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INTEGRATING INNOVATION PLATFORMS TO FACILITATE DEMAND-LED EXTENSION AND KNOWLEDGE MANAGEMENT FOR INCREASED FOOD AND INCOME SECURITY WITHIN SMALLHOLDER FARMING SYSTEMS IN MALAWI

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ABSTRACT

Malawi's economy is predominantly agro-based. Smallholder farmers are the main producers of most food crops, despite the challenges they face in accessing; reliable information on modern technologies, extension support and product marketing systems. To address this, an innovation platform was institutionalised among various research and farmer organisations, private traders and extension organisations during the 2008/09 and 2009/2010 growing seasons in Zomba district, in the southern region of Malawi. This platform aimed to promote broad-based extension on integrated soil fertility management (ISFM) to increase productivity, manage natural resources and improve marketing of maize and associated legume crops. A total of 1,000 learning centres were established at strategic locations to ensure that as many farmers as possible could access them. The innovation platform was empowered to conduct site identification, farmer training and market facilitation. Results indicated that the functioning innovation platform improved farmer accessibility to basic extension services and information on crop management, soil fertility and marketing. This was demonstrated by an increased number of farmers (65%) who were using new ISFM technologies. Furthermore, extension workers found it easier to help farmers gain access to inputs and credit. Farmers expressed satisfaction with the benefits derived from using improved soil fertility technologies (12.8%), higher yields (52.3%) and diversified household diets (26.7 %). The study concluded that integration of innovation platforms within the mainstream extension service is critical to enhancing farmer learning.

KEY WORDS: *SOIL FERTILITY, LEARNING CENTRE, MARKETING, CEREAL, LEGUMES*

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INTRODUCTION AND OBJECTIVES

Maize (*Zea mays* L.) is the staple food crop and dominates the cropping systems in Malawi. Between 1997/98 and 2006/07 seasons, maize area has ranged between 1.2 and 1.6 million hectares (ha), with average yields ranging between 0.81 and 2.86 t/ha (MoAFS, 2008a). Poor soil fertility is one of the major causes of low yields (Kumwenda *et al*., 1997). The policy of the government is to increase yield per unit area in order to meet increasing demand for the growing population and release land for other food and cash crops (MoAFS, 2008b). To address the problem of low soil fertility, the Government of Malawi, through the Ministry of Agriculture and Food Security began to implement a Farm Inputs Subsidy Programme in 2005/06 season which targeted farmers' access to fertiliser, maize and legume seeds at very low prices. This policy was a follow-up to extensive research findings that were conducted in the previous 15 years. In this period, researchers identified and developed relatively low cost technologies to improve soil fertility. These included the use of grain legume rotations and green manure such as *Mucuna* spp. (Kumwenda and Benson, 1998), pigeon pea intercropping or rotations (ICRISAT/MAI, 2000; Sakala *et al*., 2004. There was also a nationwide campaign for making and using compost manure. Several organisations have also promoted agroforestry for soil fertility improvement. The Soil Fertility Consortium for Southern Africa (SOFECSA) identified Zomba district as a focal point for testing accelerated crop productivity using integrated soil fertility management (ISFM) as the entry-point.

The main objective of the study was to test integrated agricultural research for development (IAR4D) as a model for accelerating crop productivity using ISFM as an entry-point for technology diffusion. The entry-point for increasing productivity was the promotion of ISFM using strategies that involved stakeholders along the entire value chain, working in an innovation system framework. We report on methodologies and results of a study carried out to facilitate increased yield using the promotion of legume-based systems to raise soil productivity and establishment of innovation platforms (IPs) at different levels to achieve the purpose. The organisation and set-up of field experiments and stakeholder participation was designed so that the role of IAR4D could be compared with other non-IAR4D sites.

MATERIALS, METHODS AND DATA SOURCES

Zomba is a densely populated district located in southern Malawi, which is host to Zomba town, the former colonial capital of Malawi. The town provides a hub for economic growth for the district, offering traditional market outlets, job opportunities, road and telecommunication connectivity, hotels, schools and colleges, a referral hospital and several other institutional establishments. Due to its high production of pigeon peas, common beans and other food crops, many traders come to Zomba markets to buy large quantities of these products for sale and export. Zomba district has a total land area of 258,000 ha, of which 203,028 ha is under cultivation and just over half of that (111,007 ha) is under smallholder cultivation. In 1998, the population density was 209 persons per square metre. The climate is generally considered favourable to crop production (600–1,500 mm mean annual rainfall; 10–30°C mean temperature). Generally, crop yields per ha are lower in the district than the national average, in spite of the overall high potential of the district. Site identification was carried out using the project's guidelines as well as guidelines drawn up by a district level platform. The selection was led by the district agriculture office where most of the field extension staff were based.

Planning and review workshops were held in 2007, 2008, 2009 and 2010 at district, extension planning area (EPA) and village level. In 2008, a training of trainers' workshop on ISFM and technology dissemination was conducted. A travel workshop for the district IP was conducted in 2008. Field days were guided by the overall project design. Four EPAs and five villages were selected in the district for ISFM promotion activities as well as a baseline study (Table 1).

The key strategy used by the task force was to establish learning centres (LCs) where all

stakeholders could gain useful knowledge and practical orientation of grain legume-based ISFM technological packages. The LCs enabled partners to identify, test and promote best-fit soil fertility and crop diversification technologies for increased food security and enhanced livelihoods. The field testing plots were referred to as 'learning centres' because of their utilisation. The plots served as platforms for discussions and sharing information on technologies, approaches and challenges. Extension agents used the same to initiate discussions on best-fit soil fertility technologies and other issues on maize. In the 2008/09 crop season, a total of 100 LCs were established at strategic locations. Soil samples were taken from 60 of these. The treatments used in the LCs are shown in Table 2. Treatments were planted in 10 rows, each 10 m long and 0.75 m apart. In the second growing season, all plots were planted with fertilized maize at 69:21:0+4S.

TABLE 1: TEN CASE-STUDY INNOVATION PLATFORMS IN SUB-SAHARAN AFRICA (NEDERLOF *et al.*, 2011)

District	Extension planning area (EPA)	Village	No. of farm families
Zomba	Malosa	Chitenjere 1	181
	Dzaone	Baloni	77
	Likangala	Chiondeka	50
	Mpokwa	Litta	200
		Mpokwa	143

TABLE 2: TREATMENTS SERVING AS FOCAL THEMES IN THE LEARNING CENTRES

No	Description
1	Pure crop of maize, 75 cm between rows, 25 cm between stations, 1 seed/station (75 x 25 x 1). Plus 69:21:0+4S
2	Intercrop of maize and pigeon pea, 75 x 75 x 3 + 69:21:0+4S
3	Pure stand of groundnuts, 75 cm, 15 cm between hills
4	Pure stand of soybeans (Likangala, Mpokwa EPAs) or beans (Malosa and Dzaone EPAs) 75 x 2 rows x 2.5 cm. For beans: two rows, 10 cm apart. Basal dressing of 100 kg 23:21:0+4S to both crops.

The learning centres were used to impart the following key extension messages to farmers during field interactions:

- identification of reliable seed sources of improved varieties to ensure good crop establishment and raise the yield potential;
- timely planting as well as correcting row or ridge spacing to maximise yields per unit area;
- intercrops with pigeon pea need to be systematic, rather than sporadic;
- fertilizer application in legumes, intercrops or maize should be done correctly and at the correct time;
- rotations with legumes can improve yields of subsequent maize crops;
- well managed legume crops can be a source of alternate cash food for balanced nutrition;
- efficient use of mineral fertilizers increase yields.

RESULTS AND DISCUSSION

Socio-economic and demographic background of farmers

The majority of the farmers, over 30.9%, were in the 31–40 age range. This was followed by those who stated that they were in the 41–50 age range, which accounted for 23.5% of the farmers. Only 1.2% of farmers were under 20 years of age. Only nine farmers were above 60 years of age. The majority of the farmers (74.2%) were monogamously married. Thirteen-and-a-half per cent of farmers were widowed, while there was only one case of a polygamous relationship.

Putting the innovation platform concept into practice

The general composition and roles of the IP are shown in Table 3. The technical hub established

the district IP, organised training on IAR4D and ISFM and supported the implementation of experimental plots in the LCs. The hub facilitated marketing and value chain studies and gave feedback to members of the IP on the type and quantity of commodity desired by the market. It was also responsible for analysing all field data and giving feedback to the district IP on the outcome of all the field experiments. The district IP was responsible for facilitating discussions and agreement on treatments used in the LCs. It ratified site selections, and carried out community mobilisation at EPA and village level. They also took part in facilitating monitoring and evaluation activities at all levels. The village level IP was instrumental in mobilising and conducting farmer training, field days and LC-level discussions, record-keeping and technical back-up. Most of the participating farmers appreciated the objectives of the LC and displayed an understanding of ISFM concepts, including crop husbandry practices. In the second year, the effectiveness of the IP approach was evident, as many host and non-host farmers used the concepts they had learned from the innovation platform in their own fields (i.e. proper plant spacing and populations, using good seed, planting on time and good weed control). This was facilitated by the fact farmers were able to access low cost fertilizer through the government subsidy programme. Most farmers reported groundnuts to be the best crop for using in rotations. During May and June 2010, the IP refocused its attention on marketing issues.

TABLE 3: COMPOSITION AND ROLES OF INNOVATION PLATFORM IN ZOMBA, SOUTHERN MALAWI

Platform level	Composition	Roles
Technical hub	Agronomist, economist and resources specialist	Setting agendas, secretariat to all IPs, implementing work plans and producing technical reports
District	NGOs, agro-dealers, crop specialists, extension specialist	Discussing and ratifying objectives and work plans, facilitating co-ordination of ISFM promotion and marketing, training activities at EPA or village level
EPA	District IP representatives	Discussing work plans, facilitating and implementing of ISFM LC plots, activities on marketing, training at EPA or village level
Village	Famers and local extension agents	Discuss performance of LCs, appropriateness, orienting other partners, recording events

Benefits of the innovation platform in promoting ISFM technologies

The majority of the farmers who participated in the innovation platform described the benefits they had derived from their involvement with the platform (Table 4). Most of them (52%) stated that they had learned new improved agricultural methods through the platform. Twenty-four per cent of farmers indicated that they achieved higher yields. Additionally, 14% of farmers acknowledged increased availability of agricultural inputs from government as well as innovation platform members.

It was further observed that an increasing number of farmers were using ISFM technology. This was reflected in the increasing numbers of learning centres that were being established in the communities. Initially, the team innovation platform only introduced 100 learning centres but after two seasons, the number of learning centres increased to 700 in all four project EPAs. Both participating and non-participating farmers practised these technologies in their fields. Some of the benefits of using ISFM technologies, as reported by farmers, included: improved soil fertility (13%), higher yields (51%) and diversified food security (27%) (Figure 1).

Role of platform in facilitating cereal–legume value chain development

The promotion of market-linked ISFM technology started with a value chain analysis to map and characterise the major players in the legume–

TABLE 4: BENEFITS FROM INVOLVEMENT WITH IPs

Benefits from IPs	*N*	%
Learned new planting techniques	2	4.0
Learned realignment of ridges	1	2.0
Learned improved agricultural methods	26	52.0
Higher yields than before	12	24.0
Learned benefits of natural resource management	1	2.0
Received inputs	7	14.0
Learnt to practice farming as a business	1	2.0
Total	**50**	**100.0**

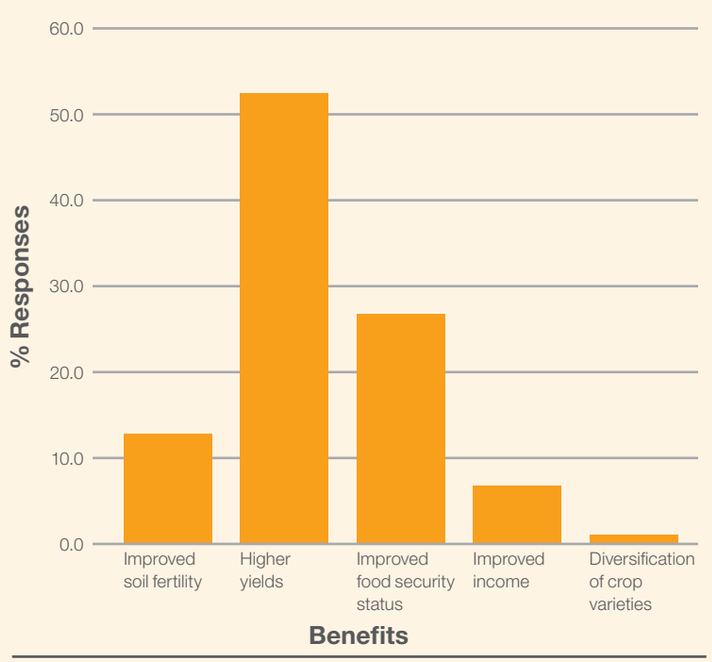

FIGURE 1: BENEFITS OF FARMER ADOPTION OF ISFM TECHNOLOGIES

maize value chain, from its production to the final end-users. The survey documented the types of grain legume products on the market and the key players, selling price, form of sale and origin of product in the main markets of Jali, Malosa and Thondwe. It was observed that there is very little processing of grain products. Only two institutions were identified, which processed grain legumes into various products, for animal feed or nutritious flour mixes for baby feeds.

Capacity-building activities on marketing were also conducted for farmers. The platform in conjunction with district agriculture staff facilitated training on marketing in order to empower farmers in business management skills as well as market research on targeted enterprises. The training also tackled issues of group dynamics, quality assurance for the market and processing.

The value chain study sought to identify buyers for cereal and legume products in the district, as well as collect data on the traders, the types of grain, seed sources, processing, prices and volumes traded.

Results indicated that there were different types of traders operating in Zomba.

1. Traders who travel to other markets to buy their products for resale, either on wholesale or retail.
2. Traders who buy their products from farmers who bring their products to the markets, mostly on market days.
3. Wholesale traders who buy directly from farmers in their communities or in different markets.

The study also found that pigeon peas, beans, groundnuts and soybeans could be consumed or sold in different forms. The soybean could only be consumed. The leaves of beans were consumed as fresh vegetables or preserved and consumed as dry leaves. Pigeon pea and groundnuts were consumed as fresh pods or dried and consumed as whole grains. The results showed that most of the legumes were consumed as whole grains (Figure 2).

Producers faced different problems in producing different types of crops. Pigeon peas had pest problems. Bean production, including soybean, suffered from pest infestation and difficulties in getting markets. Groundnuts also suffered from pest infestations and showed relatively low yields (Figure 3).

There were only two processors located in the study area. One processing unit, based in Domasi, processed soybean, groundnuts and beans into a number of products ranging from 'Likuni Phala' (an enriched cereal powder for baby feeding) to animal feeds. The other processor (Malosa Community Based Organisation) processes groundnuts into a number of products for commercial purposes. A number of challenges were highlighted by traders in the markets which related to:

1. transportation of products from buying points which was expensive and sometimes scarce;
2. high producer prices versus low selling prices;
3. lack of micro-finance institutions that provided loans to traders to boost their capital base;
4. low supply of them which forced traders to travel long distances to get them.

The innovation platform aimed to facilitate the expansion of markets and production bases for smallholder farmers. The technical hub undertook efforts to broaden market players and options for investing in production. The innovation platform initiated collaboration with farmer commercial banks to train farmers on how they could manage their businesses better and access loans to expand their production of maize and legumes. The innovation platform facilitated the formation of marketing committees, which assisted in market research for farmers and helped them to engage with local agro-dealers (i.e. Reform Enterprises began to stock legume seeds in response to

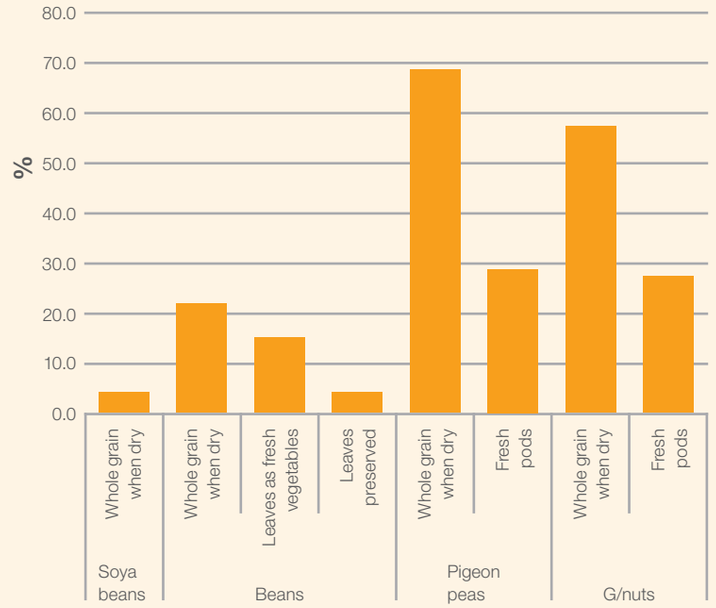

FIGURE 2: FORMS OF CONSUMPTION OF LEGUMES

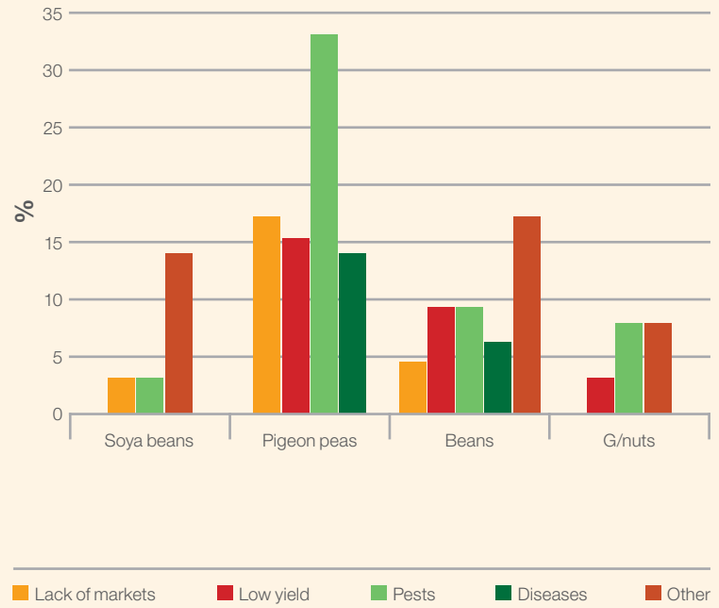

FIGURE 3: PRODUCTION AND MARKETING PROBLEMS

demands by farmers in the area). The marketing committees also provided current trading prices to farmers, including sources of such information. By the end of the second season (2008/2009), the marketing committees had established links with large traders such as: ADMARC, Mulli Brothers, Transglobe Produce Exports, Farmers World and AGORA and they had started buying from farmers.

Role of the innovation platform in knowledge sharing and learning initiatives

As noted earlier farmer productivity in Malawian agriculture is constrained by lack of appropriate technology or access to technology, inputs, services and credit and farmers' inability to bear risks. In addition, farmers' information and skills gap constrained the adoption of available technologies and management practices in Zomba district. To address these challenges, the innovation platform gradually shifted from strengthening research systems and knowledge transfer towards building innovation capacity to enhance use of knowledge. A more flexible approach that enabled knowledge generation, use

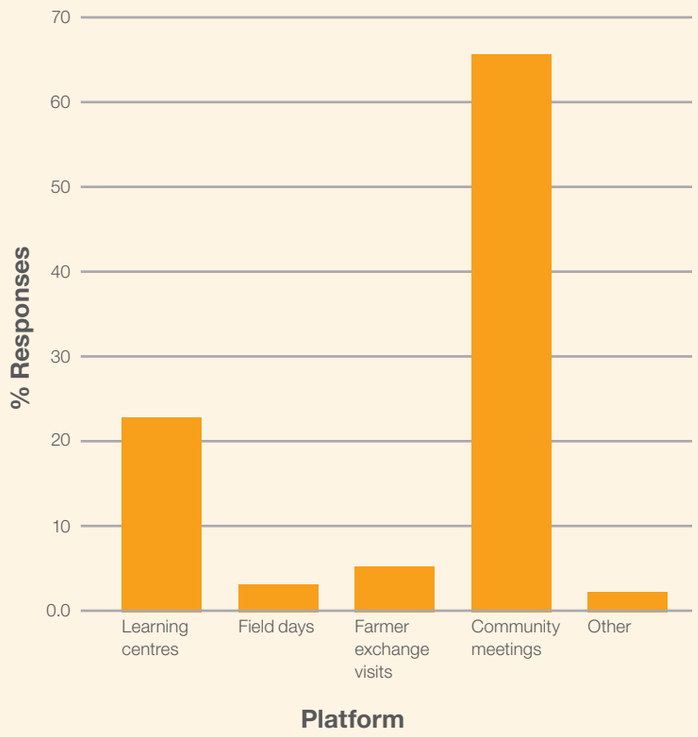

FIGURE 4: INFORMATION AND KNOWLEDGE SHARING MECHANISMS

and innovation in different contexts was developed as recommended by Freeman (1987) and Lundvall (1992). For effective operation and decision-making, the IPs were trained on how to conduct field days, feedback workshops and travel workshops to LCs.

These activities were conducted for each IP cycle with some overlaps. The key strategy used by the platform was to establish LCs whose main objective was to provide a focal point for all levels of stakeholders to gain useful knowledge and practical skills on cereal–legume based ISFM technological packages. The LCs enabled partners to identify, test and promote best-fit soil fertility and crop diversification technologies for increased food security and enhanced livelihoods. The field testing plots were referred to as 'learning centres' owing to their use as a source of knowledge for the village innovation platform. These plots served as platforms for sharing information and discussing technologies, approaches and challenges between farmers and other farmers, extension agents and researchers. A number of information and knowledge sharing mechanisms were created within the IP to disseminate ISFM information to the majority of farmers. These were identified by farmers themselves (Figure 4).

The district IP facilitated knowledge-sharing activities with members of the platform and with farmers. The IP supervised site identification, partner training, input purchases and distribution for the learning centres and activities related to the field days. A monitoring exercise was undertaken to track the number of learning centres established, community meetings conducted and field days that were organised by the extension staff or by the farmers themselves. Farmers learned better by seeing the benefits of the technologies in their fellow farmers' fields. Non-traditional farmers were convinced to adopt the technologies after observing their fellow farmers' fields during field days.

Most of the farmers rated the information shared in the platform highly both in terms of timeliness (67.8%) and adequacy (80%). Another 93.3% reported it as useful for the establishment of new learning centres (Table 5).

TABLE 5: FARMER RATING OF INFORMATION DISSEMINATED WITHIN THE INNOVATION PLATFORM

	Rating of information disseminated					
	Timeliness	Adequacy	Dissemination	Usefulness	Content	Delivery channel
Poor (%)	6.6	3.3	14.4	2.3	4.5	1.1
Average (%)	25.6	16.7	30.0	4.4	0	13.3
Good (%)	67.8	80.0	55.6	93.3	95.5	85.6

CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

The majority of farmers within the innovation platform preferred cereal–legume intercrops, with

over 96.1% ranking it as a better system, compared to other integrated soil fertility management technologies promoted by the platform (such as legume rotations or sole cropping). There were a variety of reasons given for this ranking, which ranged from improvement in soil fertility to increases in maize yields following the intercrop. Different types of ISFM technologies were promoted in the five EPAs depending on the type of area and how the technology performed in the area. In order to increase adoption, farmers were encouraged to use their inputs from government subsidies to practice ISFM in their own fields. At the end of every season, an evaluation was done of the farmers practising ISFM technologies and the non-practising famers. Farmers were given a chance to explain why they used a particular type of technology and how it had benefited them.

Results from the impact assessment study conducted at the end of the third season revealed that farmers had learned a diverse number of issues from their interaction with the learning centres and with the platform in general. Their understanding of the ISFM concept was well developed and they were able to share this knowledge with their fellow farmers in the community. These included legume-cereal rotation/intercropping (21.9%) and Sasakawa method of planting (28.1%) which has become popular amongst the farmers in the district.

However, despite these successes, a number of challenges were experienced during the implementation of the platform, which in some instances led to under-achievements of planned outputs. The major challenges experienced during project implementation were as follows.

- Attracting and sustaining the participation of the private sector in the platform. Most private sector companies were not satisfied with the capacity of farmers to meet their demands. There was inconsistent representation of private sector actors in platform meetings as well as failure to honour invitations to discussions. Thus organisations needed to ensure that their officials/employees clearly knew and understood what was happening in the IP. The IP also should give adequate and timely feedback to all participants on discussions, agreements and action plans.
- Most farmers who participated in the platform were resource constrained and lacked sufficient capacity for up-scaling of the technologies. Farmers still relied on the research team and extension staff to provide them with tools and implements for production. There is a need for platform facilitators to encourage a change in the mindset and attitude of farmers, in order to cultivate a spirit of self-dependence so farmers can get to commercial levels of production. As a solution, the IP constantly encouraged the farmers to look for inputs on their own and not wait for hand-outs. This was done to empower them and ensure sustainability of the practices without the need for external assistance.
- The platform frequently suffered from changes in representation from organisations and institutions resulting in limited continuity and institutional memory in the activities of the platform.
- The IP did not fully address the issue of marketing as some farmers failed to sell excess commodities in the market. While the IP managed to demonstrate to farmers how they could benefit from ISFM technologies, some farmers did not expand their production to meet market demands and as a result, the IP did not sufficiently facilitate the marketing functions to support farmers.
- Empowerment and capacity-building for the farmers are critical for sustainability and self-reliance. After the training in collective and future contract marketing, the farmer committees found markets on their own. This was crucial for sustaining the benefits of IAR4D, because the farmers were able to carry out market research and negotiate for contract deals independently.

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