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**Title:** Impact of Volta2 innovation platforms on improvement and increase of crop and livestock production in four villages of Yatenga province, Northern Burkina Faso

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*The innovation platforms set up by the Volta2 project have contributed to capacity development of its members mainly by reinforcing their human and social capacity. Strengthening of human and social capacity of IP members has resulted in the improvement of crop and livestock production through a better exchange of information and knowledge between different stakeholders and a better access to different agriculture support services.*

**Abstract**

This study is linked to the Volta2 project, launched in October 2010 for 3 years. This project has used innovation platforms as its principal development tool to achieve integrated management of rainwater for crop-livestock agroecosystems in two West African countries (Burkina Faso and Ghana) with a number of eight (08) villages per country. To assess the impact of the innovation platforms, this study was structured by an approach borrowed from socio-economic theory: the model of structure – conduct – performance. For data collection, focus group discussions and individual surveys with different stakeholders were used in four focal villages of Yatenga province, Burkina Faso. The improvement in crops and livestock production was measured by asking farmers for their perception of this improvement. Data analysis was carried out with SPSS software, firstly for factor analysis to identify the dominant constructs of what makes innovation platforms successful. And then, for regression analysis to determine the relationships between the structure of the platform, the conduct of its stakeholders and whether they are achieving the objectives they set themselves in terms of increased crop and livestock production. Qualitative data was also interpreted to complete and interpret the results obtained through the analysis of quantitative data. Our study shows a positive impact of the innovation platforms set up by the Volta2 project on IP members' practices. Innovation platforms have contributed to the change of mode of conduct of its members. Different trainings and advice received by IP members from facilitators of the platforms has led to an increase in their human and social capacity. IP members of one village have entered in contact with IP members of other villages. Innovation platforms have contributed to closer working relationships among IP members within the same village and to villagers gaining easier access to micro-credit organisations, animal husbandry and phytosanitary services of the agricultural ministry, etc., which can help them to improve their activities. This improvement of human and social capacity of IP members has resulted in the improvement of crop and livestock production through a better exchange of information and knowledge between different stakeholders and a better access to different support services. These findings justify the necessity to support this kind of project in the perspective of reinforcing food security and reducing poverty in rural areas around the world.

## Introduction

African smallholder farmers continuously seek to improve their agricultural enterprise, their food security and income by making more efficient use of their assets. Farmers need to intensify their production systems and adapt to continuous, often unforeseen and sudden changes in their production and marketing environments, which presupposes continuous innovation (**Nederlof et al., 2011; World Bank, 2012**).

Understanding the emergence of innovation systems has recently been put at the centre of research analysing the process of technological change (**Hekkert and Negro, 2009**), in order to understand the aims and functions of those innovation systems. Thinking around innovation platforms is thus fundamental for increased understanding of successful innovation processes. Given that agricultural innovation is complex and highly contextual in nature; innovation platforms can help stimulate the experimentation and learning required. Innovation platforms are equitable, dynamic spaces designed to bring heterogeneous actors together to exchange knowledge and take action to solve a common problem (**ILRI, 2012**).

Working through such innovation platforms has become increasingly relevant to projects developing agrifood value chains in developing countries because governments and donors have finally recognized the role of the private sector and civil society in agricultural development so as to achieve food security (**World Bank, 2008**). Also, previous studies on agricultural intervention through innovation platforms have shown the potential positive role of innovation platforms in terms of impact upon the livelihood outcomes of rural smallholder farmers in Africa (**Mapila et al. 2011; Nyikahadzo et al., 2012**). Today, national agro-industrial development policies in developing countries are encouraging the strengthening of value chain networks. Innovation platforms are one example of such networks. Stakeholder conduct within innovation platforms can be characterized through information sharing, communication, cooperation - coordination - joint planning, and trust. Concerning trust, **FAO (2005)** evokes that in Africa, credit institutions often develop at the local level based on trust. In Cameroon, for example, there are traditional savings and credit structures at the local level in different regions of the country. These institutions, known as “*Tontine*” in the local language of Northwest Province, are based on mutual trust.

However, despite the potential of the innovation platform approach, the understanding of its implementation and particularly of the process of setting up its multi-stakeholder platform is still largely ongoing. In particular, little research has been published on the impact assessment of innovation platforms; most evaluation reports use case studies to evaluate this impact (**Gildemacher and Mur, 2012**). Researching the mechanisms of how these multi-stakeholder systems foster agrifood chain development and the impact pathways between different elements of these systems is thus highly topical. The interventions of the policy makers are also dysfunctional due to lack of the needed interaction with other stakeholders within the system (**Adekunle and Fatunbi, 2012**). Policy makers often act in an isolated fashion with summarized information from their advisers; this has often led to inappropriate policy interventions. Monitoring and evaluating the impact of innovation platforms require suitable partnership and specific innovation indicators. Indicators can be used for diverse purposes. For example, the development and communication of agricultural innovation indicators, such as coordination, joint planning, increasing crop and livestock productions, etc., can be a powerful tool to facilitate policy dialogue and guide agricultural innovation policy.

So, agricultural research interventions through innovation systems concepts aim to change the way in which low income rural agrarian households in Africa interact with the market and the way in which they make decisions pertaining to the development of their agro-enterprises and the scarce resources which are at their disposal (**Mapila et al., 2011**).

Our present study aims to evaluate the impact of an innovation platform project based in Yatenga province (Northern and central Burkina Faso).

The specific objectives of this innovation platform in its second year of existence after having been set up by the Volta2 project were related to natural resource management as well as agrifood

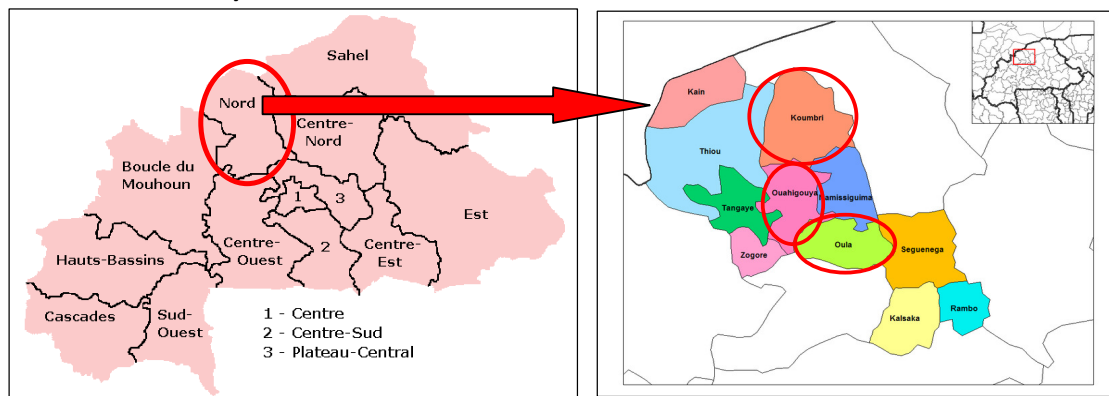
marketing; namely, access to inputs, access to credit, increased crop and livestock productions, improved soil and water management, information access and exchange, capacity development among value chain actors, coordination of activities among value chain actors and improved market access.

Our own objective in studying this innovation platform project is to assess the impact of the structure of the innovation platforms, their conduct, and their consequence on the improvement of performance of crop and livestock production in four focal villages of Yatenga province. To attain this objective, we are going to:

- i) Describe the structure of innovation platforms such as age, gender, seniority within innovation platform (IP), level of education, participation to IP meetings, type of activity within the IP, etc.;
- ii) Understand the mode of conduct of stakeholders within the innovation platform, mainly through indicators of coordination and joint planning;
- iii) Determine the performance of the innovation platform, mainly through indicators of increasing crop and livestock production.

## Methodology

### Presentation of study area



Administrative map of Burkina Faso Administrative map of Yatenga Province

**Fig.1. Administrative map of Burkina Faso and Yatenga Province**

Our study was conducted in the Northern region of Burkina Faso, precisely in the province of Yatenga. In this province our study was conducted in 3 communes and focused on four villages: two villages in Oula commune (Koura Bagre and Ziga), one village in Ouahigouya commune (Bogoya) and one village in Koumbri commune (Pogoro Silmimosse) (Fig.1). The study was conducted for 6 months from April to September 2013 with 2 months of field surveys between mid-May and mid-July 2013.

### Research methodology

The improvement in crop and livestock production was measured by asking farmers for their perception of this improvement. We are confident to use this proxy rather than an actual measure of crop or livestock production because **Liebig and Doran (1999)** have found that Nebraskan farmers' perception of soil quality indicators was correct or nearly correct 75% of the time. This past finding backs our using the perception of farmers to measure variations in the output of their main activity: crop and livestock production. We have first undertaken focus group discussions with IP members in each of the four villages identified. Then, 3 questionnaires for individual surveys were administered: one questionnaire was administered to 57 members of the IPs, one questionnaire to 12 key stakeholders chosen among innovation platform members and one questionnaire to 9 facilitators or managers of the IPs. The questionnaires capture the evolutions in the platforms' "structure", "conduct" and "performance". Statistical tools were used to demonstrate potentially significant relationships between structure, conduct and performance over time. It will be possible to attribute the relative share of the structure and ways of functioning of an innovation platform on its development outcomes. Besides individual surveys, data from the focus group discussions

uncovered the viewpoint of the stakeholders in terms of perception of IPs and their impact on stakeholders' activities.

The questionnaire to members of innovation platforms has three main parts related to structure, conduct and performance. The two latter parts are based mainly on 5-rank Likert scales so as to capture variability of stakeholders' opinions. Questions on structure of IP members were asked to IP members. They aim to identify individual characteristics such as age, sex, gender, seniority within the IP, level of education, participation to IP meetings, type of activity within the IP, indicators of wealth, etc. Questions related to structure aim also to identify the modus operandi of the innovation platform such as membership composition; decision making process; dedicated committees, units or sections; source of funding; staff availability, function and numbers; legal and regulatory framework. This questionnaire was administered to facilitators or managers of the platforms. Questions related to conduct were aimed at capturing the opinion of platform stakeholders on the way the platform facilitates interactions between chain members. This was administered to members and facilitators of the platform. Questions related to performance use selected indicators derived from the objectives agreed upon by the members of the innovation platforms.

SPSS software was used for factor analysis to identify the dominant constructs of what makes IPs successful. Then, regression analysis was done to determine the relationships between the structure of the platform, the conduct of its stakeholders and whether they are achieving the objectives they set themselves in terms of increased crop and livestock production. Qualitative data was also interpreted to complete and interpret the results obtained through the analysis of quantitative data.

We present here our data analysis process through factor analysis and regression analysis. We have made the factor analysis using principal component analysis and Varimax with Kaiser normalization rotation for the elements of conduct and elements of performance in order to reduce the number of variables used for regression analyses. The factor analysis for the elements of conduct give us two factors (factor 1 = FAC1\_1 and factor 2 = FAC1\_2) which are going to be our new variables as a part of elements of conduct in our regression analysis.

Factor 1 regroups the following statements: My viewpoint is taken into account by my value chain partners when they plan their activities; I plan my activities according to the activities of my value chain partner; My value chain partners and I plan activities together according to our production potential and customer demand. We can call this factor 1 "Joint Planning", which reflects the ability of stakeholders to work by concertation and by planning their activities together.

Factor 2 regroups the following statements: I exchange information with my value chain partners about my on-going activities; My value chain partners exchange about their ongoing activities with me; I can express my views freely in exchanges with my value chain partners. We can call this factor 2 "Coordination", which reflects the ability of stakeholders to work by coordinating their activities together.

The factor analysis for the elements of performance give us one factor (FAC1\_3) which is a new variable that we will use as a part of elements of performance in our regression analyses. We can call this variable "Improvement and increase of crop and livestock production", which reflect the impact of IPs in terms of improvement of crop and livestock production systems.

So, through factor analysis, we have three new variables that we will use in our regression analysis: Joint planning, Coordination, Improvement and increase of crop and livestock production.

For the regression analysis, we would like to assess the impact of the IPs on the new dependent variable FAC1\_3: Improvement and increase of crop and livestock production.

We need now to define independent variables that can explain the variation of this dependent variable. The theoretical model for our regression is:

$$Y = a + b_1x_1 + b_2x_2 + \dots + b_nx_n + u$$
; Where  $Y$  is the dependent variable;  $a$  is a constant;  $x_1, x_2, \dots, x_n$  are independent variables;  $b_1, b_2, \dots, b_n$  are the slope of each independent variables and  $u$  is an error term for the model.

The dependent variable, improvement and increase of crop and livestock production, can be explained by some variables from the elements of structure and from the elements of conduct.

For the variables from the elements of structure we can have the following variables: gender, age, seniority within the IP (Senio\_IP), level of education (High\_ed), participation to IP meeting (Ptici\_IP), principal source of income (Prin\_SR) and average income per year (R\_year). The principal source of income has 2 categorical variables which are: 1) agricultural activities; 2) non-agricultural activities. The variable seniority within IP also corresponds to 2 categorical variables: one for IP members who joined the IP at the beginning in 2011 and the other for those joining the IP in 2012.

For the variables from the elements of conduct we can have the following variables:

FAC1\_1: Joint Planning of activities among value chain stakeholders and Extension agents usually provide information that is relevant to my needs and production calendar.

The theoretical model of our regression is as below:

$$FAC1_3 = a + b_1gender + b_2age + b_3Senio\_ip + b_4High\_ed + b_5Ptici\_IP + b_6Prin\_SR + b_7R\_year + b_8FAC1\_1 + b_925c + u$$

## Regression analysis Outputs

### Improvement and increase of crop and livestock production

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,736 <sup>a</sup>	,542	,439	,71110487	2,101

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23,973	9	2,664	5,268	,000 <sup>b</sup>
	Residual	20,227	40	,506		
	Total	44,200	49			

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	,580	1,290		,450	,655		
Participation in IP meetings	,447	,151	,343	2,951	,005	,846	1,182
Seniority within IP	-,554	,288	-,216	-1,925	,061	,909	1,101
average income per year in dollars	,001	,000	,262	1,834	,074	,561	1,783
Main source of income?	-,984	,481	-,284	-2,044	,048	,593	1,687
Joint Planning of activities among value chain stakeholders	,356	,111	,379	3,199	,003	,816	1,226
Age	-,014	,010	-,177	-1,386	,173	,701	1,426
gender	,414	,354	,132	1,169	,249	,897	1,115
Highest level of education	-,086	,299	-,050	-,287	,776	,375	2,668
Extension agents usually provide information that is relevant to my needs and production calendar	,204	,161	,174	1,266	,213	,606	1,651

a. Dependent Variable: improvement and increase of crop and livestock production

### Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
1,752	5	31	,152

### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Unstandardized Residual	,110	50	,180	,958	50	,071

a. Lilliefors Significance Correction

### Respect of assumptions of linear regression

We undertook the appropriate tests of normality, homogeneity of error variance, multicollinearity of independent variables, and independence of errors (see tables above). All tests showed that the data we used for our model of multiple regression above met the assumptions for linear regression, which could be interpreted.

## Results and Discussion

### Improvement and increase of crop and livestock production

Our theoretical model shows that only three variables are statistically significant at 5% probability or less to explain the improvement and increase of crop and livestock production: joint planning of activities among value chain stakeholders, participation in IP meetings and main source of income.

#### - **Joint planning of activities among value chain stakeholders**

According to the regression results, joint planning of activities among value chain stakeholders has contributed significantly to the improvement and increase of crop and livestock production. Indeed, the members of IP during the field surveys have testified the role played by IPs in terms of planning their activities. IPs have created closer working relationships among IP members within the same village by exchanging knowledge in their activities, planning their activities and thinking together how to resolve common problems. This ability of IP members to work together to find solutions to common problems is one of the main objectives that highlights the definition of innovation platforms (**ILRI, 2012**). IP members who also belong to other groups or associations said the IP brought them to work in a network and integrated way for mutual help; this was the main difference between working within an IP and other groups or associations. The IP has also opened them to new partners such as the structures of micro-credit and the IP members of other villages. The IP has also strengthened their partnership with services of livestock, agriculture or animal health.

As was evoked by some IP members, the IP has taught them that working together is a powerful way to improve mutually their activity and their income. All members of the value chain are important to others and no one can improve his activity by not taking into account the other value chain partners.

The IP members declared that through joint planning of the activities, they have understood that when their animals have diseases, they can call immediately the service of animal health, which they did not do before. A consequence of this has been reduced mortality through the timely treatment of the sick animals. The producer members have learned the necessity to prepare for marketing of their produce even before production by contacting the traders on their requirements. This has resulted in the improvement of market access, which contributes to the improvement and increase of their production. This improvement of market access corresponds to one main function of innovation platforms, evoked by **Hekkert and Negro (2009)**, which is the function of market formation. Through the IP, the members have also learned about the necessity for them to plan their activity by interacting with some organizations such as agricultural and phytosanitary services of the agricultural ministry, in order to access inputs and other services for their activities. For example, before the IP, some producers did not use improved seeds. With the IP, they began to use improved seeds and also tried to see how they could make a good combination between improved and unimproved seeds. Indeed, according to what was said by some producers, using the improved seeds is profitable when there is good rainfall and they also offer the possibility that their residues can be further used for animal feed. But with low rainfall, use of the unimproved seeds is less profitable than the improved seeds. So, the strategy of these producers is to combine both types of seeds in their production in order to produce in the context of uncertain rainfall. This adaptation of producers, through innovation platforms, backs the assertion of **Nederlof et al. (2011)** that farmers need to intensify their production systems and adapt to continuous, often unforeseen and sudden changes in their production, which presupposes continuous innovation.

There are other impacts of joint planning which have not yet borne fruit. Indeed, the IP has sensitized its members about the necessity to conduct their activities by taking into account the possibility to borrow money from micro-credit institutions. Awareness was also raised by the IP on the warehouse receipt system. The implementation of this system means that IP members need to plan their activities by linking up with the micro-credit institutions. The warehouse receipt system can help producers not to sell their product at low prices during harvesting through access to credit

for their needs and can keep their harvest for sale during the period when the prices are good on the market. This system is yet to be implemented, but what is interesting is that many IP members find this idea very interesting to improve their market access and their income, which is one main function of innovation platforms (**Hekkert and Negro, 2009**).

Further discussions with the IP members revealed that IPs also contributed to change in the mode of operation of their members. Indeed, as evoked by some IP members, the necessity of integrated work, learned through the IP, has positively affected their mode of operation within their family and reinforced unity within their village. Some changes in mode of operating come from market access by IP members. Before the IP, members sold their products without any preliminary activity. But today they know that before selling their products they have to ask for information on markets, for example by exchanging information with producers from other villages, by calling other friends from another place to get market information, in order to know where they can sell their products at good value. This changing in mode of operation is very interesting for members of IPs to improve their income and thus, further invest in increasing their crop and livestock production.

Beyond greater unity at village level, integrated work developed by the IP has created more trust within IP members in different villages. This unity and trust have contributed to facilitate exchange of information on agricultural practices. Borrowing money among IP members was also facilitated through unity and trust. This importance of unity and trust is also supported by **FAO (2005)**, by saying that in Africa, credit institutions often develop at the local level based on trust. It is the same in Northwest Province of Cameroon with some local credit institutions, known as “Tontine” in the local language, which are based on mutual trust.

The survey of key stakeholders within the IP also testifies to a better coordination of IP members in their activities. Through the IP, its members nowadays mutually exchange information about their ongoing activities, especially during different periodic meetings that they now organize in the village. This helps them to mutually share knowledge on their activities, think together about their common problems and how they can improve their activities. The improvement of coordination and joint planning among IP members has thus contributed to the improvement of their activities, which can also be explained in terms of increased crop and livestock production.

#### - **Participation in IP meetings**

Our regression analysis showed that participation of IP members at IP meetings has significantly contributed to improving the members’ perception of increases in their crop and livestock production. As evoked by IP members, capacity development is one thing that can differentiate their mode of collaboration within the IP from that of other organizations, because the IP emphasizes capacity development of its members. IP meetings are the base for exchanging information and knowledge between different participants of the platforms, an essential function of networks as was asserted by **Carlsson and Stankiewicz cited by Hekkert and Negro (2009)**. Indeed, through IP meetings, IP members have received various training on crop and livestock production, techniques of feeding and animal care, market access, composting, construction of enclosures, etc. IP members during focus group discussions have emphasized the importance of training and advice that they have received from the IP in changing their practices and they suggested these training and advice should continue. Specifically various training and technical advice received by IP members during different meetings have contributed to the improvement of their knowledge in their activities and thus contributed to the improvement and increase of crop and livestock production.

The IP meetings also serve as the main forum for members to receive training from the project. According to the IP members, their participation in these meetings led to an improvement in their social capacity through their meeting with new contacts and new partners. Indeed, by participating in IP meetings, members of one village have entered in contact with IP members of other villages. Innovation platforms have contributed to closer working relationships among IP members within the

same village and to villagers' gaining easier access to different agriculture support services, which can help them to improve their activities. This improvement of human and social capacity of IP members has resulted in the improvement of crop and livestock production through better exchange of information and knowledge between different stakeholders and better access to different support services and inputs.

- **Main source of income**

According to our results from the regression analysis, main source of income has a statistically significant impact (at 5% level) on the interviewee's perception of improvement and increase of crop and livestock production. This means that IP members whose main source of income comes from agriculture also report improved crop and livestock production compared with respondents who have non-agricultural activities as their main source of income. Farmers are likely to contribute more to the improvement of crop and livestock production than those whose main source of income comes from non-agricultural activities. Likewise within the IP, members whose main source of income comes from agriculture probably mobilize their time and means through the platform for improvement of their agricultural activities. For example, some IP members mentioned that the IP had contributed to their increasing the area of land they cultivated. Indeed, IP farmer members have improved their knowledge on how to retain rainwater and enhance soil fertility through different agronomic techniques such as stone bunds, half-moons, zai, etc. This has allowed the farmer members to make use of land which could not be used for agricultural purposes before. This has increased land area cultivated, which also led to an increase in crop production. These findings from the regression model and qualitative interviews back the idea that resources mobilization, both financial and human capital, is necessary as a basic input to all the activities within an innovation system (Hekkert and Negro, 2009).

## Conclusion

This study was intended to make an impact assessment of innovation platforms, set up by the Volta2 project in Yatenga province, Burkina Faso.

Innovation platforms have contributed to the change of mode of conduct of its members in their activities. Through the IP, the members have benefited from different support in their activities, which have contributed to developing their capacity. IP members' developed capacity resulted in reinforced human and social capacity through a better exchange of information and knowledge and a better access to different support services and inputs. Joint planning and coordination of activities among IP members were also improved through closer work, and a better exchange of information in their activities. All these improvements have resulted in the improvement and increase of crop and livestock production measured by the respondents' perception of these improvements.

Thus, our study shows a positive impact of the innovation platforms set up by the Volta2 project in Yatenga province. The platforms have indeed contributed to achieving the objectives set by the platform members in terms of increasing their crop and livestock production. These findings justify the necessity to support this kind of project in the perspective of reinforcing food security and reducing poverty in rural areas around the world.

Following this study, we can make a number of recommendations to members and organisers or facilitators of innovation platforms.

➤ Recommendations to IP members:

- It could be interesting for IP members of the four villages to organize exchange visits for sharing information and knowledge in their activities;
- It is important for IP members to understand that an IP is a technical support for their activities and not a financial support. The IP is there to help them improve their activities through the development of their capacity;

- IP members should ensure a continuity of activities begun after the end of the project, especially by working closer with structures of micro-credit and other agriculture support services, by continuing to exchange information and knowledge on their activities, etc;
  - IP members should experiment the warehouse receipt system which would allow them to improve their market access and their income.
- Recommendations to organisers or facilitators of innovation platforms:
- The organisers or facilitators should extend IP activities for 2 more years at least. Indeed, both IP members and field facilitators think that it is very early to stop IP activities at the end of the project's third year because IP members are not sufficiently prepared to continue alone the activities started by the IP;
  - The organisers or facilitators of the IP should extend this experience of innovation platforms to other villages in order to benefit value chains of these other villages;
  - It is very important for organisers or facilitators of innovation platforms to help IP members acquire a legal status because without a legal status IP members cannot undertake any formal action. Indeed, as pointed out by some IP members, acquiring a legal status could help them achieve various objectives, such as accessing credit as a group, obtaining further funding for their activities, etc.
  - For other future projects using the innovation platform approach, organisers or facilitators need to better engage with the decentralized structures of the government and their different agriculture support services. These decentralized structures need also to be supported financially by the project in order to be able to move frequently for monitoring of activities in the field.
  - Finally, organisers and facilitators of innovation platforms should pay more attention to the respect of their engagement towards IP members. Indeed, many IP members have raised the problem of lack of respect of some promises made such as outside exchange visit, the appointment of a person for the daily monitoring of their activities, etc. Also, some IP members pointed out the non-respect of time during IP meetings and the weak support for their transport to IP meetings.

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