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Impact of Agricultural Innovation Platforms on Smallholder livelihoods in Eastern and Western Kenya

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Introduction

The Kenyan agricultural sector which directly contribute 26% to the GDP, and provide formal and informal employment in the rural areas, has been facing diverse challenges making it weak and uncompetitive. The challenges include non-adoption of improved technologies, weak linkages and interaction between stakeholders, poor infrastructure and unfair competition from open market operations, among others (Kirsten, *et. al.*, 2009). Approaches used in the past to share 'best bet options' with the farming communities failed to reduce the gap between on-farm and expected optimal yields (World Bank, 2006). These have ranged from linear technology transfer, farming systems to farmer participatory methodologies.

Currently, the innovation systems based approach that is operationalized through agricultural innovation platforms, is in use and it seeks to blend different knowledge sources in a process of co-innovation among multiple stakeholders to enable learning, faster uptake and wider impact. It fosters interactions amongst stakeholders around a common interest with basic reference to value chains (Makini *et. al*., 2013). The interactions within the platforms results in enhanced innovation capacity amongst stakeholders leading to development of technical, social-organizational and institutional innovations (World Bank, 2006; Kimenye and McEwan, 2014). This is a major deviation from past approaches that focused on technologies and ignored the social and institutional environment surrounding the technologies (Hawkins *et. al*., 2009; Hounkonnou *et. al*., 2012). The new approach introduced the involvement of various partners/actors to enhance utilization of agricultural innovations for desired impact and recognition of the importance of responding to consumers and market preferences.

Many organizations have embraced the use of innovation platforms in different parts of the country hence there is need to understand their impacts on the livelihoods of the smallholders in order to draw lessons and make recommendations on how to strengthen and increase the effectiveness of this methodology. Impact assessments on innovations have mainly been done to assess the economic efficiency of the innovation and the efficiency analysis (ex-post) combined with surplus approach and is the most common method used. Other methods include the livelihood, comprehensive and multidimensional approaches which go beyond the economic approach to measure goals such as food security, environmental protection and poverty reduction. The assessment methods used have thus been diverse and these also include the cost benefit analysis, economic surplus approach, comprehensive approach, livelihood approach and various combinations of these methods. Anadajeyesekeram *et. al.* (2007), writing on the impact of science on African agriculture and food security, stated that no single technique or method is sufficient to adequately address impact assessment hence the most appropriate approaches should be a mixture of both qualitative and quantitative methods and active participation of the beneficiaries. In a review of 28 impact assessment studies drawn from all over the world, Barrientos-Fuentes and Berg (2013) concluded that most impact assessments are ex-post although currently ex-ante assessments are increasingly being conducted. They also concluded that besides the direct effects of the innovations, the impact assessments also should bring out the social, institutional, economic and environmental effects.

In their study, using the economic surplus model on the impact of sorghum research and development in Zimbabwe, Anadajeyesekeram *et al.,* (2007) concluded that while there was a positive rate of return of 25% on sorghum SV2 variety, omission of administration costs, overhead and depreciation costs and the extended benefit flow period significantly affected the rate of return.

In a similar study in Zambia, the estimated rate of return on investment in sorghum research and complementary services ranged from 12% to 19% (Chissi, 2007).

La Rovere *et al.* (2008) used the livelihood approach to measure the impact of new varieties of maize in Mexico and Nepal which is an approach that considers the impact of innovations on farmers' livelihoods thus shifting the focus from the innovations to people's livelihoods in various dimensions. In their study, they concluded that there is a likelihood of over or underestimating the impacts if done too early or too late. This was demonstrated by the high impact estimated when the same assessment was conducted immediately after the end of a maize project in Oaxaca and the low impact when repeated much later. Conversely, higher impacts were recorded in a silos project when assessed much later due to farmer to farmer diffusion and presence of partners (La Rovere *et al.,* 2008). Another study on impact of public investment in maize research in Kenya by Karanja (2007), using a two linear regression method concluded that improvement in maize yield and expansion of maize area were due to an increase in research and extension expenditures, spread of hybrid seed, seed programme, use of fertilizer and higher maize producer prices.

Various other studies have been conducted in Kenya (Bolo and Makini, 2011; Kavoi *et. al.,* 2013; Kimenye and McEwann, 2011) although their focus was on stakeholder dynamics with none considering the broad outlook on their impacts to the livelihoods of the stakeholders. However, there is still very little research published on the impact assessment of innovation platforms. Most evaluation reports use single case studies to evaluate the impact of a given innovation platform. The current study sought to analyse the livelihood impact of innovation platforms on small holders in the study areas based on the previous studies that identified successful Innovation Platforms in Eastern and Western Kenya.

Rationale

Innovation platforms have been introduced as an approach to organize stakeholders around a common interest and for enhancing their innovation capacity leading to technical, institutional and social-organizational innovations. These innovations are expected to lead to improvement of food and nutrition security, income and other social benefits. To understand the outcome and impact of the use of innovation platforms, this study was conducted. The results of this study was expected to explore possibilities of replicating successful innovation platforms to other regions to enhance the livelihoods of the target communities.

Methodology

Selection of Innovation Platforms and Study Area

The study concentrated on four successful innovation platforms that were identified in a previous study that was conducted by Makini *et. al.,* (2016). In that study, fifteen innovation platforms were ranked based on a given criterion out of which the four innovation platforms were purposively chosen. The IPs included:

- Kakamega Focal Area Development Committee (FADC);
- Bungoma South Farmers Innovation Platform SIMLESA (BUSOFIPS);
- Nyeri Embaringo Commercial Village; and
- Embu QPM Innovation Platform.

The characteristics of the above selected IPs are shown in Table 1.

Table 1: Characteristics of Selected IPs

	FADC	**BUSOFIPS**	**EMBARINGO**	**QPM**
Entry Point	**Low finger Millet yields**	**Soil degradation**	**Low onion yields and poor market**	**QPM as maize protein source**
Membership	16	66	230	6,800
Established	2007	2012	2010	2003
Operation area	Kakamega (Matugu sub county)	Bungoma (Various sub county)	Nyeri (Kieni West sub county)	Embu (Embu North Sub county)

The selection of the study areas was based on where the four selected innovation platforms were located. The study was thus carried out in four counties two in Western Kenya (Kakamega and Bungoma) and two in Eastern Kenya (Nyeri and Embu).

Sampling Design and Data Collection

The number of farmers to be interviewed per county/successful IP was apportioned based on fixed proportions of at least 30 farmers (20 members of the IP and 10 non-members). The members of the IP were then randomly selected for the interview. Similarly, the non-members were randomly selected but located near an IP member and these served as a control group.

A formal questionnaire was developed and administered to the sampled households. The questionnaire included questions eliciting information on various livelihood indicators such as food security, agricultural income, social and capacity building impacts. The study partly relied

on the farmers' recall so that the sample households had to describe the situation before and after their involvement in the IP.


Farmer's interviews using questionnaires

The data collection was carried out in November 2016 by a team of five trained enumerators per county who were supervised by members of the PARI team and an extension officer from the County Ministry of Agriculture. Once at the farm, there were informal discussions with the farmer or their representative aimed at building a rapport and trust with them so that they could freely share information with the survey team. The raw data collected were entered and analysed using Statistical Package for Social Sciences (SPSS). In addition to the formal farmer interviews, key informants who included leaders of the IP and extension officers were interviewed using checklists.

Data Analysis

The analysis involved descriptive statistics followed by in-depth impact analysis using SPSS.

Descriptive Statistics

Descriptive statistics was used to describe the socio-economic features of the respondents. They provided summaries about the sample and the impact measures. Together with graphics analysis, they were to form the basis of virtually every quantitative analysis of data in this study. Descriptive statistics was also used to compare impact indicators for members and non-members of the IP.

Impact Assessment Approach and Analysis

To determine if membership to Innovation Platforms (IP) had a positive effect based on different impact indicators, an equation was used where Y represented an outcome of interest (impact indicators) which was the behaviour or outcome that was anticipated to be influenced by participating in a successful IP. If Y^0 represents a smallholder farmer's impact indicators, if they are not members of a successful IP, the Y^1 represents their outcome if they are members of a successful IP. In the simplest terms, for a given farmer, Y^0 is what happens when he or she was not a member of a successful IP and Y^1 is what happens when he or she is a member of a

successful IP. The impact of being a member of a successful IP on an individual was then the difference between what would have happened if they were members minus what would have happened if they were not members of a successful IP, or $Y^1 - Y^0$.
The paired t-test and Wilcoxson sign rank test for difference, were then used to compare mean ranks of the non-parametric statistics Y^1 and Y^o. Y^1 and Y^o being measures for improved quantity and quality production of food crops by households who were members of an IP and those non-members of IP.

Results and Discussion

These results and discussion are based on the socioeconomic characteristics of the households, the adoption of technologies and impact analysis.

Socioeconomic Characteristics of Households

The socio-demographic information about the members of the IP and non-members are shown in Table 2. The results show that there is equal female membership in the IP and the non IP members (40% for either group). The difference is with male and youth categories where there were more males amongst the IP members (39%) and more youth amongst the non IP members (40%). Members of the IP were mainly older (either male or female) with the percentage of youth being much lower. Conversely, the non IP members were mainly female or youth with male being only 20%.
As expected majority of both the members of the IP and the non-members were married. However, there is a higher percentage of widows among the non IP members than among the IP members and there are more single households among the IP members than among non-members. In terms of education levels, overall the literate levels were higher for IP members than for non IP members. The percentage of IP members who had attained secondary and tertiary education is higher for IP members compared to the non-members whereas the percentage who had attained only primary level and/or no formal education is higher for non-members than for IP members. Notably none of the IP members had no form of formal education. In terms of the whole sample majority had at least either primary or secondary education with the percentage of these with secondary education being higher. All the IP members had at least primary education.

On average the sample households were 45 years old, which ranged from 22 to 83 years. Disaggregating by IP membership, the members of the IP were older (46 years) compared to 43 years for the non- members. When disaggregated by gender the male sample households were older than the female sample households. Notably the age of male respondents was similar across the categories and similarly the age of the female respondents was similar across the categories. The number aged above 65 years was small across the categories but with a higher number among the IP members than the non-members.
Agricultural activities were the main source of income for the sample households irrespective of the category they belonged to (about 92%). Overall 5% had business as the main source of income, while for about 3% had formal employment as their main source of income.

Table 2: Socio-economic Characteristics of the Sampled Households

Variable	Category	Member (%) n=70	Non-Member (%) n=50	All (%) n=120
Gender	Female	40	40	40
	Male	39	20	31
	Youth	21	40	29
Marital Status	Married	87.1	84.0	85.8
	Widowed	4.3	14.0	8.3
	Single	8.6	2.0	5.8
Education Level	None		8.0	4.1
	Primary	33.3	44.0	38.8
	Secondary	54.2	40.0	46.9
	Tertiary	12.5	8.0	10.2
Age by gender	Whole sample	46.5	43.1	45.1
	Male	52.8	52.7	52.8
	Female	49.1	49.7	49.3
	Youth	30.4	30.9	30.7
Age group	< 36 years	21.4	38.8	28.6
	36 - 65	68.6	55.1	63.0
	> 65	10.0	6.1	8.4
Main source of income	Agricultural Activity	91.4	92.0	91.7
	Employment salary	2.9	2.0	2.5
	Business	4.3	6.0	5.0
	Other	1.4		.8

Farm Characteristics of Households

Land is an important farm resource for rural households. Figure 1 shows the average farm size owned by IP and non-IP members. In addition, it shows the proportion of total land owned that is under agriculture, an important economic activity for most households in the study area. Land markets in the study area were a common feature as about 30% of the available land for both IP and non-IP members was rented. On average, IP members have larger land resource endowment (0.8 ha) compared with 0.6 ha for non-IP members.

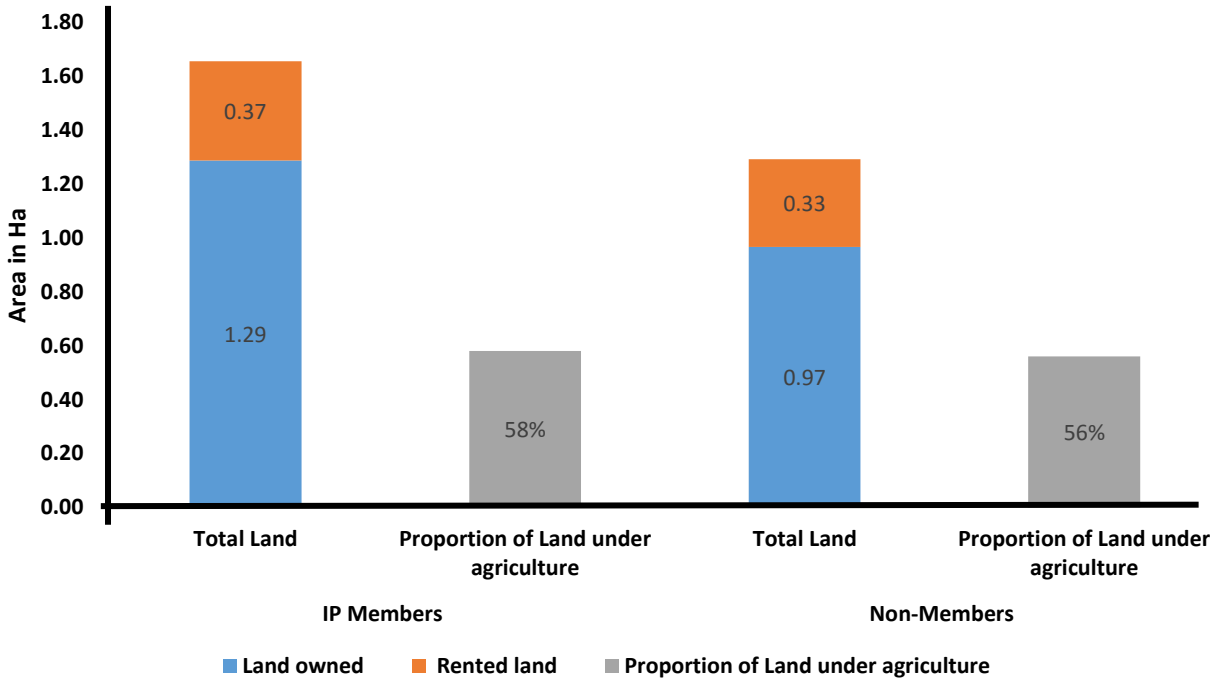

Figure 1: Proportion of Land under Agriculture

Land sizes did not vary significantly (P=0.05) among members and non-members of the various IPs in the study area. However, within each IP, there were significant differences in farm holdings owned.

Adoption of the Technologies and Innovations Promoted for Up-scaling at the IP

Adoption of innovation was defined by Rogers and Shoemaker (1971) as the decision to apply an innovation and to continue using it. Use of improved agricultural technologies is vital since the traditional subsistence farming systems can no longer meet the needs and expectation of an ever-increasing population. Therefore, access to information about improved innovations is essential to increase the intensity of its adoption. Innovation platforms provide a forum for information exchange and access of information on productivity thus enhancing innovations. Management practices were adopted at between 50-75% by 41.1% (N=95) of the respondents while only 28.4% reported that the level of adoption was above 75%. Conversely, 68% of the respondents (N=38) reported that the level of adoption of NRM technologies was above 50% (Figure 2).

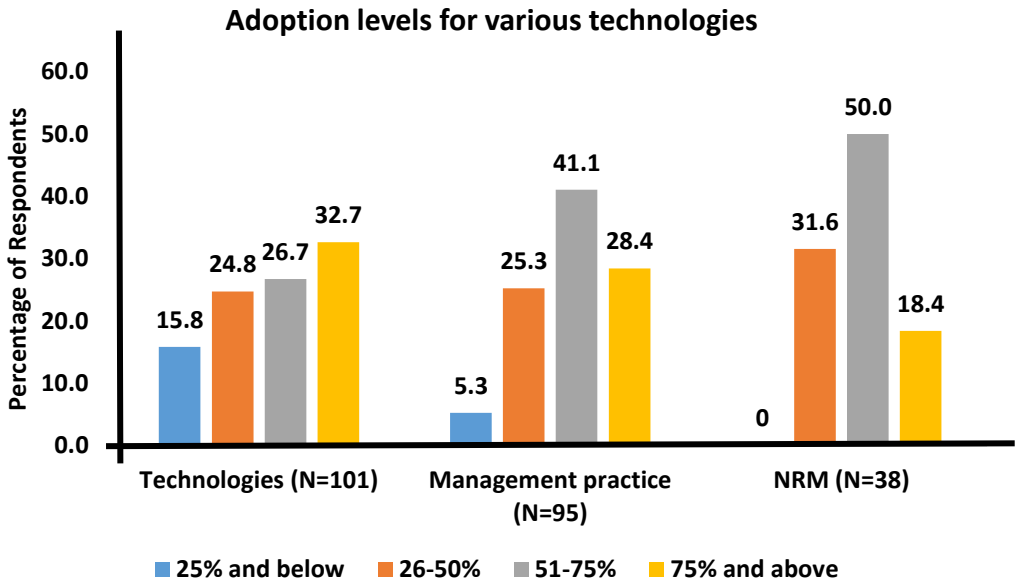

Figure 2: Levels of Adoption of the Technologies and Management Practices

In an assessment of the respondents' perception on the level of adoption of six sampled technologies, 32.7% (N=101) of the respondents indicated that the level of adoption of technologies within innovation platforms was very high (above 75%) while only 15.8% indicated that adoption level was below 25% (Table 3). Out of the sampled innovations, QPM maize had the lowest adoption level as reported by 78.6% of the respondents.

Table 3. Respondents' Perception on the Adoption Status of the Technologies

	Perceived Level of adoption (%)			
Technologies	**Very low***	**Low****	**High*****	**Very High********
Conservation agriculture	23.1	23.1	7.7	46.2
Good management practice	6.3	37.5	18.8	37.5
Improved animal breed		20.0	80.0	
Improved plant varieties	2.3	27.9	25.6	44.2
QPM	78.6		14.3	7.1
Use of agro chemical		30.0	60.0	10.0
Total	15.8	24.8	26.7	32.7

*<25%, **26-50%, ***51-75%, ****>75%

Results revealed that adoption of NRM practices ranged from 51 - 75% as reported by 43.9% of the respondents although 19.3% reported adoption was over 75% adoption (Table 4). These practices included: agro forestry practices, retention ditch, crop rotation, soil and water conservation.

Table 3: Level of Adoption of NRM Practices

NRM Technologies	Perceived Level of adoption (%)		
	Low**	High***	Very High****
Agro-forestry	40.7	44.4	14.8
Construction of retention ditch	0.0	100.0	0.0
Crop rotation	0.0	66.7	33.3
Soil and water conservation	70.0	30.0	0.0
Terracing	27.3	36.4	36.4
Total		43.9	19.3

26-50%, ***51-75%, **>75%

Impacts of the Innovation Platforms

The establishment of IPs was expected to have impacts on its members thus improve their livelihoods. This section highlights these impacts with respect to household food security, incomes, and knowledge capacity. In addition, it shows the impacts of the social well-being of the members.

Impact on Food Security

Using a Likert scale of 1-5, respondents were asked to assess changes in both quantity and quality of food produced after the establishment of the respective IPs. About 50% of the respondents either agreed or strongly agreed that both quantity and quality of food production had increased after the establishment of respective innovation platforms as compared to only 10% in the case of non-IP members (Figure 3).

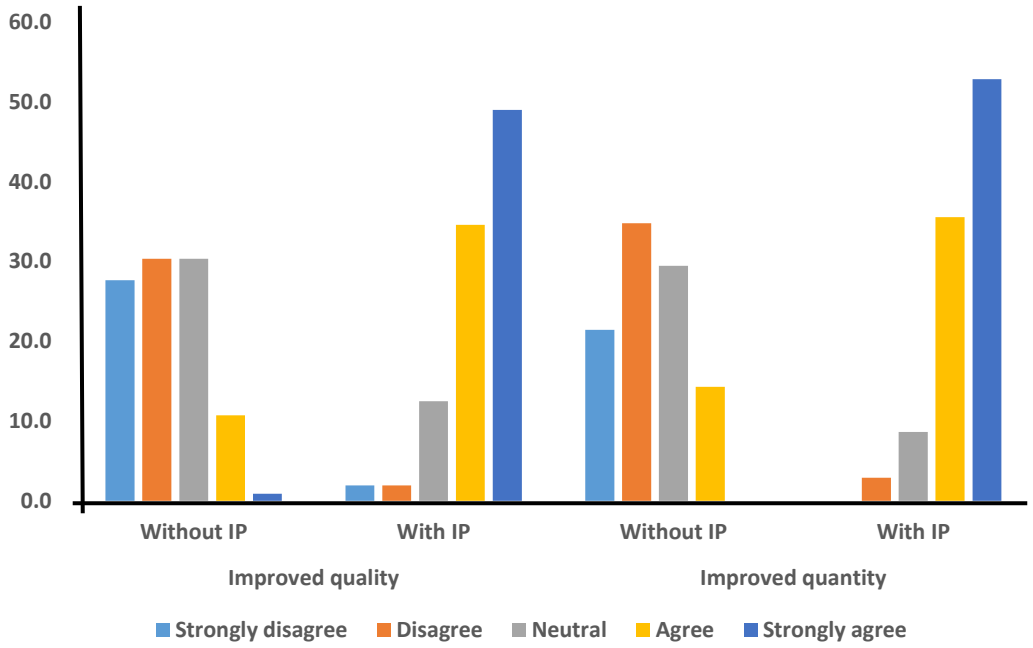

Figure 3: Respondents' Perception on Changes in Quantity and Quality of Food Production

To compare mean ranks of the non-parametric statistics for improved quantity and quality production of food crops by households who were members of an IP and those non-members of IP, a Wilcoxon sign rank test was applied. The test results indicated that improved quality production of the main value chain was more experienced when an IP was present (mean rank = 43.4) than when an IP was absent (mean rank = 32.2), Z = -7.65, p = 0.00. This statistically supports the respondents' opinions that improved quality production of the main value chain was experienced during the existence of the IP. Similarly, increased quantity in production of the main value chain was more experienced when an IP was present (mean rank = 45.8) than when it was absent (mean rank = 10.5), Z = -8.18, p = 0.00.

The respondents' opinions on availability of variety of food stuffs when an IP was present (mean rank = 46.1) was rated more favorably than when an IP was absent (mean rank = 43.3), Z = -8.035, p = 0.00 indicating a contribution of the IP to the availability of a variety of food stuffs. Conversely, missing meals was more frequent when an IP was absent (mean rank = 33.8) and was rated higher than when IP was present (mean rank = 30.8), Z = -5.77.

Impact on Agricultural Incomes

The impact on income was measured based on the changes in the productivity, increased job creation and increased household income. Figure 4 shows that majority of the respondents strongly agreed that in all the three indicators, positive change was experienced when the IP were present unlike when the IPs were absent. A Wilcoxon sign rank test showed that the positive change on the indicators experienced when an IP was present was rated more favorably than when an IP was absent (Increase on HH income: mean rank with IP=44.37, Mean rank without IP =12.50, P-Value =0.000, Z= -8.118; Job creation: mean rank with IP=29.00, Mean rank

without IP =0.00, P-Value =0.000, Z= -6.647; Increase on HH income: mean rank with IP=32.10, Mean rank without IP =30.00, P-Value =0.000, Z= -6.338).

1. We used to harvest between 2000 -2500 Kgs of onions before the IP but nowadays we harvest 9000 to 10000kg per hectare (Chairman Embaringo IP)
2. I used to be employed in Nairobi but when I visited home and saw the amount of income being earned by the onion farmers of the IP, I decided to hire a piece of land for onion growing. Today, I own a 1-acre piece of land and have constructed a house and I cannot imagine myself returning to work in Nairobi (Young farmer Embaringo IP)

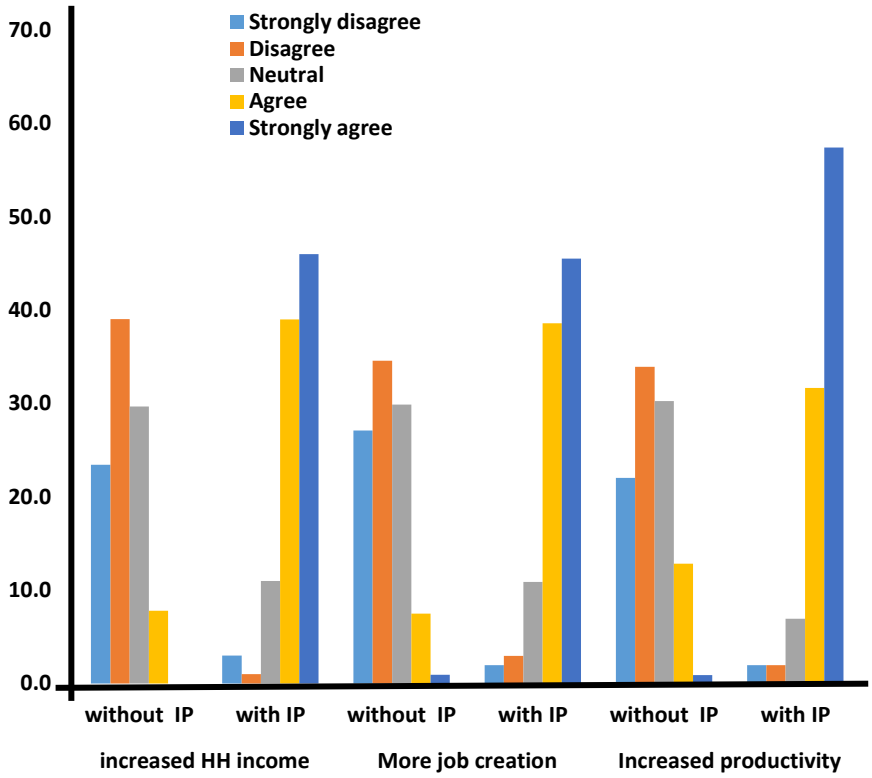

Figure 4: Income, job creation and increased productivity trends

Social Impact of the Innovation Platform

Overall about 90% of the respondents indicated that the IP had some social impact. One of the social impacts was strengthening capacity through agricultural training programs. However, from the results most of the capacity development programs were organized and sponsored by different institutions. Figure 5 shows the percentage of respondents who said that the IP has organized and sponsored agricultural training programs and those who said other institutions had organized the training programs.

''…as IP members, we helped to construct an access road which serves both members and non-members alike. Additionally, the area chief calls upon me and other IP officials to address residents during his 'barazas' on various issues. (Chairman Embaringo IP) ……Survey KII''

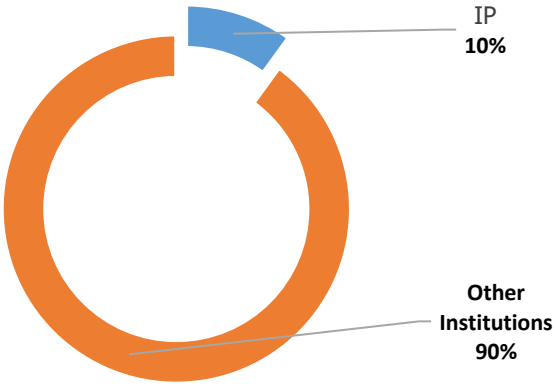

Figure 5: Training organized and sponsored by IP Vis a Viz Other Institutions

The respondents were asked if through the IP; "they had individually been empowered to be more self-reliant" and "they had individually or collectively increased their bargaining power". There were five possible responses including: I strongly agree; I agree; I am neutral, I disagree and I strongly disagree. The responses were as shown in Figure 6. Majority of the respondents either agreed or strongly agreed that they had become self-reliant and their bargaining power had increased through the IP.

> *''Before the IP was established, brokers used to dictate to us the price of our products, but with the operationalization of the IP we dictate our price to them. The IP gave us a bargaining voice… (Chair of Embaringo IP)……Survey KII''*

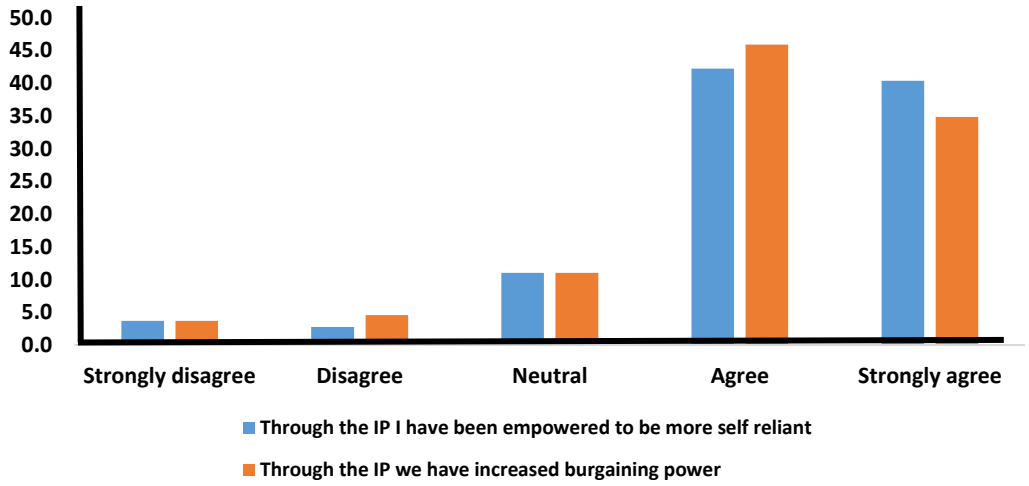

Figure 6: Impact of the IP on Self-Reliance and on Empowerment

Policy advocacy

Only eighteen respondents (18%) reported that they had participated in policy formulation either at County or national level. Of those who had participated in policy formulation 83.3% were motivated to do so by the fact that they were members of the IP, whereas about 17% were motivated by other reasons.

Organization of events

The respondents were asked how often the IP organized events compared to other organizations. The responses were as shown in Figure 7, which indicates that there were more respondents (34.6%) who said that the IP organized more than three events in a year compared to 25.6% who said that other groups organized more than three events in a year. Conversely, there were more respondents (56.4%) who said that other groups organized events only once in a year compared to the 39.5% who said the IP organized events only once in a year.

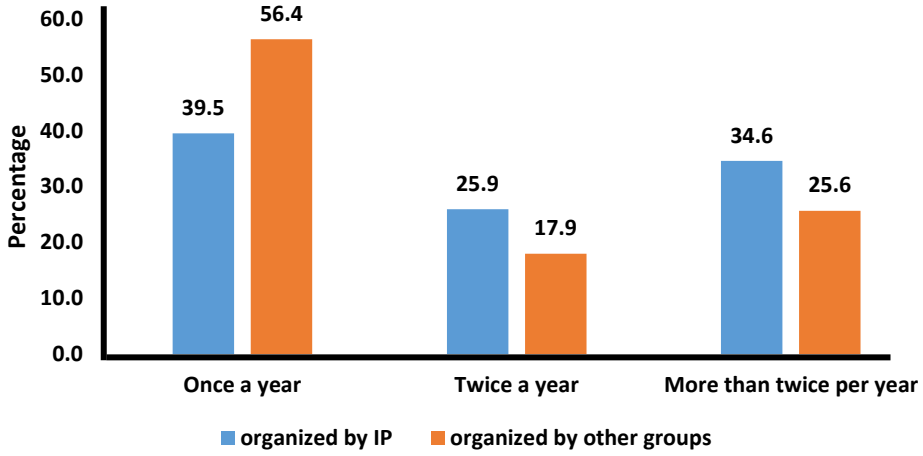

Figure 7: Organization of Events in Innovation Platforms

Initiators of linkages with other institutions/groups

About 52 respondents reported that they had linkages with other institutions and groups. When asked who initiated those linkages about 44.6% stated that the IP initiated them (Figure 8). Linkages with other organization and groups was important because it created an opportunity to learn new ideas.

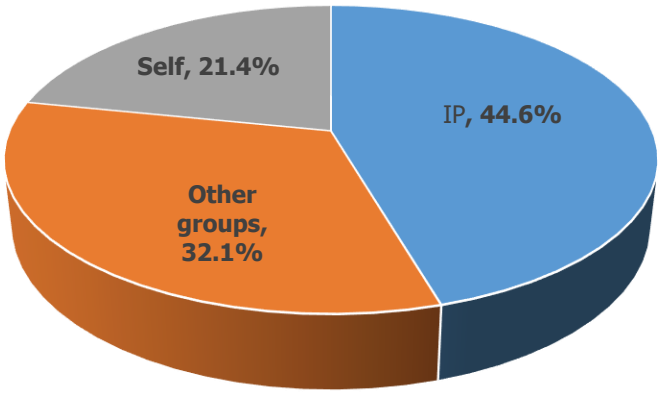

Figure 8: Initiators of Linkages

Conclusion and Recommendations

This study aimed at understanding the outcome and impact of the use of innovation platforms, as well as identifying and exploring possibilities of replicating successful innovation platforms to other regions in order to enhance the livelihoods of the target communities.

The results of paired t-test and Wilcoxson sign rank test, indicated significant impacts of improved food security, food diversity (proxy for improved nutrition), improved incomes, as well as other social aspects on members of IPs. Results also indicated that there was significant improvement in adoption of technologies and innovations (varieties breeds and NRM practices) promoted for up-scaling at the IP, and management practices arising from capacity building secured through the IPs.

These findings confirm that platform facilitators' investments fostered development in the target agricultural product value chains. For successful setting up and implementation of an IP, it is necessary to identify and target development of capacity needs of members. Subsequently, technologies and innovations promoted for up-scaling through the IP for subsequent adoption by members. Having visible impacts is likely possible to catalyse the successful application of the IP approach

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