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Use of innovation platforms in addressing soil fertility challenges: experiences from rural Zambia

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ABSTRACT

Low soil fertility has been recognized as one of the challenges contributing to low crop productivity in Zambia. In order to address this challenge, the government, the private sector and non-governmental organizations (NGOs) have promoted the use of Soil Fertility Management (SFM) technologies such as agroforestry, animal manure, compost, intercropping of legumes, and minimum tillage. In recent years, Innovation Platforms (IPs) have been used as a means to promote farmer participation in appropriate technology identification and development. This is done to enhance technology adoption and rural development in general. In Zambia, there has been little or no documented experiences or lessons learnt in the use of IPs to address any agricultural problem. Therefore, this paper, attempts to fill this information gap by providing information on the experiences in the use of IPs to address low soil fertility challenges in Zambia's Kasama and Chipata districts. An IP was established in each district with members drawn from different organizations. The objective of the IP was to provide a platform for discussing and disseminating information in order to enhance the awareness of low soil fertility issues and available appropriate SFM technologies. The experience with the use of IPs showed that IPs are a platform were farmers participated freely in identifying and prioritizing soil fertility challenges. Farmers also participated in proposing solutions and developing an action plan to address the challenges. The other experiences with IPs showed that they are effective information and technical knowledge sharing platforms which enhanced awareness of soil fertility challenges and the available SFM technologies. The IPs also contributed to improving working relations among public, private sector and NGOs. Also IPs were equally key in mobilizing locally available resources (skills, competences and finances) to train farmers in some of the SFM technologies; to raise and distribute agro forestry seedlings and planting materials to farmers; and to help access the local media.. Therefore, the use of IPs should be encouraged as an approach for extension service delivery in rural areas. In order to successfully implement IPs it's recommended that a careful selection of stakeholders to participate in IPs is done. Working with local traditional leaders in IPs is also effective in dissemination of information to address low soil fertility challenges.

Key words: Crop productivity and farmers, extension, innovation platform, low soil fertility, Soil Fertility Management (SFM) technologies, Zambia

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RÉSUMÉ

La faible fertilité des sols a été reconnue comme un des défis contribuant à une faible productivité des cultures en Zambie. Afin de relever ce défi, le gouvernement, le secteur privé et les organisations non gouvernementales (ONG) ont encouragé l'utilisation des technologies de gestion de la fertilité des sols telles que l'agroforesterie, le fumier, le compost, les cultures intercalaires de légumineuses et travail du sol. Ces dernières années, les plates-formes d'innovation (PI) ont été utilisées pour promouvoir la participation des agriculteurs à l'identification et au développement de technologies adéquates. Ceci se fait pour améliorer l'adoption des technologies et le développement rural en général. En Zambie, il y a eu très peu ou même pas d'expériences documentées ou de leçons tirées de l'utilisation des PI pour résoudre des problèmes agricoles. Par conséquent, le présent document vise à combler cette lacune en fournissant des informations relatives aux expériences sur l'utilisation des PI pour faire face aux problèmes de faible fertilité des sols dans les districts de Kasama et de Chipata. Une PI a été créée dans chacun des deux districts avec des membres provenant de différentes organisations. L'objectif était d'avoir une plate-forme de discussion et de diffusion de l'information afin de mieux faire connaître les problèmes de fertilité des sols de même que les technologies de gestion de la fertilité des sols. L'expérience de l'utilisation des PI a montré qu'elles constituent une plate-forme ou les agriculteurs participaient librement à l'identification et à la hiérarchisation des problèmes de fertilité des sols. Les agriculteurs contribuent également à la proposition de solutions et à l'élaboration d'un plan d'action pour relever les défis. D'autres expériences ont montré qu'il s'agissait des plates-formes efficaces d'échange d'informations et de connaissances techniques permettant de mieux comprendre les problèmes de fertilité des sols et les technologies disponibles. Les PI ont également contribué à l'amélioration des relations de travail entre secteur public, secteur privé et ONG. Aussi, elles ont joué un rôle clé dans la mobilisation des ressources disponibles localement (compétences, et finances) pour former les agriculteurs dans l'utilisation de certaines des technologies de gestion fertilité des sols ; produire et distribuer des plantules agroforestières et du matériel végétal aux agriculteurs; et faciliter l'accès aux médias locaux. Par conséquent, l'utilisation des PI devrait être encouragée comme une approche pour la prestation de services de vulgarisation dans les zones rurales. Afin de mettre en œuvre avec succès les PI, il est recommandé de bien choisir les acteurs concernés. La collaboration avec les chefs traditionnels locaux dans les PI permet également de diffuser des informations sur les problèmes de fertilité des sols.

Mots clés: Productivité des cultures et agriculteurs, vulgarisation, plateforme d'innovation, faible fertilité des sols, technologies de gestion de la fertilité des sols, Zambie

INTRODUCTION AND BACKGROUND

Low soil fertility has been cited as one of the major constraints to agricultural productivity in Africa (Vanlauwe and Giller, 2006; Beedy *et al.,* 2010; Wheeler and von Braun, 2013). Degraded and infertile soils resulting from mono-cropping and inadequate recycling of organic matter compounded by rainfall variability and recurrent dry spells have led to low crop yields in most of Africa (Ngwira *et al.,* 2012). Due to these challenges, poverty, food insecurity and child malnutrition have negatively affected countries like Zambia.

The agricultural sector supports livelihoods of about 60 % of the 13 million Zambians and accounts for 9.8 percent of the Gross Domestic Product (GDP) (7NDP, 2017). The country has prioritized the agriculture sector as critical in the development agenda of reducing poverty (which currently stands at 56%); food insecurity and increasing household income (7NDP, 2017;

NAIP, 2013). The agenda has been challenged by low crop productivity and production. The low crop productivity has resulted largely from limited access and availability to agricultural credit facilities, inefficient agricultural extension services, unsustainable use of natural resources, low resilience to climate change effects (NAP, 2017), and high cost of inorganic fertilizers (Kwesiga *et al.,* 2003; Akinnifesi *et al.,* 2006) and low soil fertility (Chivenge, 2011).

In Zambia, low soil fertility has resulted in low labour and land productivity largely due to the fact that most soils are degraded and this has been attributed to over reliance and use of acid producing chemical fertilizers on most farm lands (Chivenge, 2011). For instance, the average cereal yield in Zambia is 2 metric tonnes per hectare (CF, 2017), which is well below the cereal global average of 4 metric tonnes per hectare (World Bank, 2014). The low cereal productivity has been attributed to poor soil management practices among other factors. It is argued that a rapid rise in population may have exacerbated soil degradation due to land pressure (FNDP, 2006), thus confining crop production to the same plots, which are overused to the point of diminishing returns. Most smallholder farmers cultivate maize every year regardless of whether they address the soil fertility problem or not (Ajayi *et al.,* 2007b). This is so largely because maize is the staple crop for the country.

A number of Soil Fertility Management (SFM) technologies have been identified to improve soil fertility. Among the most common SFM technologies are: agroforestry (improved fallow, natural fallowing, and biomass transfer); use of animal manure, compost, relay or intercropping of legumes (and dual purpose legumes, and incorporation of crop residues (Place *et al.*, 2003). The use of inorganic fertilizers has also been cited as a means to improve soil fertility, (Sanchez, 2002; Kwesiga *et al.,* 2003; Akinnifesi *et al.,* 2006).

In order to mitigate low soil fertility, previous efforts from government, private sector and civil society have focused on promoting Soil Fertility Management (SFM) interventions using conventional extension approaches that emphasize top down information flow models among farming communities. In these models, knowledge generation and learning follows a linear approach where researchers and experts produce new knowledge and technology, and transfer it to the end users who need it to innovate and change (Lundy *et al.,* 2007). These models are not participatory in their approach, because farmers are not involved in the initial development of the technologies. In recent years, IPs have been promoted as a means to encourage farmer participation in appropriate technology identification and development. This is done to enhance technology adoption and rural development in general.

Several authors have defined IPs. For instance, Homann-Kee Tui *et al.* (2013) define an IP as "A space for learning and change, which is normally a group of individuals who are representatives of organizations, with diverse backgrounds and interests. Often, IPs constitute of farmers, traders, food processors, researchers, extension, government officials, civil society etc. In a participatory way, members diagnose problems, identify opportunities and find ways to achieve their goals. They may design and implement activities as a platform, or individual members coordinate activities."

On the other hand, Makini *et al.* (2013) define an IP as "A forum established to foster interaction among a group of relevant stakeholders around a shared interest. The stakeholders perform different but complementary roles in the development, dissemination and adoption of knowledge for

socio-economic benefit. This could be in the form of new ideas, methodologies, procedures, concepts or technologies used or adapted from other locations."

Most often IPs are formed within a certain period of time and their structure allows them to be self-managed, flexible and always working towards the main purpose. Indeed IPs can be organized either at local or national level and may focus on a single issue or may deal with multiple topics. A facilitator is normally identified and assures the organization coherence and internal and external communication. The facilitator equally ensures that all meetings and activities being undertaken are documented. Skilled facilitation is necessary to ensure that special interests or more influential actors or louder voices do not control or dominate the IPs (Cullen *et al.,* 2013). For IPs to achieve change, special attention needs to be paid to building sufficient local capacity in facilitation. This may involve identifying local partners who can take on facilitation roles and engaging these partners in facilitation from an early phase. It may also require investing in strengthening facilitation skills through pro-active mentorship (Rooyen *et al.,* 2013). Innovation Platforms (IPs) are advantageous over conventional methods such as surveys, value chain analyses, etc. in that they can very quickly identify the key constraints by drawing on extensive local knowledge. Furthermore, local people are more likely to own the solutions they themselves identify, and hence increasing their likelihood of success.

Innovation Platforms have been used to explore strategies that can boost productivity, manage natural resources, improve commodity value chains, and adapt to climate change. Agricultural research organizations have used IPs to help make their research more relevant and to facilitate the adaptation and dissemination of outputs. Innovation Platforms have compelled researchers to look beyond their own discipline or commodity boundaries and consider the entire picture (Lema and Schut, 2013). Local and national governments use IPs to improve policy making, links with clients, and their outreach services for citizens (Cadilhon *et al.,* 2013). Innovation Platforms have also been used as a response to the failure of the conventional agricultural research and extension approach of translating research results into development and social impacts (FARA, 2007), that address prevalent poverty, hunger and malnutrition in Sub-Saharan Africa (Mokwunye, 2010).

Zambia is currently implementing a Swiss National Science Foundation (SNSF) funded project called Organic Resource Management for Soil Fertility (ORM4Soil). The overall goal of the project is to contribute to improving soil fertility through the promotion of appropriate SFM technologies. In order to achieve this goal, the project works with farmers and researchers in the designing and assessment of new SFM technologies. The new technologies that are designed are tested using on-farm and on-station research trials. The project uses IPs as an information gathering and sharing platform. Farmers' problems that are associated with low soil fertility are jointly identified and prioritized. Farmers are also involved in identifying possible solutions to these problems. The research findings to address these problems are also communicated through the IPs. The IPs serve as a valuable source of feedback to improve on the technologies being tested. The IPs also generally serve as a platform for discussing and coming up with action plans that address various rural development issues in the districts.

The ORM4Soil project supported the formation of two IPs at district level in Kasama of Northern Province and in Chipata of Eastern Province. The two districts were selected to form IPs because they are hosting both on-farm

and on-station trials on SFM technologies. The decision to conduct trials in the two areas was informed by the differences in farming systems and climatic conditions (Chipata is in agro ecological region two (II) while Kasama is in region three (III). Region II receives rainfall ranging from 800-1000 mm per year while region III receives rainfall of above 1000 mm per year. Figure 1 below shows the location of Chipata and Kasama in Zambia.

The goals of these IPs were to provide a platform for discussing and disseminating information that would address low soil fertility problem; to enhance the visibility of low soil fertility and technologies available to address the problem; and to influence policy decisions to address low soil fertility problems. Stakeholder identification and mapping was conducted and it resulted in 25 IP members in each district. The members were drawn from different organizations which included representatives from the Ministry of Agriculture (MoA) extension branch; Forestry Department; Community Development Department; MoA research, Chiefs and Traditional Affairs Department; Non-Government Organizations (NGOs); financiers; agro dealers; local traditional leaders; Faith Based Organization (FBO); local media stations; farmer organizations, and farmers. These members had a shared vision of addressing low soil fertility in the two districts. The gender perspective was considered in the formation of IPs. For instance, in Kasama, 38% of the IP members were women, while in Chipata, 31% of the IP members were women. Table 1 below shows the list of the identified stakeholders in the IPs and their respective roles.

Figure 1. Map showing location of Zambia in Africa and the two study Districts
Source: Afriseed (http://www.stewardsglobe.com/)

Table 1. List of stakeholders and description of their roles as members of the Innovation Platforms in both Kasama and Chipata

Stakeholders	Number	Roles
Representative of District Agricultural Coordinators Office (DACO)	01	The representative of the DACOs office was the Patron of the IP. He ensured the smooth facilitation of IP meetings, coordinated the execution of activities and decisions taken by the members.
Camp Extension Officer (CEO)	02	He/ she was responsible for execution of IP activities at camp level and site management of farm trails supported by ORM4Soil project.
Farmers	04	They were all producers, members of farmers' organization in their locality. Their role was to report opportunities and constraints of farmers to the platform.
Agro-dealers	02	They were the representative of agro-dealers and their responsibility was to provide to the IP, information related to agricultural inputs.
Traders	01	He was the representative of traders. He was in charge of providing to the IP information about markets of agricultural raw and processed products such as seeds, grain cereals, etc.
Media	02	There were the representative of the media houses. There were responsible for sensitization and dissemination of information to stakeholders at a large-scale level.
Processors	01	He was the representative of processors' associations. He was in charge of providing to the IP, information on agricultural raw material needed in the industry and processed products that where available on market.
Extension services	01	He was a representative of the extension service. His role was to provide agricultural related extension services and advice to famers and IP members.
Researchers	02	There were representative of Researchers, their role was to train, trainers and providing technical advices to the different actors of the platform on available SFM technologies.
Financiers	01	He represented the local financing institutions whose role was to provide financial information on agricultural activities.
Chief representative	01	He was the representative of the local traditional leadership. His role was to ensure that he informs the chief and his subjects on information related to soil fertility and to influencing decisions that promote soil fertility in his chiefdom.
Departments of Community	02	The role of the representatives of the Department of Community and Social Services was to assist in farmer organization. While

and Chiefs and Traditional Affairs		the role of the representative or the the Department of Chiefs and Traditional Affairs help interpret the traditional and cultural values with regards soil fertility and linking the IP to traditional leaders.
Forestry Department	01	His role was to provide technical information on agroforestry management to the platform and to provide training to farmers and extension officers on agroforestry.
Non-Governmental Organizations	02	They were representatives of non-governmental organization involved directly or indirectly in promoting soil fertility management technologies. Their role was to provide the IP with information on the opportunities and constraints of the agricultural technologies they are promoting.
Farmer cooperative	02	They were representatives of cooperatives movement. Their role was to assist with farmer mobilization to execute IP activities and providing information on the opportunities and constraints of the agricultural technologies they are promoting.

Innovation Platforms have become common in agricultural research and development projects as a way of moving away from top-down, linear approaches that have not improved rural livelihoods. (Hendrickx *et al.,* 2015). The use of IPs have developed into popular structures comprising of diverse stakeholders along commodity value chains with a common purpose of addressing the needs of smallholder farmers (Steins and Edwards, 1998). In the recent past, there has been efforts by projects, programmes and civil society to use IPs in Zambia, an example of this is a World Bank funded programme Agricultural Productivity for Southern Africa (APPSA) with support from International Institute of Tropical Agriculture (IITA) that has been using IPs in the soybeans and cowpeas value chains. However, there has been little or no documented experiences, results and lessons learnt in the use of IPs to address any agricultural problems in Zambia. This paper attempts to fill this information gap by providing information on the experiences in the use of IPs in Zambia's Kasama and Chipata districts which were trying to address problems of low soil fertility in rural areas.

METHODOLOGY

The information for analyzing the results and experiences of using IPs as an approach to address low soil fertility was collected during the IP workshops which were held in Kasama and Chipata districts. The IPs which were formed in each district consisted of 25 members, as guided by Schut *et al.* (2014). An average of 21 (84%) IP members were participating in each workshop. This good attendance enriched discussions on most of the relevant issues that were raised with regards to soil fertility.

Three (3) workshops were held in each district and attended by members from different organizations. The IP workshops were held quarterly and lasted for about 3-4 hours. The facilitator of these IPs was the District Agricultural Coordinator (DACO) of each district. The facilitators were equally responsible for formally inviting the IP members to the workshops. The facilitators in both IPs were passionate with the problem of low soil fertility that was being addressed. They were also conversant with cultural and traditional norms and understood the professional diversity of

the IP members. Besides the important role of the facilitator, a note-taker documented the outcome of the different sessions and captured discussions among the participants. Standard workshop procedures were developed which helped guide the proceedings of the meetings. This was in line with Schut *et al.* (2014), who noted that workshop facilitation and note-taking procedures ensure that the workshop organization, facilitation and documentation are standardized. They further note that it was essential for comparing or aggregating the outcomes. For instance, every evening, after the workshop, the note-takers (the authors) would have a brief meeting to review the days' proceedings and synthesize the salient aspects of the key issues that had been deliberated and agreed upon by the IP members. The synthesized information formed the basis of the results and experiences discussed in this paper.

The three IP workshops had clear targets as follows: the first meeting was a launch of the platform, which focused on introducing the IP concept and objectives, welcoming and introducing members and explaining their roles as members. The frequency and duration of the meetings were also agreed. Resource mobilization strategies and sustainability measures were also discussed. The first meeting equally acknowledged ORM4Soil project as the sponsors of the IPs.

In the first workshop, problem identification with regards to the challenges associated with low soil fertility faced by farmers in each district was also done. In the second IP workshop, the causes of the challenges associated with low soil fertility were prioritized and possible solutions were identified. Based on the proposed solutions, an action plan was also developed in a participatory manner. The IP members were assigned to lead the implementation of specific activities. The third IP workshop was mainly for getting feedback on the implementation of the proposed solutions from the assigned IP members.

The collection of data using IP workshops with participants from different stakeholder groups across different levels was essential for studying complex agricultural problems such as low soil fertility. It helped to bring out perceptions on what constitutes the main problems, and what they perceived as feasible or desirable solutions (Faysse, 2006; Ortiz, *et al.,* 2013). The method equally targeted stakeholders individually in homogeneous groups and in heterogeneous groups so as to capture individual, group and multi-stakeholder perceptions on problems and solutions. The homogenous group would for instance be exclusively all the extension providers or media practitioners in the district. These would have representatives on the local IP. The representatives would report the proceedings and action point in the IP to their homogenous groups. The homogenous groups would average 4-10 members and would also meet quarterly. The representation of different organizations on the IP makes the IP a heterogeneous group. The discussion and debate in the IP workshops generally provide a rich analysis of complex agricultural problems and potential solutions. In addition to collection of data using IP workshops with the stakeholders from different organizations, key informant interviews and participant observations were also conducted.

As indicated above, a qualitative approach of data analysis was used. The notes that were taken during the IP workshops were summarized in thematic areas by the authors. The major points in each thematic area formed the basis of the results and discussion. The data from the key Informant interviews and participant observations were also summarised according to themes and major points that were mentioned or observed were incorporated in the results and discussion section below.

RESULTS AND DISCUSSION

This section documents a synthesis of the results, experiences or lessons learnt in using the IP approach to address low soil fertility issues in Kasama and Chipata Districts of Zambia. The results, experiences or lessons learnt were mostly noted during the IP workshops and during the implementation of the action plans by the IP members.

Farmer participation in identifying priority soil fertility problems. In the first workshop, problem identification with regards to the challenges of low soil fertility faced by farmers was conducted in each district. The IP members in both sites identified low soil fertility as one of the major challenges that was contributing to low productivity of major crops such as maize. Further, deliberations on soil fertility revealed several other problems associated with or that perpetuate low soil fertility. After the IP members reached a consensus in both sites on the identified problems, they ranked them in order of priority as shown in Table 2 below.

Table 2. Ranking of problems associated with low fertility in two Innovation Platforms in Zambia

Problems associated with low soil fertility identified by Kasama IP Workshop participants	Rank	Problems associated with low soil fertility identified by Chipata IP Workshop participants	Rank
Acidic soils	1	Lack of Agroforestry planting materials	1
Inadequate knowledge in SFM technologies	2	Limited land to practice some SFM technologies like fallowing.	2
Lime not available in the district and when available the commodity is expensive	3	Inadequate knowledge and skills in soil fertility by both extension officers and famers.	3
Lack of trainings in soil fertility and available SFM technologies	4	Few radio programs covering SFM technologies - most radio programs mainly cover Conservation Agriculture (CA).	4
Inadequate agro forestry planting materials	5	Difficulties experienced with keeping plant residues in field because of bush fires caused by mice hunting and uncontrolled grazing of livestock in farmer fields	5
Cultural practices that promote soil degradation such as *chitemene* farming system and bush fires caused by mice hunters.*	6	Lack or limited incorporation of soil fertility related messages in farmer field schools, field days and agricultural shows	6
Inadequate livestock to use in practicing some SFM technologies	7	Poor communication among members on soil fertility related issues.	7
Inadequate radio programmes covering SFM programmes on both local and national radio stations	8		

Note: *Chitemene farming system which meaning "to cut", is a shifting cultivation system involving the cutting and burning of trees and shrubs in fields practiced in northern Zambia (Chidumayo, 1999)

In the second IP workshop, the DACOs facilitated the review of the deliberations of the previous workshop. After the review was conducted, IP members provided solutions to the identified problems. They developed an action plan in a participatory manner, and some IP members were assigned to lead the implementation of specific activities. For example, activities that were to do with using the local media to disseminate information on soil fertility were spearheaded by the IP members representing media organizations in the district. The specific team leaders where supported by other IP members who either would provide technical information on soil fertility or provide resources to air the radio programmes. The action plans developed were realistic in that they largely focused on the possible solutions that could be locally sourced or financed by the IP members and the respective organizations they represent on the platform. Tables 3 and 4 below show the action plans for Chipata and Kasama Innovation Platforms, respectively.

Table 3. Action Plans for Chipata Innovation Platform

	Identified Problem	Action to be taken	By Who	When
1	Lack of Agroforestry planting materials	Sourcing of agroforestry planting materials and seedlings.	Research, COMACO, TLC and Forestry Department	March, 2017
2	Limited land to practice certain SFM technologies like fallowing	For farmers with limited land, promotion of SFM technologies that do not require much land like compost, use of manure and legume intercropping,	Extension, Research, COMACO	April, 2017
3	Inadequate knowledge and skills in soil fertility issues by both extension officers and famers	Training farmers and extension staff in SFM technologies such as compost making and planting and managing of agro forestry trees	COMACO, Extension and ZARI, Forestry Department	March, 2017
4	Few radio programs covering SFM technologies most programs cover Conservation Agriculture (CA)	Promotion of Soil fertility radio programmes such as panel discussion and specific educational topics on local radio station (Breeze FM).	COMACO, Radio Breeze FMs, NAIS and DACOs office	April, 2017
5	Inadequate planting materials for soil fertility such as agro forestry	Research to spearhead the promotion of planting materials	Research, Forestry Department, COMACO and TLC	April, 2017
6	Difficulties experienced in keeping plant residues in field because of Bush fires	Discussion with local head men on enforcing rules and regulations aimed	Senior Chief Headmen, Department of Chiefs and traditional affairs and Forestry	March, 2017

	caused by mice hunting and uncontrolled grazing of livestock in farmer fields	at discouraging cultural practices that contribute to low soil fertility such as bush fires caused by mice hunters, charcoal burning and restraining of animals to graze in farmer fields practicing residue retention	Department	
7	Lack or limited incorporation of soil fertility related messages in farmer field schools, field days and agricultural shows	Incorporation of sustainable land management issues and practices in existing farmer field schools, field days and agricultural shows Encourage farmer exchange visits and field visit to the ORM4Soil project sites.	Extension, TLC, COMACO and Research	April, 2017
8	Poor communication and dissemination of soil fertility information among IP members.	Need to establishment a WhatsApp® forum for all stakeholders so as to improve communication and dissemination of available SFM technologies.	Facilitator to spearhead the establishment of WhatsApp® forum supported by Extension	February 2017

Table 4. Action plan for Kasama Innovation Platform

S/N	Identified Problem	Action to be taken	By Who	When
1	Acidic soils	Promotion of soil pH testing among farmers before applying lime.	Research, CARITAS, ZNFU and Extension	April, 2017
2	Inadequate knowledge in SFM technologies	Promotion of SFM technologies among farmers through trainings, incorporation in field days and shows.	Extension, Research and CARITAS	March, 2017
3	Lime not available in district and when available the commodity is expensive	Committee to spearhead the inclusion of Lime among the inputs in the FISP and to negotiate for availability of relatively cheaper lime on the market in the district.	Extension, ZNFU and CARITAS	May, 2017
4	Lack of trainings in SFM technologies	Intensify education of communities on the importance of practices such as residue	CARITAS, Extension and Research	April, 2017

		retention/no burning, crop rotation, agroforestry and modified *fundikila**		
5	Inadequate agro forestry planting materials	Establishment and distribution of Agroforestry planting materials.	Research, Forestry Department and Extension	April, 2017
6	Cultural practices that promote soil degradation such as chitemene, and bush fires caused by mice hunters	Discussion with local headmen on the enforcement of regulations to discourage burning of crop residues, charcoal burning, uncontrolled grazing and use of *chitemene* farming system.	Senior Chief, Forestry Department and Department of Chiefs and Traditional Affairs	March, 2017
7	Inadequate livestock to use in practicing some SFM technologies	Link the farming community to lending institutions on livestock or government livestock restocking programme.	Extension, CARITAS, ZNFU	March, 2017
8	Inadequate radio programmes covering SFM programmes on both local and national radio stations	Radio Lutanda to pioneer the inclusion of radio programmes that promote soil fertility.	Radio Mano, Radio Lutanda, Extension, CARITAS, ZNFU	March, 2017

Note: *Fundikila means to form mounds, an *in situ* compost-based farming system practiced in northeast Zambia (Chidumayo, 1999). while Modified fundikila means that instead of allowing the natural vegetation to grow, Velvet beans or Sunnhemp which can produce large quantities of high quality biomass (rich in nitrogen) are planted at the beginning of the rainy season and buried in big ridges towards the end of the rainy season. The material in the ridges is left to decompose through the dry season. At the on-set of the next rainy season, the big ridges are broken-up to either build smaller ridges or to plant on flat land.

The third IP workshops that were held in each district reviewed the deliberation of the previous workshop, though the focus of these workshops was to get feedback on the implementation of the proposed solutions. These proposed solutions or activities were assigned to specific IP members to lead in the implementation. The section that follows discusses in detail the experiences and lessons learnt in the implementation of the IP action plans that were jointly developed in the second IP workshop in both districts.

Experiences in using Innovation Platform (IPs) to address low soil fertility challenges. The main experiences in using Innovation Platform (IPs) to address low soil fertility challenges in the districts were as follows:

Management of the Innovation Platforms. Facilitation is an important element, especially when establishing a platform and maintaining its viability. Innovation Platforms require fairly high-level facilitation skills and normally these skills are not readily available. Therefore, the choice of the facilitator is critical to the success of IPs. There was no challenge in this area of facilitation as the facilitators in both districts were highly experienced. They acquired their facilitation skills and experience during their work as extension officers. Both facilitators had risen in the public service positions, from being hands-on field officers to district extension

administrators. The DACOs coordinate all agricultural programmes at district level. This important role of the DACOs office made them command respect at district level. The respect they commanded also made them to be suitable choices as IP facilitators. During the IP workshops, the facilitators were critical in stimulating meaningful discussions on soil fertility. The success of the IPs could equally be attributed to the leadership and commitment of the facilitators.

In addition to this, the involvement of IP members in developing an action plan also motivated them to implement their planned activities to address low soil fertility. The IP members did not establish a separate parallel extension structure for implementing action plan activities. They used the existing extension structures in the districts. This was a cost effective measure as no additional resources were needed to establish a parallel extension structure. The resources to implement the activities were locally sourced from some member organizations which had funds to address low soil fertility in the districts. Furthermore, the involvement of IP members in critical decisions such as setting the date of the next meeting and the confirmation of their availability a week before the meeting also helped to create a sense of ownership among the members and generally contributed to good attendance of the IP workshops. In addition to this, given the low literacy levels of some members, the IP members agreed to use both local languages and English in the IP workshops. The use of local languages contributed to enhancing understanding and participation particularly among the farmers. During the IP workshops, the facilitators deliberately gave the farmers enough time to air their views freely. The participation of farmers was critical in that it provided an opportunity to hear the farmers' views on the problems or challenges of low soil fertility.

Strengthening synergies and working relations at local level. The IPs have helped to establish and strengthen synergies among institutions that were engaged in improving soil fertility at district level. Innovation Platforms have equally helped to improve working relationships among different organizations (public, private and NGOs) with different mandates aimed at improving crop productivity and soil fertility in the two districts. These organizations now look at each other as partners and not competitors as was the case in the past. The public extension workers regarded the civil society as lacking competencies to carry out extension services. They also regarded the civil society as not willing to partner with public extension, mainly because of the resources at their disposal to carry out activities. The NGOs equally regarded the public extension staff as lacking competence as well and generally not committed to achieving set targets. After developing working relationships through the IP workshops and joint execution of IP activities, the organizations realized that they both (public and NGOs) had strengths they could leverage on to effectively execute extension services. The improved working relationships contributed to the reduction in duplication of efforts among organizations and improved beneficiary targeting. The improved working relationship also resulted in efficient utilization of available resources in the two districts.

Information sharing. As a follow up on the action plan for the second IP workshop, WhatsApp® platforms were established in both Chipata and Kasama districts. The purpose of the WhatsApp® platforms was to keep alive the soil fertility discussion among members and to communicate upcoming soil fertility events. It was encouraging to see the enthusiasm in the use of the platform by the members. It was good to note that the Senior Chief had access to a mobile phone with WhatsApp® application and he was

able to use the forum to disseminate information about an upcoming field day that was to be held at his farm in collaboration with Total Land Care (TLC). The Senior Chief and other members of the IP posted on the platform to seek clarification on the proposed date of the next IP workshop. The WhatsApp® forum greatly supplemented the IP efforts of information dissemination and proved to be an important Information Communication Technology (ICT) tool to keep the soil fertility discussion active beyond the four hours' duration of the IP workshops.

The IPs are indeed an important and effective information sharing forum among members. Another example of this is with regard to soil testing services. Farmers were not aware that both regional research stations in Kasama and Chipata were offering soil pH testing services. The farmers only knew that these services were only offered in Lusaka, the capital city of the country. Farmers had to travel a total distance of 850 km from Kasama and 565 km from Chipata to access these services. Through information sharing during the IP workshops, farmers got to know about the availability of soil testing services in their districts. These soil testing services were affordable, costing as low as 0.84 USD per soil sample. The farmers and other IP members also learnt that the local public research stations were equally offering specialized soil testing services such as, determining soil macro nutrients NPK (Nitrogen, Phosphorus, and Potassium). This information on soil pH testing is critical to the farmers as it guides them on the quantity or rate of lime to apply. Currently, most farmers apply lime at a blanket rate not informed by knowledge of the soil pH in their fields. With the shared information about soil testing services, some IP members from the research institutes testified that there was an increasing number of farmers who showed interest in the services offered at the research stations and were also accessing them, particularly the soil pH tests.

In addition the IP members in Kasama district recognized the fact that the soils in the province are acidic, and to reduce the soil acidity, there was need for soil testing to inform the level of liming required. The participants agreed to influence policy change in the government supported Farmer Input Support Programme (FISP) to ensure that the input package particularly under the introduced e-voucher was to include lime as one of the inputs. The IP equally deliberated on several options it could pursue to reduce the cost of lime in the district, so that more farmers could easily access the lime. Transportation of lime from source to Kasama was also noted as a major contributor to the high price of the input. Among the options that were proposed was to reduce the cost of lime through bulk purchase. The IP members agreed to bring the proposal of including lime on the Farmer Input Support Programme to the attention of the office of the local Permanent Secretary for further action. The IP tasked the DACOs office and some other IP members to spearhead the implementation of this course of action.

The IPs also identified inadequate number of livestock as one of the problems associated with uptake of the some SFM technologies such as the use of animal manure in Kasama district. The department that handled livestock extension in the district informed the IP workshop that as a way of increasing local livestock population, the Government was training extension staff and farmers in livestock production. A total of 12 extension staff and 981 small scale farmers were trained. The trained farmers were also provided with improved chickens, goats and cattle on a pass on arrangement in collaboration with projects such as Total Land Care (TLC), and Scaling up Nutrition (SUN), Livestock Infrastructure Support Programme (LISIP) and Self Help Africa (SHA). Through

this information sharing, most members of the IP who were not aware of these initiatives in the district benefitted by learning about these opportunities that were available for improving livestock production.

Apart from sharing technical information, the facilitators in the IPs also allowed members to announce upcoming district events that were relevant to addressing low soil fertility issues such as scheduled dates for field days, agricultural shows, radio programmes, and staff and farmer training activities. Most field days and agricultural shows that were hosted in the districts were supported by seed companies who used the field days to promote their hybrid seeds on the market. With the influence of the facilitators and representatives of seed companies on the IPs, the agricultural shows and field days that were held deliberately fused in discussions on the importance of soil fertility and the technologies that were available to address soil fertility challenges.

Networking among institutions to efficiently utilize local skills and competencies. In Kasama District, CARITAS Zambia, a faith based Non-Governmental Organization (NGO) was promoting the use of modified *fundikila*, while in Chipata, Common Market for Conservation (COMCO) was promoting the use of compost. The formal and informal interaction of the IP members during the workshops helped in establishing synergies among institutions that were engaged in improving soil fertility. These institutions appealed for skilled personnel among the various institutions which were participating in the IP to help in developing training models for farmers and to assist in the training of farmers. The skilled personnel were mainly sourced from the Ministry of Agriculture (MoA) which housed both research and extension departments in the districts. Through such networking, the IPs created a bridge between the institutions that had resources and those that did not have, but had technical skills and competences. As a result of this, close to 950 farmers were trained in the use of improved fundikila in Kasama while about 10,700 farmers were trained in compost making in Chipata.

Local resource mobilization. In order to address the problem of lack of agroforestry planting materials in the districts, the IP members mobilized the resources locally from their organizations. For instance, the Department of Forestry in Chipata district with support from COMACO raised 5,234 seedlings of *Gliricidia sepium* (Mexican lilac), and distributed the seedlings to 300 farmers. Total Land Care (TLC) also supported the propagation of *Fardherbia albidia* (winter thorn). In addition to these efforts by NGOs, the representative from Msekera Regional Research reported that in response to the growing demand for agroforestry planting trees, they had established a *Gliricidia sepium* seed orchard at the research station and 500 on-farm fields in the province to help with seed multiplication. In Kasama district, a representative from Misamfu Regional Research Station informed the IP members that they had established agroforestry seed banks for *Sesbania sesban* (sunnhemp), *Tephrosia vogelii* (fish bean), velvet beans and pigeon peas.

In a similar vein, TLC which promoted conservation agriculture in Chipata District had resources to support airing of soil fertility related programmes on a local radio station. On the other hand, National Agricultural Information Services (NAIS), a government unit in the MoA had recorded radio programmes, which it had failed to air on the local radio stations due to lack of resources. The interactions in the IP workshop allowed the two organizations with other members of the platform to work together

and contribute resources to ensure that the radio programmes reached the intended targets. This joint collaboration resulted in the airing of the programmes on radio and development of new ones. In the same district, a COMACO representative informed the IP workshop that their institution hosted a round table discussion quarterly. The IP members took advantage of this opportunity and hosted a panel discussion on soil fertility. The discussants were IP members from different organizations and this activity was successfully carried out.

Facilitation of exposure visits. The IP members organized exposure visits to the sites where appropriate soil fertility technologies were being promoted in the district. Among the sites that were visited in the two districts were the on-station and on-farm trials on soil fertility technologies supported by the ORM4Soil project. The technologies being tested were selected with the involvement of some IP members. The project intends to use the IPs as an important tool for information gathering and sharing and for providing feedback on the technology performance. The technologies that were being promoted included maize intercrop with agroforestry trees such as *Sesbania sesban* (sunhemp); *Tephrosia vogelii* (fish bean) and velvet beans. Other technologies included crop residue retention, minimum tillage, use of manure and modified *fundikila*. In the traditional *fundikila* practice, farmers made mounds using ordinary grass but in the modified *fundikila* method, crops with high organic content such as velvet beans were used. The members of the IP visited these sites and appreciated the technologies being promoted.

The IP members were able to make visual judgment that the crop grown under modified *fundikila* performed better than the crop under traditional *fundikila* in Kasama, while in Chipata the farmers noted that the crop grown with half rate (100kg/ hectare) of basal dressing fertilizer application and manure as top dressing in combination with modified *fundikila*, was just as good as the crop grown with full rate of fertilizer application (200 kg/ hectare for both basal and top dressing). Field days were also held in the two sites and the IP members, mainly farmers, participated. The IP members from the media documented the field days and aired them on local radio stations in both sites. Plans are under way to produce television programmes for airing on the local and national television channels.

Involvement of local traditional leaders. The traditional leader showed great commitment by participating in all the IP workshops that were held in the district. In the second workshop during the formulation of the action plan the Senior Chief offered to assist with networking with Headmen in his area. He organized meetings with the Headmen to discuss ways of improving or sustaining soil fertility with Headmen in his chiefdom. Among the major issues discussed was how best to enforce the rules and regulations aimed at discouraging cultural practices that contribute to low soil fertility. The cultural practices that were to be discouraged included burning of crop residues, bush fires, charcoal burning and uncontrolled animal grazing. The burning of crop residues and bush fires were mostly caused by mice hunters who burn the fields or bushes during hunting. In the third IP workshop the traditional leader reported that he took advantage of his regular quarterly traditional meeting with his Headmen, to discuss issues of soil fertility and on how best to enforce rules and regulations that discourage cultural practices that contribute to low soil fertility. A total of 100 Headmen were in attendance during the three meetings held.

The Senior Chief also reported to the IP

workshop that he summoned and strongly reprimanded a number of people in his chiefdom who were engaged in charcoal burning and causing bush fires; and other people who let their livestock to graze crop residues in other farmers' fields. Apart from the authority he carried as a traditional leader he was also a progressive farmer. The Senior Chief used his good standing in the community to influence 12 other traditional leaders in the district on the need to improve soil fertility by discouraging cultural practices that contribute to low soil fertility. This is a clear example of how IPs can identify and use the local champions such as traditional leaders to help influence and enforce decisions that are aimed at improving soil fertility.

CONCLUSION AND RECOMMENDATIONS

This paper shares the experiences and lessons learnt in the use of IPs to address soil fertility challenges in Zambia. From the experiences, it was clearly shown that IPs provided a participatory platform where farmers were able to identify and prioritize soil fertility challenges. Farmers were also able to propose solutions and develop an action plan to address the identified challenges. It was also noticed that the success of implementing IPs was determined by many factors. Among them were the choices of IP stakeholders and facilitator. These were critical elements, especially when establishing a platform and maintaining its viability. The involvement of all the IP members in a participatory manner in IP discussions was also important, as it created a sense of ownership among the IP members and a willingness to participate in tackling the IP problems. In addition, the use of local languages was equally critical, as it contributed to enhancing understanding and participation particularly among the farmers.

It is therefore recommended that a careful selection of stakeholders to participate in IPs is done. The stakeholders should be persons or organizations that are key players and are also committed (time and resources) to addressing identified IP problems. It is also recommended that the selected IP facilitator should possess high-level facilitation skills.

It was also observed that IPs facilitated the strengthening of synergies among institutions that were engaged in improving soil fertility at district level. The IPs equally helped to improve working relationships among different organizations (public, private and NGOs). The improved working relationships contributed to the mobilization of local resources, and reduction in duplication of efforts among organizations and improved beneficiary targeting. The locally mobilized resources (skilled personal and funds) resulted into propagation of agroforestry seedlings, airing of radio programmes on soil fertility, joint development of training modules for farmers and training of farmers in appropriate SFM technologies.

The use of IPs also showed that IPs were an important and effective information sharing forum among members. For example, some traditional leaders were actively involved in engaging the community on soil fertility related activities. In addition to sharing technical information, the IPs also provided useful platforms for dissemination of extension messages that were relevant for addressing low soil fertility challenges among the farmers and others. It is therefore, recommended that extension practitioners should consider involving traditional leaders in IPs and the use of IPs should be encouraged as an approach for extension service delivery in rural areas.

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STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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