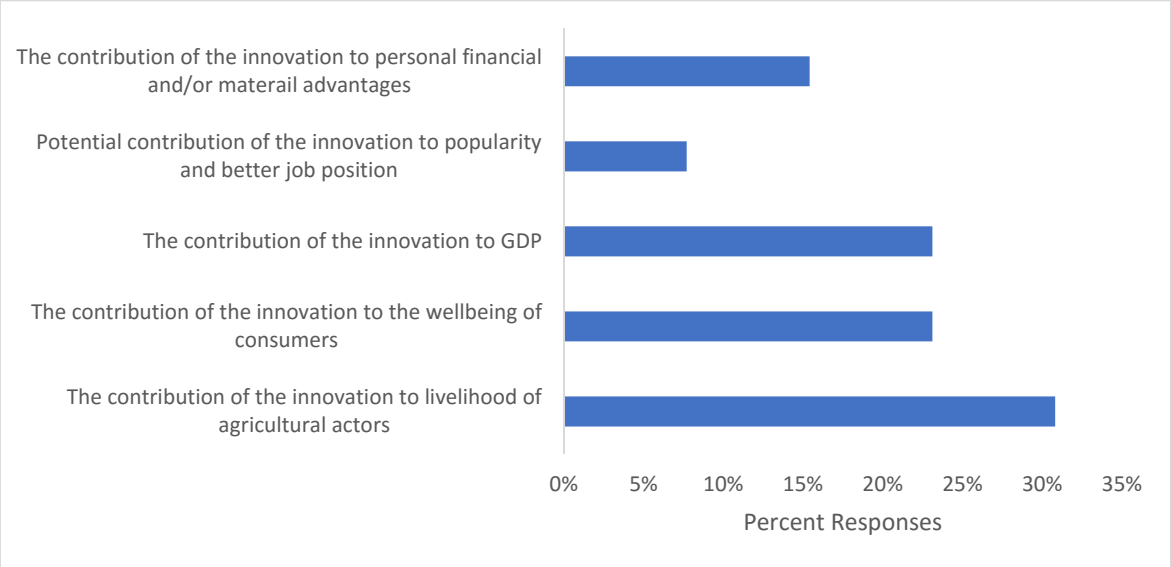


Figure 4.2 Factors that brought policy makers to engage in the SWCR innovation

Apart from livelihoods, any innovation that contributed to gross domestic product was important and adequate to attract the interest of different stakeholders. The commitment of stakeholders ensures that innovations are monitored till they are fully commercialised (see Box 3 for narrative by one interviewee).

Box 3: A perspective of how policy makers were engaged in the SWCR innovation

"Technical committee meetings were steered by policy makers to provide inputs in the design and construction of micro-reservoirs and dams for cited areas for innovation. Expert advice was given for the design of reservoirs and the need to survey and produce maps for designs; furthermore, the design of slopes used and also on the construction material and the protection of slopes was advised. Technical studies and collaborative research were conducted with JIRCAS. Working visits to the sites where innovation was to take place were conducted by team members from the collaborating institutions as well as for other policy makers. A request was made by the project to some key directorates under MOFA for expertise in design of water control structures and supervision of construction works. This involved citing of subsequent meetings that were held for presentations, and discussions based on these presentations and field observations".

The end-users of the SWCR technology are rice farmers cultivating in valley bottoms in Ghana. The role that the Ministry of Food and Agriculture (MoFA) played at the national, regional and district levels was highlighted by all the respondents. At the national level MoFA-GIDA provided

officers who coordinated, monitored and evaluated the project. At the local level (regional and district) agricultural development units supported the dissemination and diffusion of innovation. The officers were directly involved in regular monitoring and evaluation of activities. Agricultural extension agents who live closer to farming communities were provided with logistics to engage regularly with farmers. During the innovation process and for tracking progress of commodity, rice data was provided by MoFA SRID (2016). The last decade (2006-2016) data suggest that despite concerns about high level importation, production of local rice increased significantly. The complementary role of seed and fertiliser subsidy with the SWCR is recognised. The area under cultivation has increased from 125,000 Ha in 2006 to 233,000 Ha in 2015. Output of paddy rice has increased from 250,000 Mt in 2006 to 641,000 Mt in 2015 (MoFA, 2016). The yield gap is bridging from less than 1Mt/Ha in year 2000 to 2.6 Mt/Ha in 2014, achieving 33% of expected (MoFA, 2016).

The study's interviewees suggested that important strategies for the successful engagement of policy makers in furthering the SWCR innovation processes should include:

- Availability and provision of adequate funding for the innovation process (50%);
- Engagement of adequate technical and human resource (25%)- employ professionals and skilled workers to support activities at the laboratory and field levels; and
- Broad consultation before start of projects (25%).

Conclusion

SWCR innovation process was initiated in the late 1990s to use locally available materials for soil and water management and to reduce cost of fertilisation. The continued effort of the different stakeholders in providing logistics and monitoring the progress of the innovation through commercialisations has been key in its success.

History of Maako Ntoose pepper variety (MNT)

Initiation: The Maako Ntoose, is a variety of pepper, which was developed by CSIR-CRI in the late 1990s to the early 2000s. The innovation combined some characteristics of pepper with

that of tomatoes. The yield of the variety was estimated to be about 35 metric tonnes per hectare over the cropping season of about 5 months, higher than the potential yield estimated at 32 Mt/ha by the Ministry of Food and Agriculture for traditional varieties (MoFA, 2016). It was expected to increase yield and lower cost in the processing of pepper. The advantage of this innovation was its nutritional qualities, particularly its higher content of Vitamin C compared to other varieties. This advantage was the main reason why the researchers collaborated with the World Vegetable Centre (AVRDC), the Ministry of Food and Agriculture, A. Panford Ltd--a private commercial agro-processing company, and the Vegetable Producers and Exporters Association of Ghana (VEPEAG), a trade association, to conduct this work. Funding for the project varied with different organizations getting on board at one point in time during the innovation process. The National Agricultural Research Project (NARP) and CARE International provided funding in the initial stages. Export Development and Investment Fund (EDIF) of the Ministry of Trade and Industry (MoTI) provided funds (USD 65, 000) in the interim, and the Agricultural Subsector Investment Programme (AgSSIP) of MoFA at the latter end of project.

Implementation: The research to develop Maako Ntoose was a collaborative work with contributions from the Asian Vegetable Research and Development Centre (AVRDC) which provided germplasm used for the experiments. MoFA provided financial support (albeit meagre) to personnel at the local level to support scientific evaluation of the trials. MoFA also supported extension officers (briefly) to interact with farmers and disseminate the innovation. A. Panford Ltd and the Vegetable Producers and Exporters Association of Ghana (VEPEAG) assisted in selecting the genetic attributes suitable for the release of the variety. MoFA could not support the private sector to raise enough funds to support the adverting and other promotion activities needed to ensure commercialisation of the spice vegetable.

Concrete results: Target for the development of this innovation was the general public (including food processors and processing companies) and therefore it was hoped that the innovation would spread widely to reach as many people as possible. A. Panford Ltd. brought along into the collaboration, private partnerships and business practices which led to better appreciation of the attributes described by the researchers' as innovation output. Initially, members of the VEPEAG who realized that the new product was good, patronized it and provided a ready market for it. However, due to lack of government level promotion through dissemination and sensitisation campaigns at the local level and further innovation and scaling of the project, VEPEAG patronage could not be sustained. One out of the three study interviewees indicated that RMG Ghana Ltd. has recently accepted the innovation and has taken the franchise of *Maako Ntoose* to innovate it further for the market. It intends to expand the production, distributing and packaging of the seeds so that farmers can purchase it for multiplication and commercial production. RMG is a private sector company that offers agronomic and technical services to farmers, as well as up-to-date customer service to all the distribution network.

Factors that may have been decisive/most influential in the failure of the innovation process

The Maako Ntoose innovation process was considered a failure although it was well designed for implementation. The study interviewees linked the lack of sustained success of the innovation to constraints that greatly hampered the production and distribution of quality planting material to farmers:

- Poor dissemination of project results: the awareness creation among farmers about the beneficial attributes of the new product was limited. Awareness was created about the innovation among few farmer groups but information was not widely disseminated to other farmers in all 10 regions of Ghana for cultivation. There was dissemination through the print media and on the internet via AVRDC's website (Ameyaw-. The "how to produce commercial quantities of the seeds" was not adequately demonstrated to farmer; the hands-on training that was necessary to cause adoption of the new product
- Funding and logistical constraint - the project faced challenges with late release of funds and lack of transport vehicles to move the Research team from one ecological zone to another. After a year of support CARE International ended its support due to lack of funds. Certain equipment needed by CSIR-CRI for seed extraction and seed production could not be procured.
- Inadequate infrastructure for production of commercial quantities - Seed production equipment needed to enable production of the seed on a commercial basis was not available. In Ghana, the Grains and Legumes Board produces foundation seed and sell to farmers and other producers to produce certified seed.
- Lack of institutional support- local government agricultural extension offices did not integrate the process into regular activities of disseminating innovations and promoting new products through field demonstration. There was no strong seed production system. The Government institutional structures for promoting the innovation were weak, coupled with the absence of a seed law. In 2010, the Plant and Fertilizer Act 803 was passed to regulate seed production, cleaning and processing, and trading (including import and export).

Level and process of engagement of policy makers in the innovation process

The policy makers engaged in MNT included MoFA's Crop Services Directorate, Plant Protection and Regulatory Directorate (PPRSD) and MESTI's CSIR research officers. Policy makers' engagement in MNT innovation process was mainly motivated by the mandate of their institution (Appendix 4.3, Q3.3). Invitation to participate is the major way by which policy makers were engaged in the MNT innovation process. The study interviewee who was involved in the process of MNT innovation mentioned a plant breeder at CRI as functionary who included him in the MNT project (Appendix 4.3, Q 3.3). He was involved as project team member about ten years ago (since 2008). Work on the innovation has ceased at the research stations and the current staff of MoFA's Crop Services Directorate (CSD) and Plant Protection and Regulatory Services Directorate (PPRSD) could not provide information on the innovation. The officer was

consulted to be part of inception and other project meetings that discussed technical or socio-economic/ political challenges.

"The World Bank was informed about the Maako Ntoose planting material, which had dual functions and characteristics, by a Plant breeder from CSIR-CRI. The idea was considered good and a decision was made to constitute a research team to engage and support the Maako Ntoose project. MoFA nominated some resource persons to represent the Ministry on the committee, to get involved in the designing of the proposal and training of farmers. I was working in a World Bank project and they were supporting the Maako Ntoose project, which got me involved".

The study's interviewees confirmed that researchers contributed technical information through laboratory and field experimentation. There were agronomic and breeding discussions and dissemination activities with the farmers involved in the field experiments. The public administration officers (policy makers) provided technical and institutional support, coordinating the meetings, inspections and evaluations that led to release of the variety and made it acceptable for commercial production. The study's interviewees considered contribution of innovation to livelihoods as key factors driving the engagement in the MNT innovation process (Figure 4.3). The MNT innovation was considered as a solution to livelihood challenges of pepper producers and consumers. Whiles producers could overcome yield challenges, consumers would overcome nutrition challenges. The interviewees supported the assertion that the MTN innovation contributes to gross domestic product. Hence, policy makers at all levels of operation should be interested in engaging in its development. The commitment of stakeholders waned when the funding support from both the public and private sector stopped. The innovation could not be monitored to full commercialisation.

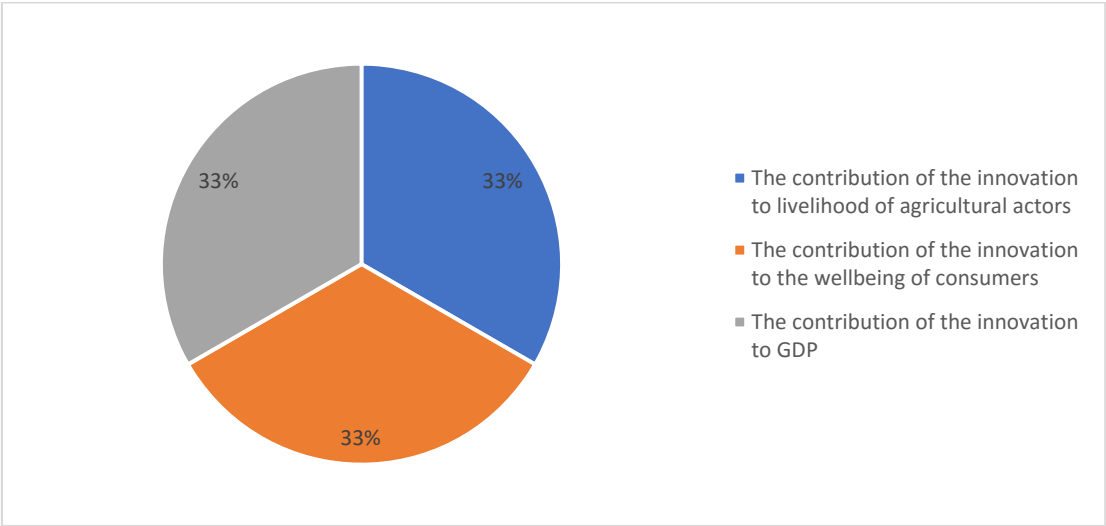


Figure 4.3 Factors that brought policy makers to engage in the MNT innovation

The role that MoFA played in obtaining funds from EDIF and AgSSIP at the national level was highlighted by the study interviewees. The contribution of the private sector was considered key in the MNT innovation process. The lack of consistent support from the public sector through dissemination of project results and providing infrastructure for further piloting and scaling, was a key contributory factor to project failure. Although recent statistics on pepper suggest that the area under cultivation has increased slightly (from 13,200 Ha in 2010 to 14,680 Ha in 2015), the yield gap remains wide. The national yield gap bridging achieved is only 25.7% of expected; in 2014 the yield was estimated at 8.3 Mt/Ha instead of the 32 Mt/Ha anticipated (MoFA, 2016). The adoption of Maako Ntoose planting materials and agronomic practices could increase yield to 35 Mt/ha (Ampadu-Ameyaw et al., 2017). The study's interviewees suggested that important strategies for the successful engagement of policy makers in further agricultural innovation processes should include: i) Broad consultation before start of projects (67%) and ii) Engagement of adequate and technical human resource (33%).

Conclusion

MNT innovation process was initiated in the late 1990s to increase yield and lower cost in the processing of pepper, and take advantage its nutritional qualities, particularly its higher content of Vitamin C compared to other varieties. The initial patronage of members of the VEPEAG could not be sustained due to lack of government support for further farm level promotion and advertising among investors. The innovation failed since it could not be sustained in the market.

History of Utilisation of Azolla as Manure in Lowland Rice Cultivation on the Vertisols of the Accra Plains (UAM)


Initiation: The technology was developed in the early 1980s to enhance the fertility of the vertisols in the Accra plains, for increased rice productivity, manage the high cost of inorganic fertilizers, declining soil fertility and growing demand for organically produced foods. It involved the development of techniques by which Azolla plant could be utilized as green manure in rice fields. Azolla is a fern mainly found growing on the surfaces of ponds and also along the lower Volta Lake at Kpong and Asutuare (Eastern and Greater Accra region). It fixes nitrogen through a symbiotic association with an alga, *Anabaena azollae*. The product of this association can be utilised as green manure in rice fields and has been reported to lead to a saving of 21 percent in the use of organic fertilitiser (Ampadu-Ameyaw, 2017 & Asuming-Brempong & Watanabe,

1987). Nitrogen has been found to be a major constraint in the production of rice grown under irrigation on vertisols of the Accra Plains. The constraint is attributed to low fertility because of low levels of organic matter in the soils. Consequently, the symbiotic association should help farmers to reduce the cost of rice production since they need not buy much fertiliser for their crops. The innovation was the result of collaboration between the Agricultural Research Centre (of Kpong), the Ecological Laboratory, and the Soil Science Department, all of the University of Ghana. The project was funded by MoFA's Agricultural Subsector Investment Programme (AgSSIP). MoFA-GIDA's Kpong Irrigation Project (KIP) supported the organization of a few farmers' fora. Other collaborators included University of Philippines, WARDA and Government of Belgium.

Implementation: The technology dissemination was done by demonstrating the use of the innovation at two fora of farmers who directly participated in the experiments and others who showed interest later, in the Eastern and Greater Accra regions only. Due to intense heat, Azolla is not available all year round. Replication can only be done in some parts of the country provided the temperature is high enough to support the growth of the fern. The optimum temperatures for most species are between 18ºC and 28ºC, although this can be as high as 30ºC for species such as *A. pinnata*, *A. mexicana*, *and A. caroliniana*. Light affects the photosynthesis and regulate nitrogenase activity in Azolla and Anabaena (www.theazollafoundation.org). Azolla is recommended for areas that are waterlogged most of the time

Concrete results: This innovation was initially developed for use by rice farmers at the KIP site at Akuse and Asutsuare. A total of 200 farmers were sensitized about the innovation at a farmer's forum. Practices like burning of vegetation and non-application of organic matter to farmlands, which have contributed to the depletion of the organic content of soils were to be replaced by introducing the green manure. It was envisaged that production by the majority of farmers will be increased and this will contribute to food security and improved farm incomes. The incorporation of Azolla, enhanced the nitrogen content of the soil and brought about a 21% savings in organic fertilizer use. However, there was no widespread dissemination of the innovation among farmers and industry. Extension workers in the Ministry of Food and Agriculture at the local level were not involved sufficiently in disseminating the innovation due to logistical constraint.

Factors that may have been decisive/most influential in the failure of the UAM innovation process:

The lack of sustained success of the innovation was linked to lack of natural resource support, inadequate public funding, limited promotion and awareness creation and lack of institutional support for promoting the innovation. In terms of natural resource, it is explained that fixed nitrogen is used by the Azolla for growth, but it is released when the fern dies and decomposes. The fern is very sensitive to harsh weather conditions therefore it dies soon after the rainy season. The innovation can be replicated in other parts of the country where the weather is wet to support the growth of the fern all year round. Even though the innovation can help farmers

to reduce the cost of rice production, release of funds for the project by the public sector (MoFA) was neither sufficient nor timely. The awareness creation about the innovation was within a narrow scope; apart from scientific publications produced by the lead researcher, no widespread campaign was carried out among farmers by extension service officers at the local level. Results of the benefits of Azolla were not fully disseminated to end-users. One interviewee questioned how policies on practices such as burning of bush and rice straw (which were detrimental to Azolla growth), were implemented, to increase the benefit of the UAM innovation. The Bushfire prevention and Control Law (PNDCL 299, 1990) was identified.

Level and process of engagement of policy makers in the innovation process

Public administrators, researchers and NGOs interviewed believed, engagement in the innovation process was mainly motivated by the mandate of the institution to contribute to knowledge or livelihood development of agricultural actors and consumers (Appendix 4.4, Q3.3) (Figure 4.4). The interviewee engaged in the process of UAM innovation mentioned a Head Scientist/Coordinator at University of Ghana Research Station at Kpong as functionary who included her in the UAM project in 1981 (Appendix 4.4, Q 3.3). The officer was consulted to be part of inception and other project meetings that discussed technical or socio-economic/political challenges. It was confirmed that selection of officers (at Ministry, research or NGO level) is usually based on the work mandate or due to past performance and experiences known (Appendix 4.4, Q3.8). Hence, researchers contributed to the lab and field level work, carrying out experiments with University of Philippines and sharing results with Public officers and participating farmers.

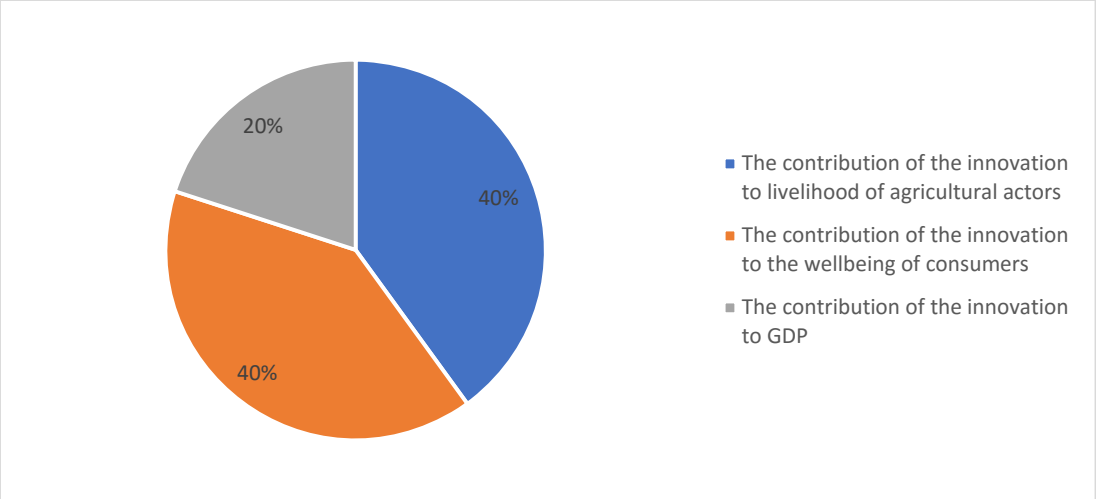


Figure 4.4 Factors that brought policy makers to engage in the UAM innovation

During the few workshops that included MoFA, CSIR-SRI and farmers, technical information was shared, and technical advice was provided by KIP leading to improvement. Information was provided on productivity trials with strands of Azolla, other rice agronomic discussions and dissemination activities with farmers. The collaborations formed in this innovation were to

facilitate the pooling of expertise available and knowledge base, especially from the University of Ghana to undertake, the research. This led to the selection of the Azolla strains that performed very well from the experimentations. However, MoFA provided minimum institutional support at the local level by providing logistics to KIP staff to organise farmers' fora. Hence adoption was recorded among the few experimental farmers in Kpong, Asutuare and Ashaiman Irrigation Project (Ashaiman, Greater Accra region).
Interviewees suggested that important strategies for the successful engagement of policy makers in further agricultural innovation processes should include: i) adequate and timely information given to policy makers (50%); and ii) availability and provision of adequate funding for the innovation process (50%).

Conclusion
UAM was initiated in the 1980s for soil fertility improvement of rice fields. There were pilot studies in two out of the ten regions of Ghana. Extension workers of the Ministry of Food and Agriculture at the local level were not involved sufficiently in disseminating the innovation due to logistical constraint. The innovation could not be scaled for commercial benefit, leading to its failure.

Synthesis of factors influencing the engagement of policy makers in innovation processes
Policy makers get involved actively in multi-stakeholder exchanges and activities that occur to facilitate and realize agricultural innovations. These interactions and engagement with other system actors of the agricultural innovation process offer insight and provide learning platform for policy makers. Policy makers actively engaged in a subject produce an experiential policy making process with the successful realization of the agricultural innovation. It is when budgets to sustain policy-makers activities are low or flow irregularly that innovations fail.

Major factors influencing policy makers' engagement
In this study three factors were considered most important as driving policy makers to engage in all the four agricultural innovation processes (Figure 4.5). They were:

- The contribution of the innovation to the livelihood of agricultural actors
- The contribution of the innovation to the wellbeing of consumers and
- The contribution of the innovation to gross domestic product (GDP).

How the innovations contribute to livelihood of agricultural actors (farmers, processors and traders):
The HQCF innovation was expected to increase the supply of cassava flour for food and beverage production. Policy makers expected that there will be improvement in the income of cassava farmers who will produce and distribute high yielding planting materials and fresh roots. There will be improvement in the income of service providers who engaged in processing or marketing of flour or industrial products.

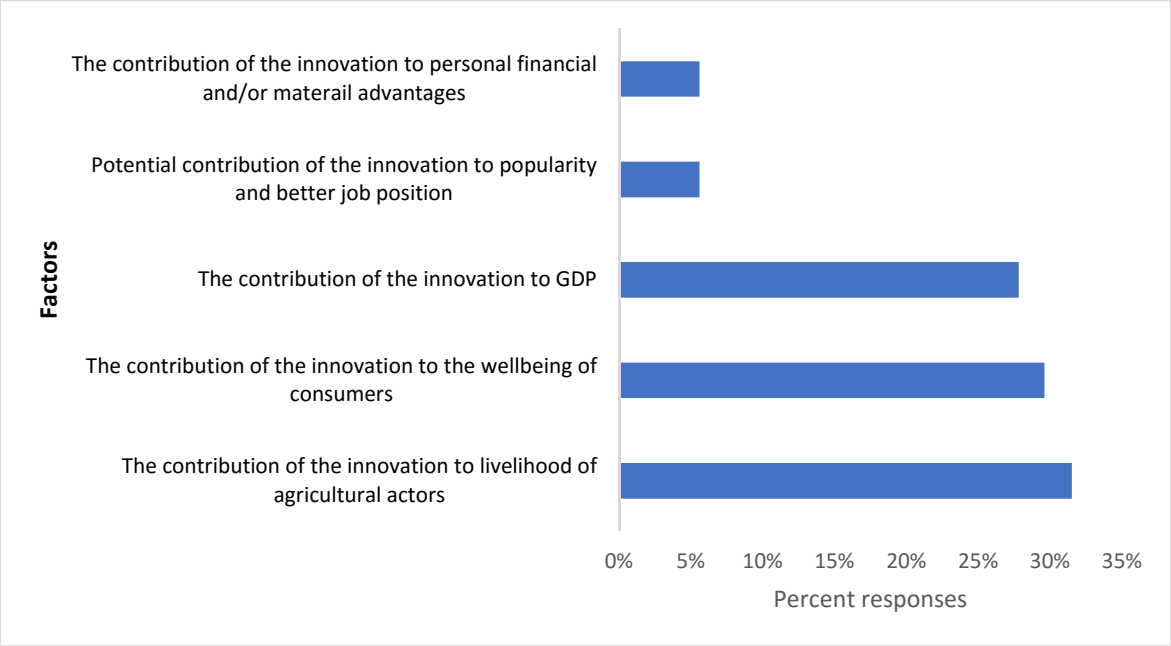


Figure 4.5: Factors that brought policy makers to engage in agricultural innovation process

SWCR innovation provided simple implements and practices for rice production, contributing to increased income of traders of the implements and the rice farmers who apply them. The increased supply of rice lead to improved income of rice processors and traders.

The MNT innovation produced a higher yielding pepper variety with enhanced nutrition properties. Policy makers expected that farmers, traders and processors will obtain increased income and enhance their livelihoods.

UAM innovation provided organic fertiliser and practices for rice production, contributing to increased income of the rice farmers who apply them. Rice processors and traders have increased access to rice, leading to improved income.

How the innovations contribute to wellbeing of consumers:
HQCF is used to partly substitute wheat flour (composite flour). Policy makers expected that the cost of purchasing products made with HQCF will be lower.

The increased supply of rice because of SWCR and UAM innovation was expected to increase access to lower cost rice to consumers.

The enhanced nutrition of MNT pepper contributes to food utilisation, hence increasing food security.

How the innovations contribute to gross domestic product (GDP):
Gross domestic product is the summation of consumption, private investment, government spending and net export. Of interest to policy makers in increased investment and consumption of products of the innovations. When well developed, all the four innovations could enhance

the GDP of the nation. The reduction of foreign exchange due to wheat and rice imports cannot be over emphasised.

Other factors influencing policy makers' engagement

Occasionally, policy makers may engage for personal gain, in terms of material advantages and better job position. This motive is driven by profession progression and wellbeing, which are linked to livelihood outcomes. Carney (2000) considered livelihood outcomes as food security, increased income, well-being, reduced vulnerability and improved use of natural resource base. A few interviewees were of the opinion that some policy makers refuse to engage in the innovation process due to: (i) lack of potential contribution of the innovation to political popularity/visibility and election winning, (ii) lack of potential contribution of the innovation to better job position; and (iii) lack of potential contribution to technical, political and/or moral support to a friend, a parent, or a colleague involved in the innovation process.

Suggested strategies for successfully engaging policy makers

For successful engagement of policy makers, the study's interviewees suggested among other things (Figure 4.6): i) broad consultation at initiation of the innovation process; ii) adequate funding for the innovation; iii) adequate technical and human resource to support the innovation process; and iv) establishing effective information flows among policy makers and other stakeholders. Other strategies that were listed as less important but should not be overlooked included: Linking innovation to national development framework; conducting policy makers' needs assessments; and effective monitoring and evaluation of innovation process. The general indication is that when the capacity-building of policy makers are strengthened their ability to provide technical advice will improve and with adequate logistics the contribution to monitoring and evaluation of outcomes at all stages of agricultural innovation will be enhanced.

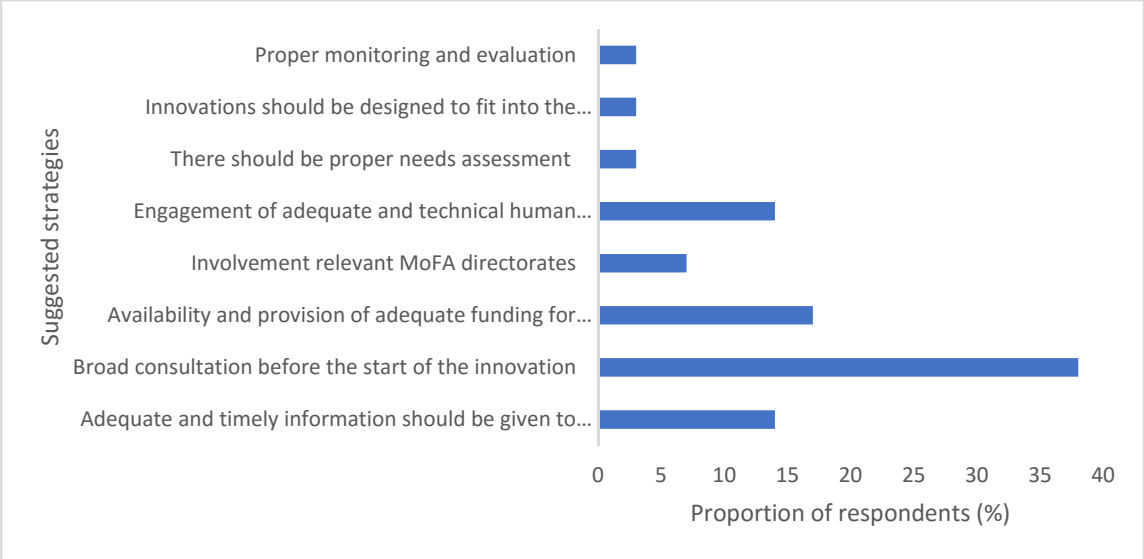


Figure 4.6 Suggestion of strategies for successful engagement of policy-makers in further agricultural innovation process

Discussion

Four innovations were studied. The High-Quality Cassava Flour and Simple Water Control Strategies for Rice Cultivation were identified as two fairly brilliant success cases and Maako Ntoose and Azolla as unsuccessful cases of engagement of policy makers in agricultural innovation processes in Ghana. The four cases demonstrated that effectively engaging different policy makers at different stages of the innovation process requires five capitals –human, physical, financial, social and natural (Carney, 2000). The human resources should be adequate in terms of numbers and technical and managerial competencies. Consistent financial flow in timely manner will allow procurement of logistics and infrastructure building and maintenance. It also allows for human capacity building, advertising and effective commercialization. The availability of small implements needed for the simple water control strategies (SWCR) on the market has supported its adoption by farmers and continued engagement of stakeholders. The ownership of rights to a process that is crucial in developing an important product may be a source of significant economic power. Effective information flows among the policy makers build strong social capital. In the case of HQCF, a strategy to institute a policy to guide implementation is being pursued. As Klerkx et al. (2012) suggested, in order to sustain stakeholder engagement, innovation brokering involving performing several linkages building and facilitation activities in innovation systems, creating an enabling context for effective policy formulation and implementation, development and innovation is needed.

Policy makers' involvement especially by creating a favourable policy environment brings food quality, safety and health assurance to end-users of innovation. The assurance given to different actors through the policy will impact on economic agents and markets better and different aspects of the innovation can be explored: Yield-increasing, cost reducing, quality-enhancing, risk-reducing, environmental-protection increasing, and shelf-life enhancing. As Sunding and Zilberman (2000) assert, private investment in the generation of embodied innovations requires appropriate institutions for intellectual property rights protection.

What the unsuccessful cases teach is that it is not enough to justify the initiation of an innovation process only on biological-chemical and mechanical basis (Rogers 2003). The natural resource should be well mapped and understood before start of projects. Otherwise, when there are averse environmental changes as seen in the case of Azolla, policy makers will lose interest in engaging. Initiatives that foster environmental awareness and attachment to local ecosystems, develop capacity for social entrepreneurship in the environmental arena, promote dialogue between key stakeholders, and provide institutional support to new institutions may facilitate the emergence of integrated, collaborative ecosystem-management approaches (Biggs et al, 2010). When funding support is irregular, awareness campaigns among target groups including farmers, processors and industry as a whole become limited. Participating public administrator get discouraged when they are not provided with adequate logistics to make them mobile, do research and provide technical advice. Most of the policy makers are driven by social welfare to engage, yet it is effective markets that are needed to sustain the innovation system.

Maako Ntoose is considered non-successful; when the private company RMG Ltd. is able to repackage the message and commercialise effectively, the product life cycle will be revived, and policy makers will revive interest in engaging again. For the Ministry of Food and Agriculture to be proud and associate with the success, it should provide budget for public relations aspect of promotion. Researchers' interest in further improving the variety can continue and all other stakeholders can re-examine their role if the public policy making officers take post and contribute effectively. Neef and Neubert (2011) contended that agricultural researchers engaged in participatory processes with local stakeholders should decide for which issues and in which phases certain participatory elements could be used in a specific research context. Although the private sectors participation in MNT was identified at the initial stage the marketing research and consumer studies expected from public sector funding were not well integrated.

In initially engaging stakeholders, a simple, compelling focus is important in enabling a collaborative group to form and "gel." The group should be coordinated by policy makers. For example, in the case of HQCF, producing a composite flour that can reduce the need for wheat flour provided a clear issue for approaching MoFA-RTIP project and different stakeholders (farmer organisations, breeders, food researchers, extension agents and processing companies) and initiating discussions. Once the group had formed, it was possible to develop more complicated and diverse foci. The need to involve policy makers in subsequent groups was not lost, hence officers of MoFA, MESTI, MoH and MoTI have been involved in workshops that discuss further work of researchers and consultants facilitating the innovation process. In the case of SWCR, developing cheap and easy-to-construct terraces that can be replicated by farmers in many places to reduce cost of production and farm management, provided a clear issue for approaching the different stakeholders (including MoFA-GIDA and AgSSIP). In the case of MNT, improving nutritional qualities of pepper, increase yield and lower cost in the processing of pepper provided a clear issue for approaching and initiating discussions with different stakeholders (public administrators, breeders, food researchers, private sector processing companies). In the case of UAM, enhancing soil fertility with organic rather than inorganic fertilizer provided a clear issue for approaching and initiating discussions with different stakeholders (public administrators, soil researchers, farmer groups, extension agents). The examples from innovation platforms applied by IWMI, COS-SIS, FARA and IITA support shared learning at different levels. To sustain the interest of policy makers in shared learning, motivation in the form of regular and timely information flows, capacity-building to strengthen ability to provide technical advice and providing logistics to contribute to monitoring and evaluation of outcomes at all stages become important.

Emerging findings/theories

Agricultural innovations systems are complex socio-ecological systems, with many different actors and numerous interconnected subsystems (Rooyen et al. 2017). Agricultural innovation platforms should create an environment in which specific scheme actors can engage,

experiment, learn and build adaptive capacity to increase market-related offtake and move actors out of poverty.

In initially engaging stakeholders, a simple compelling focus is important in enabling a collaborative group to form and "gel." The initial collaborative group should include policy makers, whose major role should be to coordinate activities that will ensure consistent success at the initial, intermediate and end-term level. Once the group has formed, it is possible to develop more complicated and diverse foci. The most severe obstacles to sustaining policy maker involvement are linked to institutional and governance concerns - institution should remain innovative and adaptive over time and there should be fair distribution of benefits and incentives among stakeholders during engagement (Sayer, 2013; Gunderson and Holling 2002, Berkes et al. 2003 & Chapin et al. 2009).

Conclusion, Decision and Policy Implications

Agricultural policy makers hold influential positions and are able to exercise a high degree of control or influence in the innovation system. They facilitate mobilisation of resources (human, financial, physical, natural and social) needed to get the system to function. They regulate by promoting or slowing down the growth of processes designed to improve the lives of ordinary people. They promote growth when they coordinate institutions, release funds timely, provide technical advice, and engage in innovation diffusion, commercialisation as well as monitoring and evaluation. Any actions short of these attributes slow down growth and development. It means that their involvement at all stages of the agricultural innovation process is not only necessary but should be the sufficient condition.

The study sought to identify and document success and failure cases of engagement of policy-makers in agricultural innovation processes in Ghana and draw lessons about key success and failure factors of the engagement. Four innovations developed in the last three decades were used as case studies. Two of the innovations including High Quality Cassava Floor and Simple Water Control Systems for Rice production developed in the late 1990s were considered as success cases. Two others, Maako Ntoose (developed in late 1990s) and Utilisation of Azolla as manure in Lowland Rice Cultivation on the Vertisols of the Accra Plains (developed in early 1980s) were considered as unsuccessful cases. All the four were initiatives of research institutes of the Council for Scientific and Industrial Research or departments in Universities, in collaboration with international research institutes, Ministry of Food and Agriculture and financiers.

The key factors of success of the HQCF and SWCR innovations are linked to effective financial support during development and effective marketing after the laboratory and field experimentation stages. Farmers generate income from sale and consumer acceptability has sustained the products on the market. The competition for cassava flour and rice from imported alternatives is high, calling for more efforts from policy makers to help beat the

competition. For HQCF, policy makers (MESTI) are supporting creation of policy environment to promote the product among processors. Field experimentation is monitored by both MESTI-CSIR and MoFA-AEAs. When Industry was invited by RTIMP at the right time to participate in different fora that discussed the HQCF process it contributed to advertising and personal selling through social sensitisation campaigns. The regular engagement of MoFA and SRI staff at farm level assured input dealers to stock small implements needed for the simple water control strategies, which has supported its adoption by farmers and continued engagement of stakeholders.

The key failure factor of Maako Ntoose and Azolla utilisation, is lack of commercialisation. The new vegetable is not on the market. MoFA's involvement at the local level was not well structured; where they lead in widespread to disseminate through local level extension and demonstration was not included in the initial plan. Despite the involvement of private sector (A. Panford Ltd. and VEPEAG), lack of funds to support regular monitoring and scaling up of projects led to the project closure. The utilisation of Azolla is known among few farmers. There are several water bodies in Ghana to support the scaling of Azolla experiment; apart from the natural resource factor it is constrained by availability of funds from both the public and private sectors.

The main factors that brought policy makers to engage in the four agricultural innovation processes are the expected enhancement of agricultural actors' (especially farmers and traders) and consumers' livelihoods and growth in gross domestic product. For more beneficial policy maker engagement outcomes, improved interactions between the different subsystems and their agents are key. The commercialisation stage of the agricultural innovation process should not be assigned totally to private sector, since the profit maximisation goal limits too much expenditure on high cost alternatives. The development and market introduction stage of new products require high expenditure. For government initiated new products (as seen with all the innovations), the core policy-making institutions (Ministry of Food and Agriculture, Ministry of Science Technology and Innovation and now Ministry of Local Government and Rural Development) need to budget for engagement at each stage, particularly the commercialisation stage. In this way, policy officers mandated to participate in stakeholder engagement can sustain their interest and support other stakeholders (especially private sector) to promote the innovations through advertising and personal selling techniques.

References

Albaigès, J.; Morales Gutiérrez, AC; Águila Obra, AR; Padilla Meléndez, A; Nuez, de la, JM; Bel Vignal, A; García Salguero, M; 2009. La innovación social, motor de desarrollo de Europa. Socialinnova, Seville, Spain. Available at http://comunidadinnycia.guadalinfo.es/sites/default/files/innovacion_social_librocompleto.pdf

Amerasinghe, P., Cofie, O. O., & Drechsel, P. (2013). Facilitating outcomes: multi-stakeholder processes for influencing policy change on urban agriculture in selected West Africa and South Asian cities. *International Water Management Institute (IWMI).* 153 pp.

Ampadu-Ameyaw, R., Omari, R., & Essegbey, G. O. (2017). Factors Influencing Scaling-up of Agricultural Innovations: Lessons from Ghana. *FARA Research Report*, *1*(4), 20.

Ampadu-Ameyaw, R., Omari, R., Essegbey, G. O. & Dery, Sylvester (2016). Status of Agricultural Innovations, Innovation Platforms, and Innovations Investment. *2015 PARI project country report: Republic of Ghana*. Forum for Agricultural Research in Africa (FARA), Accra Ghana.

Berkes, F. (2010). Ecosystem stewardship: sustainability strategies for a rapidly changing planet. *Trends in Ecology & Evolution*, 25(4), 241-249.

Biggs, R., F. R. Westley, and S. R. Carpenter. 2010. Navigating the back loop: fostering social innovation and transformation in ecosystem management. *Ecology and Society*, 15(2), 9.

Birkland, T. (2011). An Introduction to the Policy Process: Theories, Concepts and Models of public policy-making. Routledge Taylor and Francis, London and New York

Botterill, L. C. (2005). Policy change and network termination: The role of farm groups in agricultural policy making in Australia. *Australian Journal of Political Science*, 40 (2, 207-219 https://doi.org/10.1080/10361140500129982

Carney. M (2000). The development of a model to manage change: Reflection on a critical incident in a focus group setting. An innovative approach. *Journal of Nursing Management*. 8 (5), 265-272

Chapin III, F. S., Folke, C. & Kofinas, G. P. (2009). A framework for understanding change. In *Principles of ecosystem stewardship* (pp. 3-28). Springer New York.

Cooper, R. G. (2001). Winning at New Products: Accelerating the process from idea to launch, 3rd Edition. Reading, MA: Perseus Books. CTA & KIT (2005) Methodological Framework.Analyzing the Agricultural Science Technology and Innovation (ASTI) Systems, in ACP Countries. The Netherlands.

Devaux, A., Horton, D., Velasco, C., Thiele, G., Lopez, G., Bernet, T., Reinoso, I. andOrdinola, M. (2009). Collective action for market chain innovation in the Andes. *Food Policy* 34(1):31–38.

Dubbeling, M.; Zeeuw, H. de; Veenhuizen, R. van (eds) (2010). Cities, poverty and food: multi-stakeholder policy and planning in urban agriculture. *International Water Management Institute (IWMI).* 152 pp.

Evenson, R. (1974). International diffusion of agrarian technology. *The Journal of Economic History*, 34(1), 51–93.

Fatunbi, A. O., & Adekunle, A. A. (2013). A Partnership Approach for Effective Engagement of the Private Sector in Agricultural Research and Development. *World Journal of Agricultural Sciences*. 9(1), 53-59.

Folke, C., Colding, J., & Berkes, F. (2003). Synthesis: building resilience and adaptive capacity in social-ecological systems. *Navigating social-ecological systems: Building resilience for complexity and change*, *9*(1), 352-387.

Gerpott, T.bJ (1999). *Strategic Technology and Innovation Management*, Stuttgart, Schäffer-Poeschel.

GoG (2007) Food and Agricultural Sector Development Policy. Government of Ghana, Ministry of Food and Agriculture, Accra. Ghana.

GoG, (2014) Ghana Shared Growth and evelopment Agenda II, (2014-2017). Government of Ghana, National Development Planning Commission, Accra, Ghana.

GPFI/IFC (2011). "*Scaling Up Access to Finance for Agricultural SMEs: Policy Review and Recommendations"* Washington, DC: International Finance Cooperation (IFC). Cities, poverty and food: multi-stakeholder policy and planning in urban agriculture.

Gunderson, L. H & Holling, C. S., (2002). Resilience and adaptive cycles. *In: Panarchy: Understanding Transformations in Human and Natural Systems, 25-62*.

IICA, (2013). Impactful Innovations: Lessons from family agriculture in Latin America and the Caribbean. San Jose, CR. Inter-American Institute for cooperation on Agriculture.

IICA, (2014). Innovation in Agriculture: A key process for sustainable development. Institutional position paper. Inter-American Institute for cooperation on Agriculture.

Jones, R. S., & Kimura, S. (2013). Reforming agriculture and promoting Japan's integration in the world economy. *OECD Economics Department Working Papers*, No. 1053, OECD Publishing.

Jotie, Sule N. (2017). Ghana's agricultural policy since 1960: Planting for food and jobs, the new baby. Ghana Information Services Department, Accra, Ghana

Makini G., Wambugha, F.,Kamau, M., Nafula, M., Makelo, G. & Mburathi, K. (2013). A guide for developing and managing agricultural innovation platforms. Kenya Agricultural Research Institute (KARI), Kenya.

Klerkx, L., Van Mierlo, B., & Leeuwis, C. (2012). Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions. In, Farming Systems Research into the 21st century: The new dynamic. *Springer Dordrecht*, 1 (1), 457-483.

Mohanty, R. P., Agarwal, R., Choudhury, A. K. & Tiwari, M. K. (2005). A fuzzy ANP-based approach to R & D project selection: a case study. *International Journal of Production Research*. 44 (24), 5199-5216.

Mokyr, Joel. 1990. *The Lever of Riches: Technological Creativity and Economic Progress*. New York: Oxford University Press, Inc.

Mytelka, L.K. (2000). Local Systems of Innovation in a Globalized World Economy. *Industry and Innovation*, 7 (1), 1-18.

Neef, A., & Neubert, D. (2011). Stakeholder participation in agricultural research projects: a conceptual framework for reflection and decision-making. *Agriculture and Human Values*, *28*(2), 179-194.

Obirih-Opareh, N. (2008). Strategies of poverty reduction in Africa: the case of irrigated agriculture in Ghana. *African Renaissance*, *5*(2), 58-68.

OECD (2002), Reading for Change: Performance and Engagement across Countries, OECD, Paris.

Ponzoni, R. W. (2008). Proceedings of a workshop on the development of a genetic improvement program for African Catfish Clarias Gariepinus: Accra, Ghana. World Fish Report.

Quaye, W., Essegbey, G.O., Decker, E. and Onumah, J.A. (2015). The role of science technology and innovation in socio-economic development of Ghana – Linking research to the private sector at the CSIR-Technology Transfer and Development Centre (TDTC). *Journal of Advances in Science and Technology Research* 1(2), 6-14.

Rogers, E. (2003). *Diffusion of Innovations*. Fifth edition. Free Press: New York.

Rooyeen, A. F., Ramshaw, P., Moyo, M., Strizaker, R. & Byornlund, H. (2017). Theory and application of Agricultural Innovation Platforms for irrigation scheme management in southern Africa. *International Journal of Water Resources Development*. 33 (5), 804-823

Sayer, J., & Cassman, K. G. (2013). Agricultural innovation to protect the environment. *Proceedings of the National Academy of Arts and Sciences* 110 (21), 8345-8348; https://doi.org/10.1073/pnas.1208054110

Sam, J., & Dapaah, H. (2009). Baseline survey report: West African Agricultural Productivity Programme (WAAPP), Accra, Ghana.

Sova, C. A., Thormton, T. F., Zougmore, R., Helfgott, A. & Chaudhury, A. S. (2017). Power and influence mapping in Ghana's agricultural adaptation policy regime**.** *Climate and Development***,** 9 (5), 399-414

Sunding and Zilberman (2000) The Agricultural Innovation Process: Research and Technology Adoption in a Changing Agricultural Sector. A report prepared for the Handbook of Agricultural Economics. University of California at Berkeley, USA.

Wilsdon, J., & Willis, R. (2004). *See-through science: Why public engagement needs to move upstream*. Demos.

World Bank. (2007a). *Enhancing Agricultural. Innovation: How to Go Beyond the. Strengthening of Research Systems*. The World Bank, Washington, DC.

World Bank, (2007b). World development report 2007: Agriculture for development. Washington, D.C. Available at http://siteresources.worldbank.org/INTWDRS/Resources/477365-1327599046334/8394679-1327614067045/WDROver2008-ENG.pdf

Yasabu, S. (2017). Innovation and R4D platforms in Africa Rising: questioning sustainability. Http://www.afria-rising.net/