Impacts of Farmers' Field School on Livelihood Capitals in Tsunami affected Communities of Aceh, Indonesia

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Abstract

This paper evaluates the livelihoods impacts of farmers field school (FFS) in the Tsunami-affected communities in Aceh. Using techniques of participatory approach, eight units of FFS on chili were evaluated in July-August 2009. Three major tools used for the impact evaluation purpose are focus group discussion, impact assessment on five categories of livelihood capitals, and scoring of changes (impacts) on key aspect of chili cultivation and farmers knowledge. For this purpose, "before and after" method of impact assessment framework was used. The results indicate that FFS has favorably affected five assets (capitals) of farmers' livelihood: physical, financial, human, social, and natural capitals. Several negative impacts on such capitals are also identified, but overall, positive impacts of FFS on all capitals offset the negative impacts. FFS also has empowered individual farmers, and the farming communities. Farmers reported that there is an overall improvement in farming knowledge after participating FFS. Technically, after the FFS, farmers' knowledge on plant protection and soil fertility improvement has increased. After completing FFS, farmers know several technical and agronomic aspects of chili cultivation, which were unknown to them before. Farmers also reported that their social cohesiveness and marketing skill are important for chili farming; and FFS led to increases on both of these factors. Farmers also gave a very high score on five livelihood capitals. In summary, FFS has successfully delivered the improved knowledge and skill on chili farming, and vegetable production in general, to the farming communities that were divested by the Tsunami in 2004.

1INTRODUCTION

The tsunami of December 2004 damaged nearly 40,000ha of agricultural land in Aceh province, affecting up to 92,000 farms and small enterprises. Therefore, the AVRDC led project in Aceh in 2006 adopted strategy of restoring soil fertility, enhancing food security, nutrition and livelihoods of the tsunami affected communities through rehabilitation of vegetable production land, and building technical capacity of the farmers on soil and crop management. The project was implemented through adapted Farmer Field Schools (FFS) on vegetables in 80 villages. Vegetable production creates more income and jobs per hectare than cereal production (Weinberger and Lumpkin 2005), hence vegetables FFS was initiated since vegetable would quickly restore the rural livelihoods.

Farmers' field school is a process of learning by doing. The World Bank along with a number of development agencies promoted FFS since it is a more

effective method to extend science-based knowledge and practices (Feder et al. 2004). FFS uses a participatory approach to assist farmers to develop their capability on analytical skill, critical thinking and creativity such that farmers can make better decision. In short, the objective of FFS is to enhance human resource development, in which farmers become experts in their fields. Farmers are expected to be able to conduct observations, to analyze agro-ecosystems, to make decisions, and to implement pest control strategies based on the results of their field observations. In reality, the FFS involves pest control and other aspects of farming such as balanced and efficient fertilizing, efficient use of water, crop rotation, and soil conservation.

In Aceh, the process of FFS was carried out using a framework of an agro-ecosystem analysis. Participants learnt about the agro-ecosystem and dynamics of insect population during the process of making observations in the two plots during one planting season. They were planned as per structure of local agro-ecological systems. The key to understanding pest outbreaks lies in comprehensive relationships between dynamics of insect pest and its natural enemies in which farmers lack knowledge of the relationship. A topic designed to open unknown the complexity of agro-ecosystem. Farmers observe the dynamics of insects representing natural food chains in agro-ecosystem. The most important concept discovered by farmers through this special topic is ability of determine whether insect is pest, which is unbeneficial or natural enemies and other insects, which are beneficial to crop production.

FFS, which were originally created for IPM training, has been adapted for many areas of agriculture, forestry and health (CIP-UPWARD 2003). FFS is a participatory learning process, which lasts the entire length of the season for annual crops. In many of the farming sector training activities in Indonesia, a farmer field school (FFS) approach has been adapted locally (Luther *et al.* 2005; Pontius *et al.* 2002), which was adapted in Aceh. In this project, FFS was adapted with emphasis on soil remediation techniques but also include other ICM components of vegetable.

Chili was selected as the main topic of FFS in Aceh. Many farmers demanded for FFS on chili during the rapid survey and consultation with farming communities in 2008; which was also due to good market price of chili in 2008 and higher profit margin than that from other crops. Chili has highest crop acreage in Aceh, covering 9680 ha in 2007. Before the tsunami, the annual combined value of production of smallholder farmers for the province of Aceh was estimated to be about AUS$ 60.6 million for chili. The average net return to farmers has been estimated at 20.9 million IDR/ ha for chili (Mustafa *et al.* 2005).

In this context, the objective of this paper is to evaluate impacts of ICM based chili cultivation FFS process on five components of livelihood capitals of farmers attending the training. This study is from eight FFS sites, a detailed impact assessments of 27 FFS sites is forthcoming.

STUDY METHODOLOGY

Among several FFS completed in Aceh, in this paper, impacts of selected 8 FFS sites on five broad categories of livelihoods capital are analyzed. Implications of the farmer field school on farmers' knowledge and understanding on crop

management practices, and on selected aspects of five components of livelihoods, were assessed. Qualitative approaches and multiple-choice tests (scores) were used to document ex-ante impacts perceived by the participants. The study used tools and techniques of participatory assessment and we have integrated qualitative and quantitative data for deriving ex-ante impacts.

This study used ex-ante evaluation, meaning that farmers have already completed FFS training and crop growing experiences during one crop growing season, and they would be applying these knowledge and technology learnt during FFS in the next crop-growing season. Then farmers were asked to provide their expectation and perceived effects of FFS on range of vegetable farming issues. .

Each of 8 FFS group surveyed consists of 10-12 farmers graduated from FFS. Pre- and post- knowledge level of farmers, for a sample of 8 FFS sites comprising of approximately 100-120 FFS participating farmers, were compared. Survey techniques and tools of participatory impact assessment were used to collect qualitative survey data by raising specific questions to each of FFS group. Every farmer in the group had equal opportunity to answer all questions, based on her/his perception or experiences during the sessions of FFS. We allowed for different answer among farmers and participants, and a consensus data points were recorded in the chart sheet shown to all of the participants. The specific questions were based on structured questionnaires related to impacts of FFS prepared beforehand, using concept of PIA.

We have used three specific tools of PRA and PIA, they were focus group discussions (FGD), impact assessment on five components of livelihood assets, and impact scoring tool. A majority of farmers' have perceived a very positive impact on five forms of livelihood capitals, as compiled from the FGD and impact scoring methods of PIA. These five livelihood capitals include: physical capitals, financial capitals, human capitals, social capitals and natural capitals. Then, using impact scoring techniques, farmers' improvement on farming and crop management knowledge after participating FFS were recorded. The specific topics within broad category of knowledge included starting from land preparation to harvesting, and marketing of harvested products. Before participating FFS, farmers were assumed to have score of 10 on each of the factor. Immediately after completion of the FFS sessions, farmers were asked record improvement by adding the existing score. Then the changes were measured in percentage formulated as: $\%C = \frac{X-10}{10} \otimes 100\%$, where X is the score reported by farmers after completing FFS; and $\%C$ = change in score value in percentage term.

RESULTS ON FFS IMPACTS

Impacts of FFS on five components of livelihood capitals

FFS is expected to impact favorably on five sets of livelihood capitals: physical capital, financial capital, human capital, social capital, and natural capital. The impact on individual components could be positive or negative. Nevertheless, it is expected that overall positive impacts would offset any of the negative impacts, hence, a net positive benefits on livelihoods components is priori expected from the FFS training.

Major impacts of FFS on physical capital, both positive and negative impacts have been reported in Table 1. After the FFS, farmers perceived that they would be using much less material inputs (pesticides and chemical inputs), except for organic materials. They prefer to use more of organic materials instead of inorganic materials in chili farming. Synthetic pesticides will be partly replaced with botanical pesticides (Neem paste). Inorganic fertilizers will be partly substituted with composts. However, farmers still consider that production level would still be expected to increase with these substitutions. All of them are very positive impacts of FFS on physical capital. In Aceh Besar, farmers' expectation on increase on productivity is relatively low, but their expectation on lower use of chemical inputs (and reduce production cost) is substantially high. Farmers in Aceh Besar prefer to use compost instead of inorganic fertilizers. In contrasts to Pidie, farmers in Aceh Basar expect that production can increase more with moderate reduction in material inputs.

Table 1 Impact of FFS on physical capitals of the chilli farmers attended training.

Particulars	**Magnitude of FFS impact**	
Positive impacts	Aceh Besar	Pidie
Productivity of chili	Increase slightly	Increase by 5-20 % (4)
Use of chemical pesticides	Decline by 25-75% (2)	Decline by 20–40% (3)
Use of inorganic fertilizers	Decline by 20 %	Decline by 20-40% (3)
Use of organic fertilizers	Increase by 100%	Increase by 30 %
Use of botanical pesticides	Increase	
Water use	More efficient	
Level use of seed		Decline by 40%
Level of input use	Overall decline	Overall decline
Negative impacts		
Time of observation	Increase	Increase
Labor for composts and natural pesticides	Increase	Increase
Labor devoted to manual irrigation		
Weeds and fungus infestation in wet season		Increase
Labor use on chili farming in general		Increase by 10%

Note: the magnitude of changes in each variable is reported by the farmers' group. Figures in the parentheses are number of group that reported these change.

Level of labor input used on chili is expected to increase after attending FFS. This is because of requirements of preparing organic materials, and increased number of regular monitoring and observation of pests and diseases. Farmers perceive that increase in labor input is considered as negative impact. This is particularly true if farmers have to pay wage for hired labor, or spend extra time such that they lose opportunity to earn additional money from alternative civilities. When there is rampant unemployment in the village, creation of additional employment is good for the social objective of the development. These farmers (peasants) in Aceh are not likely to migrate to urban area in the near future soon,

because of already a high-level of uncertainty of employment in the urban areas nearby. Another negative impacts relates to the use of compost is that majority of the farmers believe that compost will cause increased fungus and weeds infestation in wet season. Thus, fungus and weeds are potential to reduce growth of plant. The increased weeds level also leads to increase labor use for weeding-related activities.

Overall, positive impacts of FFS on physical capital offset some of the negative impacts. There are more positive benefits than negative effects as perceived by farmers in the communities surveyed. Increase in labor use could be positive effects for some households while a negative factor for others (Better off farmers).

Impacts of FFS on physical capital also strongly relate to financial capital because the physical capitals have monetary value based on market price and wage rate. Impacts of FFS on financial capital are in Table 2. Positive impacts of FFS relate to saving of material use, particularly chemical materials which farmers could not produce locally and they need to purchase from the markets. Substitution with organic material has also saved scarce capital of the farming communities. Majority of farmers attended perceived increased in value of production after the training, as farmers would get cost saving on external inputs and increased crop productivity. Eventually, more efficient use of agrochemicals and increased productivity means also a more farm income and profit from per unit of land. In Aceh besar, farmers perceived more benefits from saving of labor cost due to reduction in inputs use. In Pidie, farmers expected increased benefits largely from higher productivity.

Table 2. Impact of FFS on financial capitals

Particulars	**Magnitude of FFS impact**	
Positive impacts	Aceh Basar	Pidie
Value of production		Increase by 15%
Price of product		Slight increase
Cost of material inputs		
Labor cost for input application	Decrease by 25%	
Cost of production	Decrease by 5%	Decrease by 20-25% (2)
Profitability	Increase by 50%	Increase by 20%
Household's income		Increase by 50%
Negative impacts		
Labor cost related to organic material		Increase by 10%
Opportunity cost of getting other paid jobs	Moderate increase	

Note: the magnitude of changes in each variable is reported by group. Figures in the parentheses are number of group reported.

Negative impacts of FFS on financial capital directly were related to opportunity cost of employment and wage rate structures. Labor wage rate in many villages increased after the FFS training due to more labor uses ad and more time to be devoted to collect organic materials for compost and botanical pesticides. Farmers used compost and botanical pesticides to substitute inorganic fertilizers

and synthetic pesticides. Because of more time spent in securing organic products, farmers also perceived that they have also lost chance to earn additional money wage from locally.

Overall, farmers have an expectation that net financial impacts of FFS are still positive. Labor cost saved from reduction in external material use has also been offset by labor cost associated with collection of organic materials. Collecting raw material of compost also involve opportunity for farmers to create another business locally.

Within a crop season of training, impact of FFS on human capital was identified by all of the farmers groups surveyed (Table 3). Increase in human capital strongly related to enhancement of knowledge on vegetable farming overall. More achievement in human capital mostly comes from improved knowledge on plant-protection and crop management related issues. Increases in human capital were also intangible and farmers could not provide an exact value of change on these elements related to human capitals, and in quality terms (Table 3). Overall, all of these issues related to human capitals were positives, suggesting for a positive impacts of the FFS on farmers' overall knowledge and skill on growing chili.

Table 3. Impact of FFS on human capitals

Particulars	**Magnitude of FFS impact**	
Positive impacts	Aceh Besar	Pidie
Knowledge on seed technology	Better (2)	Better (1)
Knowledge on pests and diseases	Better (2)	Better (5)
Knowledge on natural enemies	Better (1)	Better (2)
Knowledge on soil fertility and fertilizer	Better (2)	Better (2)
Knowledge on compost	Better (1)	Better (2)
Knowledge on bio-pesticides		Better (1)
Knowledge on marketing		Better (2)
Ability to conduct economic analysis	Better (1)	
Knowledge on irrigation	Better (1)	
General knowledge on chili farming	Better (3)	Better (6)

Note: Farmers could not measure quantitatively. Figures in the parentheses are number of group reported.

Within the two sites, there is no major difference in farmers' expectation on positive impacts of FFS on human capital between Aceh Besar and Pidie. Farmers in Aceh Besar felt slightly better on irrigation than in Pedie issues also because of there is no irrigation problem in Pedie and different farming systems.

The farmers' groups surveyed identified no any noticeable negative impact of FFS on the factors related to human capital. Nevertheless, farmers think that the only negative impact on human capital is increased jealousness among farmers who were left out from the FFS training in the village. Among the farmers participating the FFS, not all have same interest on subject covers during the FFS. Some farmers wanted to focus more on certain topics of chili farming (e.g., pest management), and some wanted on other issues. These envy and internal conflict of heterogonous interests were not so serious but a natural course on a development intervention, which will gradually disappear over farmers as knowledge diffusion takes place.

There is no noticeable difference in terms of farmers' perception on social capital related impacts of FFS between farmers group in Aceh Besar and in Pidie

(Table 4). After completing FFS, the social relationship among farmers within group as well as between groups has become more coherent and strong. The level of communication among farmers has become more frequent and with more effective information in the community. This is supported by the increase in frequency of farmers' group meetings in the village. Information sharing, particularly for vegetable production technology, has become more frequent and effective because of the improved relationship, and increased frequency of contact, between farmers and agricultural officers. Farmers no longer hesitate to do consult agricultural officers if they found any problem on farming and other issues. These unquantifiable impacts on social capital are strong aspects of FFS than that of other kinds of formal training.

Table 4. Impact of FFS on social capitals

Particulars	**Magnitude of FFS impact**	
Positive impacts	Aceh Besar	Pidie
Information sharing	Better	More intensive
Communication among farmers	More often	Smoother
Communication between farmers' group		Better
Information spread		Faster
Solidity of farmers' group	Better	
Communication between farmer and agric. officers	More frequent (2)	More frequent
Farmers' group meeting		Increase
Negative impacts		
Social envy in the community	Exist (increased)	Exist (increased)
Conflict in different interest		Exist (increased)

Note: Farmers could not measure quantitatively. Figures in the parentheses are number of group reported.

Table 5. Impact of FFS natural capitals

Particulars	**Magnitude of FFS impact**	
Positive impacts	Aceh Besar	Pidie
Agro-ecosystem		Keep balanced
Soil fertility	Increase	Increase
Soil structure	Better	Better
Natural enemies(population and kind)	Increase	Increase
Pesticide contamination to agro-ecosystem	Decrease	
Use of ground water	Decrease	
Risk associated with poison	Decrease	
Human health	Better	Better (2)
Negative impacts		
Pests and diseases	Tend to increase	
Weeds		Tend to increase
Work of botanical pesticides		Tend to increase
Attack from animal		Tend to increase

Note: Farmers could not measure quantitatively. Figures in the parentheses are number of group reported.

Impacts of FFS on natural capital of the farming were also identified by farmers because of application of several inputs and services related to natural resources and their sustainability in the farming (Table 5). Farmers reported clear and noticeable positive impacts of FFS on natural capital such as improvement on soil fertility, biodiversity, and human health. There is also highly similarity between perceived impacts as reported by farmers in Aceh Besar and Pidie. Agro-ecosystem also kept balanced; balance population of pests and their natural enemies. Improved soil fertility and more balance soil structures because of increased use of organic materials. Farmers also learnt techniques on reducing synthetic pesticides use, which helped in avoiding possible contamination to agro-ecosystem and risk of pesticide poisoning. All of them contributed to positive impacts on human health.

However, farmers also perceived few negative impacts of FFS, as they believed that pests and diseases tend to increase if farmers do not perform regular observation in the field and adopt control measures. They believe that efficacy of botanical pesticides, the substitute of synthetic ones, is lower than that of chemical pesticides. Farmers also believed that the use of compost, the substitute of inorganic fertilizers, carries several seeds of weeds, thus increased use of compost in the community might also increased weeds infestation on the crop field.

In general, after completing FFS, farmers have realized that, they have realized more benefits out of FFS, and the negative aspect of FFS are only minor not so important. In a short time, skill and knowledge on farming have been improved to many of the FFS participating farmers. They were interested, and also capable now, to adopt in the following crop season many of the technology-components learned during the FFS session. Likewise, farmers were willing to continue to learn more agricultural technology through FFS in the following season, if it were organized.

FFS impacts on farmers' knowledge

Farmers reported that their knowledge and skill on many aspects of chili farming have improved substantially after completing the FFS (Table 6). The FFS attending farmers' knowledge on plant protection was increase by the over 60 to 90 per cent across the FFS groups than the level of understanding they have got before.

Table 6. Improvement in knowledge on agronomy

Particulars	Percentage change		
	Aceh Besar	Pidie	Total
	Mean & SD	Mean & SD	Mean & SD
Knowledge on insect pest	90 (90)	50 (20)	60 (60)
Knowledge on diseases	110 (90)	60 (20)	80 (50)
Knowledge on natural enemies of pests	80 (60)	60 (10)	70 (40)
Knowledge on pesticides	80 (30)	90 (30)	90 (30)
Knowledge on soil fertility	80 (30)	70 (60)	70 (50)
Knowledge on fertilizers	90 (40)	90 (10)	90 (20)
Knowledge on organic fertilizers	150 (150)	50 (30)	90 (100)

Note: figures in the parentheses are standard deviation, which indicates variation of farmers' responses

Farmers understanding on diseases and pesticides increased dramatically, before participating FFS, farmers knew little about pests and diseases on chili and kind of pesticides to apply. Earlier, farmers knew nothing about natural enemies, and then they used to think that all insects found on the field were pests. Now, farmers have realized that not all insects are pests. They can also able to distinguish harmful and beneficial insect types to the crop, and likewise, pollinators or natural enemies of pests. Farmers' knowledge on pesticides has also been enhanced, particularly knowledge on botanical pesticides. Farmers also know now that pesticides do not only kill insect pests, but also eliminate beneficial pests.

After completing FFS, farmers also felt that their knowledge on managing soil fertility and fertilizer application has enhanced by 90 per cent than what they knew earlier (Table 7). Their know how on application of manure increased most. After attending FFS, solidity of farmers' group also enhanced (Table 7). After completing FFS, intensity of information sharing among farmers within FFS group, as well as with non-FFS attending farmers has been doubled. The improvement on information sharing among farmers was more in Aceh besar site than in Pedie.

Table 7. Improvement in information sharing and cohesiveness

Particulars	Percentage change		
	Aceh Besar	Pidie	Overall
	Mean & SD	Mean & SD	Mean & SD
Information sharing within farmers' group	120 (90)	90 (20)	100 (50)
Information sharing between farmers' group	120 (90)	90 (20)	100 (50)
Cohesiveness of farmers in the community	20 (30)	130 (90)	90 (50)

Note: figures in the parentheses are standard deviation, which indicates variation of farmers' responses

CONCLUSION REMARKS AND POLICY IMPLICATIONS

During 2008-09, a chili crop based farmers' field school on integrated soil management, combined with pest management, was implemented in selected communities in Aceh that are affected by the 2004 Tsunami. FFS process not only helps in enhancing farmers know how and skill on crop production but also help in empowering the farmers groups. As expected, preliminary impacts (or as perceived impacts by the FFS participants immediately after completion of the FFS) analyzed here clearly suggest that it has provide a very positive impact on all five categories of livelihood capitals in the communities. Some of the major impacts perceived by the farmers are as listed below. After participating in FFS, farmers believe that they would use physical inputs more efficiently, reduce the level of inputs that are environmentally unfriendly (chemical pesticides), and/or, would replace them with inputs that are environmentally friendly (organic in origin). They also believe that production cost of chili would reduce following the techniques learnt at FFS, and more productivity and profit from the chili farming. Socially, farmers also feel that participation in the FFS has further enhanced solidarity and interaction among

farmers and agricultural officers. Sharing of extension related information became more effective as the number of farmers' group meeting in a year increased substantially. These kinds of impact were also due to improvement on human capital of the FFS participants.

In addition to enhanced farmers' understanding on chili production practices, farmers' awareness on marketing of vegetable production, particularly chili, has also been increased. Market information becomes more accessible and symmetric, and farmers can make negotiation with traders or collectors. In short, FFS has successfully delivered the improved knowledge and know-how on chili production to the farmers even in far-flung locations in Aceh. This knowledge is equally also relevant for production of other vegetables, and farming practices in general. Farmers also expressed their interest to continuation of such FFS in the future even with sharing part of the cost for its implementation, which reflects farmers have very well realized usefulness and worth of the FFS.

Study limitations: Data for this study were collected from participatory survey, and from group discussions with 10-12 farmers in each site. Because of less number of farmers groups surveyed, we could not perform statistical test, which is one of the limitation of the kind of study methodology. Moreover, a full impact assessment paper out of the survey from 27 FFS sites, with PIA, and another 270 household surveys is forthcoming. Nevertheless, the methodology adopted here is innovative with potential application on monitoring and evaluation of the wide range of development projects.

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