

EMPOWERING RURAL LIVELIHOODS THROUGH FARMERS' FIELD SCHOOL ON VEGETABLE PRODUCTION IN ACEH PROVINCE- INDONESIA

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ABSTRACT

This paper evaluates immediate impacts of farmers' field school (FFS) in Indonesian farmers' communities on five livelihoods assets: physical, financial, human, social, and natural capitals. The impacts of FFS were documented at least a year after completion of FFS. A before and after method of impact assessment framework was applied to this study. The results indicate that FFS has very favourably increased vegetable farming capability and knowledge base of the FFS participants. Farmers reported very positive impacts of FFS on all of the five categories of livelihood assets. In summary, FFS has successfully delivered improved knowledge and skill on vegetable production in general. Besides, the FFS has strengthened the group formation and social capitals related to vegetable farming.

Keywords: Farmers' Field School (FFS), Ex-post Impact Evaluation, Vegetable Cultivation, Participatory Approach, Livelihood Capitals, Indonesia.

Introduction

The December 2004 tsunami caused its greatest damage and loss of life in the Nangroe Aceh Darussalam (NAD) Province of Indonesia. About 50,000 hectares of agricultural prime land were destroyed. As agriculture provides for the livelihoods of the majority of the population in the region, this condition has reduced the

economic capacity and sustainability of small farming systems. Since then, region's agricultural sector is facing serious challenges posed by the degradation of natural resources because of salinity, soil erosion, and water contamination. In the context of complete destruction of the physical, institutional and social structure of the farming communities in several places of the

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coastal areas of Aceh, there is an urgent need for external support for strengthening institutions, particularly on research and development, extension and technology transfer, and better market access.

In this context, under the ACIAR funded project in Aceh, Indonesia, AVRDC and its partners led project in Aceh in 2006-2010 introduced a 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.

Vegetables were selected for farmers' field schools (FFS) since vegetable production creates more income and jobs per hectare than cereal production (Weinberger and Lumpkin, 2005; Mariyono et al., 2016; Mariyono, 2017), hence vegetables FFS was initiated since vegetables would quickly restore the rural livelihoods. Recently, vegetable production is gradually picking up in Aceh. The FFS had adopted ICM based chilli cultivation FFS process and had used over 12 different sub-component technologies for enhancing productivity of chilli in the targeted project sites.

Chilli was selected as the main topic of the FFS as many farmers demanded FFS on chilli during the rapid survey and consultation with the targeted communities done in 2008. This was also due to prevailing fairly good market prices of chilli than that of other vegetables, and in turn, a higher profit margin from chilli than that from other vegetable crops. Chilli has also highest

promise of agribusiness development (Mariyono and Sumarno, 2015). 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 chilli. The average net return to farmers has been estimated at 20.9 million IDR/ha for chilli (Mustafa et al., 2006).

Using a participatory approach to training, the FFS adapted for vegetable farming (i.e., chilli cultivation) in Aceh provided assistance to farmers in developing their capability on analytical skill, critical thinking and creativity such that farmers can make better decision. In short, the direct goal of FFS was to enhance farmers' capacity to cultivate chilli with improved technologies that are ecologically friendly at the local farming system. At the same time, the underlying objective of FFS was also of human resource development, in which farmers are empowered to become experts in their vegetable fields. In FFS, farmers are expected to be able to conduct observations, to analyse agro-ecosystems, to make decisions, and to implement pest control strategies based on the results of their field observations. Farmers would obtain those capabilities from participating in FFS. The FFS adapted to vegetables in Aceh also adopted the same concept and overall procedures to engage farmers in participatory action research, which lasted for over a crop season at each of the FFS sites.

The project was implemented through FFS adapted to vegetables and trained 1648 farmers in 77 villages of Aceh. In addition to

training to farmers, 20 FFS trainers, and several other mid-level professionals from government agencies, and of the local community organisations, were also trained in managing and facilitating the FFS locally. This study aims to assess the short term impacts of FFS, compiled and analysed broad ranges of influences on farming communities that were brought by the FFS implemented in Aceh province of Indonesia using a framework of livelihood capitals. The specific objective of the study is to document and analyse the impacts of FFS on five components of livelihood capitals of the farmer-participants of the FFS.

Review of Literature

Indonesia is a pioneer in development of FFS in the late 1980s for dissemination of integrated pest management (IPM) technology packages on paddy, and since then it has been widely used for dissemination of new agricultural technologies and production practices in other food crops, vegetables and high-value cash crops, and natural resources management. Until now, integrated pest management is one of the largest disseminations of agricultural technologies through FFS in Indonesia, and other countries in Asia as well. In 1986, government of Indonesia revolutionised its policy on plant protection strategy by implementing the IPM Programme by issuing Presidential Decree No. 3, and also banning on use of 57 brand-names of synthetic pesticides in rice farming. The presidential decree was motivated by the fact that the commonly used pesticides were no longer effective for controlling major pests in paddy fields, such as

brown plant hopper and stem borers; this was largely also due to unwise use of pesticides. All of these situations led to a huge fall in agricultural production, food crises associated with pest outbreaks on paddy in the 1960s (Settle et al., 1996) and in the 1980s (Barbier, 1989).

In addition, several studies then also pointed out other adverse impacts of unwise use of pesticides on local environment and health of farming communities including farm labour (Mariyono, 2009a). The comprehensive packages of IPM related farmers' level training on paddy was in fact then implemented three years after the presidential decree with the objectives of: higher agricultural productivity, increased farmers' income, guarded pest population (i.e., to keep pests below economic threshold levels), limited use of chemical pesticides, and an improved environment and better public health (Mariyono et al., 2010).

Several previous impact studies of IPM training and related other training in Indonesia have reported that after initiation of the IPM training, the pesticide uses on paddy and other major crops have been reduced by 50 per cent without sacrificing the level of production (Bond, 1996). One study by SEARCA (1999) also reported that pesticide use decreased and yield of rice increased after the adoption of IPM by farmers. A study by Mariyono (2007), reported that Indonesian farmers have adopted several components of IPM principles in Indonesia and thus there is an indication of diffusion of IPM knowledge among Indonesian farmers.

Indonesia is one of the pioneers in widespread use of IPM in Asia, and recent studies have demonstrated that adoption of IPM in Indonesia has helped farmers reduce their reliance on pesticides and also has allowed increasing their harvests, and thus IPM programme is relatively successful in Indonesia in meeting its objectives (van den Berg, 2004). Some of the recent impact studies on IPM have also reported that the adoption of IPM has led to a reduction of incidence of pesticide-related illnesses dramatically among the farming community and level of environmental pollution in Indonesia (Agrochemical Report, 2002).

Since the declaration of success of the IPM programme in the country, there have been various impact studies on IPM dissemination that were implemented in Indonesia and several other countries in Asia through FFS approach. The FFS impact evaluation studies so far have been conducted with several approaches and indicators of assessment, but largely the available literature also revolves around the plant protection measures and change on crop productivity and farm income levels.

In fact, some studies have criticised the FFS approaches and have raised questions on merit of FFS for wide scale dissemination of the farm technology packages (Feder et al., 2004a). Being a pioneer in implementation of FFS, a large part of the recent impact assessment pieces of literature are also produced from Indonesia. Using farm level data in Indonesia and a quite complex model, Feder et al. (2004a) reported that there is no difference between IPM-trained and non-

trained farmers in terms of change in level of pesticide use and level of rice yield. Using spatial analysis with the same data as used by Feder et al. (2004a), other authors like Yamasaki and Resosudarmo (2008) refine the methods and the findings of Feder et al. (2004a) and they reported that IPM-FFS partly impacted positively on improving yield of rice, but not for reduction on level of pesticides use.

With different angle of view, Mancini and Jiggins (2008) used participatory approach of research to illustrate that the deeper understanding of the occupational hazard of handling pesticides indeed induced a change in the FFS participants' attitudes towards the use of pesticides. They found that farmers who were members of FFS groups were significantly better off than non-member farmers, and the FFS-trained farmers were also better in handling pesticide applications. Studies by Mariyono (2009b; 2015), and Mariyono et al. (2010) showed that changing from the Green-Revolution-based technology to IPM-based technology in Indonesian rice production practices has also brought an agro-chemical saving technological progress by significantly decreasing pesticide use along with dissemination of IPM knowledge. The gradual decrease in pesticide use in Indonesia did not occur instantaneously after implementing the IPM programme in 1986, but it was successful implementation of farmers' level training on complex agro-ecological setting of crop production practices, such training activities were gradually formalised and now popularly known as FFSs. Therefore, in the case of Indonesia, the historical evolution of IPM and FFS training are very

much intertwined and have evolved simultaneously reinforcing impacts of one another

Most of the past impact studies of IPM or of FFS are on a narrow aspect of the training, such as on changes in pesticide use and/or change of yield of produce. In reality, one of the fundamental messages of FFS is also to empower farmers or to enhance farmers' knowledge base and farming capabilities, but not much focus on impacts of FFS on farmers' overall knowledge base and on broader aspects of improvement on farmers and farming community livelihoods as such. Undoubtedly, the FFS graduated farmers' knowledge on pest management issues had been enhanced as reported by several studies in the past, but diffusion of technology/knowledge from the FFS graduates to other ordinary farmers around the communities or in other communities nearby have not occurred so much; and one of the reasons cited in the literature is that the graduates could not convey complicated messages obtained from FFS to other farmers (Feder et al., 2004b). Feder and Savastano (2006) reported that farmers-to-farmer diffusion of IPM knowledge had occurred effectively whenever the opinion leader was strong. Likewise, in an impact study of FFS on knowledge of potato growers in Peru, Godtland et al. (2004) found that farmers participating in FFS were able to explain more on pest and disease management of potato farming than their counterparts who have not attended FFS.

Information on broader impacts of IPM-FFS on livelihood would be of more interest to

development planners and rural development sector decision-makers. There are two major categories of impacts of IPM-FFS: they are immediate impacts (short term effects) and long term impacts (or developmental impacts). IPM-FFS is expected to give immediate impacts, in terms of improving farmers' know-how on pesticide use and crop production practices, farm technical uses, and farm profitability. Eventually, such short term impacts continue to generate other much longer term effects on the well-being of the farmer participants and farmers' livelihoods, and in the long run, also on the social and political domains of the farming community in the region as a whole. As reported by van den Berg and Jiggins (2007), IPM-FFS has benefited farmers through immediate impacts as well as developmental. Providing a summary of participatory research involving an impact assessment of agricultural technology, Lilja and Dixon (2008) analysed broader impacts of FFS on livelihoods and suggested that with farmer empowerment, and changes in opportunity structures, farmers' well-being has been improved in many countries by combining farmer-empowerment and innovation through experiential learning in FFS groups. This was also facilitated by changes in the opportunity structure through transformation of local government staff, establishment of new farmer-governed local institutions, and emergence of private service providers.

As noted earlier, a large body of IPM-FFS impact assessment studies are available (and also many from Indonesia and in Asia)*, but there is a

* This could be because of a large FAO supported regional project on IPM in Rice in the late 1990s.

virtual absence of studies on impact assessment of FFS that discuss on methodology and on the impacts of FFS on livelihoods of farmer-participants in totality. Large bodies of past studies focus mainly on short term impacts and on effects on few selected issues like reduction of pesticide use or improvement on crop yield.

Methodology

Immediately after completion of FFS in Aceh, we evaluated the farmers' perceptions and their feedback towards process involved in conducting the FFS and the perceived impacts of the FFS on the changes that have been brought on farmers' knowledge base on vegetable cultivation practices, and farming practices, in general. The real developmental impact of FFS will be achieved after few years of FFS when the farmer participants would actually apply the improved knowledge and technology know-how learnt at FFS at their own farm field and would realise the kind of changes on crop production and productivity levels, which is also called as long term impact of the intervention through FFS here. In practices, these development impacts of external intervention would expect to increase over the time. Nevertheless, it is important to document and analyse some of the immediate effects of the FFS and/or any other rural development intervention immediately after its completion, and if possible within the project period, so that the stakeholders and participants' perspectives and perceptions towards the project activities and interventions can be analysed, documented for improved evaluation and incorporating the feedbacks and lesson learning in the activities. When to conduct impact

assessment of FFS and what is the right procedure are still some of the unsettled issues in the FFS impact literature (van den Berg and Jiggins, 2007; Feder et al., 2008) and many of these issues are also issues and site-specific.

Considering the nature of activities, and the short time period we had for impact assessment task, combining participatory and conventional methods also enhanced the effectiveness of impact assessment task as such (Mancini and Jiggins, 2008). The use of participatory methods enabled us to explore several qualitative and social and institutional impacts of FFS. However, information obtained from PRA is also very location and context-specific, so we have also used a household survey and compared some of the indicators obtained from both the survey methods.

Out of 77 FFSs that were implemented in Aceh by the AVRDC-led project in Aceh during 2008-09, in this impact assessment study, 27 FFS sites and farmers' groups were surveyed. The qualitative survey was done by consulting farmers in a group comprising 10-12 farmers at each of the 27 FFS sites.

Analytical Framework: The impacts of FFS on five capitals of livelihoods were assessed using framework of sustainable rural livelihoods (SRL), which was defined by Neubert (2000: 11-12) as:

"A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can

cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base."

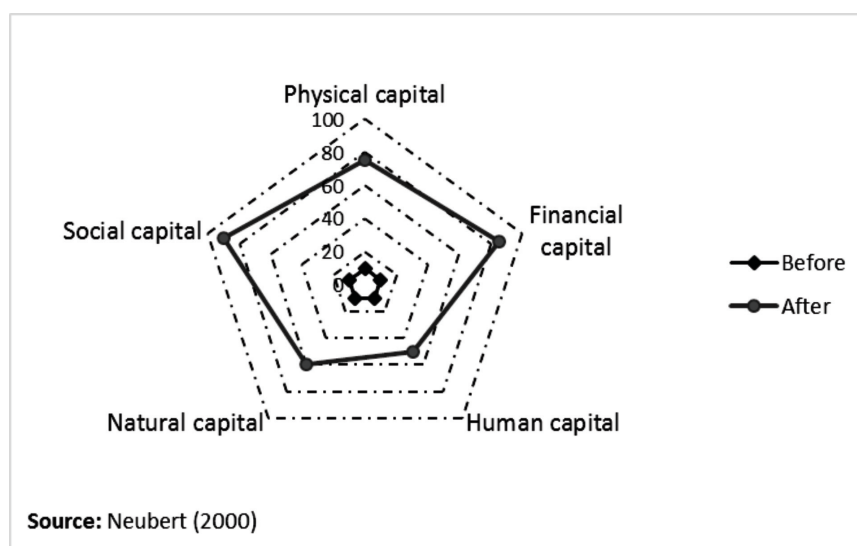
The SRL can be adapted for evaluation purposes of IPM-FFS, but so far there is a scarcity of literature available that exclusively deals with impacts of FFS on rural livelihoods of the community and, as far as the author's knowledge, almost none on subject related to FFS impacts specific to livelihoods capitals of the farmer participants. In this context, we have adapted the SRL framework and FFS impact assessment method to document the perception of change in farmers' livelihoods brought by the vegetable ICM-FFS, as noted earlier.

The five categories of livelihood capitals likely to be impacted by FFS are described as (1) physical capital: basic built infrastructure, tools, and equipment; (2) financial capital: financial

assets, including incomes, savings, loans, credit, remittances, pensions and other transfers; (3) human capital: assets, such as skills, knowledge, ability to work, good health, etc.; (4) social capital: social assets, such as networks, memberships in groups, relationships, and the wider institutions of society; and (5) natural capital: natural resource stocks from which resource flows are derived, including land, water, biodiversity, landscapes, etc.

The SLR framework assumes that a stronger and more sustainable capital base is essentially empowering. The different types of livelihood capital asset are also presented as a pentagonal diagram in Figure 1. This is a five-axis graph on which accesses by different households or groups to each different type of assets can be plotted. Before FFS, farmers were assumed to have ten value point of each capital; and after FFS, farmers were expected to have higher value point.

Figure 1: Pentagonal Diagram for Sustainable Rural Livelihoods



As noted earlier, this study used ex-ante evaluation framework, that is, the participants have already completed FFS training and have got crop-production experiences during the one crop growing season, and they would be applying these knowledge and technology learnt during FFS in the next crop-growing season. Here, farmers were asked to provide their expectation and perceived effects of FFS on range of vegetable farming issues. Thus, the results on consequences of FFS as documented in this study are also kind of immediate impacts of FFS.

In many agricultural extension projects, the participants and locations are usually selected with several criteria. For example, active and innovative farmers and easily accessed places are usually the ones selected by such training. Active and innovative farmers are selected because they are expected to be the core of the project and source of information for other farmers. Locations that are easily accessed, which is close to the main road, market and city centre, usually have better fertility of land. All of these potentially could lead to a selection bias. But, with limited resource and availability of short time, using "before" and "after" comparison one could still avoid the selection bias, because the change in performance level of farmers is due mostly to programme. This is also based on assumption that farmers without access to project have not enough time to improve their performance level, or in other words, this method does not account for the benefits accrued to the FFS through the diffusion process in the communities. Considering all of these issues, resources constraints, and a short duration of FFS in each of the communities

(3-4 months), this study used "before" and "after" approach of programme evaluation (Gittinger, 1982).

Two surveys methods were used to collect data: group level survey using techniques of PRA and individual (conventional) household survey. Considering the nature of activities, and the short time period we had for impact assessment task, combining participatory and conventional methods also enhanced the effectiveness of impact assessment task as such (Mancini and Jiggins, 2008). The use of participatory methods enabled us to explore several qualitative and social and institutional impacts of FFS. But, the PRA based methods are also not sufficient and out of criticism, as they are often criticised for being "quick and dirty" research methods. Likewise, the hypotheses and generalisations in the PRA or RRA report about farmer problems and constraints remain untested, mainly because most of the data gathered remain un-coded (Gladwin and Peterson, 2002). Information obtained from PRA is also very location-specific.

To be sufficient, data collected from PRA were complemented with data from individual survey. The individual survey would accommodate variation among respondents, and provide information on some statistical test, and, the use of individual survey extrapolation of observations from small samples to wider population (Feder et al., 2004a). Therefore, the impacts of in FFS at individual farmer participants using a structured form, and through head to head consultation with farmer participants were

analysed. In this case, farmers are asked about their expectation or prediction of farming with the improved technologies introduced during FFS. Data collected in the individual survey include general background of farmer participants, knowledge improvement on pest and diseases, improvements in farming practices, and comment and suggestions of farmers on FFS process as a whole.

This study combined focus group discussion (FGD) tools of PRA with selected tools and techniques of Participatory Impact Assessment (PIA). Using five components of livelihood assets, the impact of FFS on each of the components of livelihood assets were documented. Then, using impact scoring techniques, improvements in farming and crop management knowledge of farmers, after participating in FFS, were recorded. The specific topics within broad category of knowledge included starting from land preparation to harvesting, and marketing of harvested products. For quantifying the impact of FFS, farmers were assumed to have initial score of 10 (i.e., $X_0 = 10$) on each of the factors before participating in FFS. After immediate completion of the FFS sessions, farmers were asked to record improvement by adding the existing score. Then, the changes were measured in percentage formulated as:

$$\%C = \frac{X_1 - 10}{10} \otimes 100\% \quad (1)$$

where X_1 is the score reported by farmers after completing FFS; and $\%C$ = change in score of value in percentage term.

FFS programmes emphasise farmers' ownership of development processes, partnership with other development agents, and group collaboration (Mancini & Jiggins, 2008). FFS is likely to impact favourably on livelihood of farmer, which can be observed in the level of change in five different sets of livelihood assets: physical capital, financial capital, human capital, social capital, and natural capital. A hypothesis of this study is that FFS increases five livelihood capitals, by mean that after completion of FFS farmers undergo better livelihood measured in terms of five capitals. Modified and adapted FFSs are hypothesised to have positive impacts on farming practices and better understanding of farmers on complex farming technologies, such as vegetable production and high-value crop production practices, as discussed and illustrated in this study, and eventually on rural livelihood.

Results and Discussion

The impact of FFS on individual components of five livelihood capitals could be positive or negative. Nevertheless, it is expected that overall there would be net positive benefits of FFS on livelihoods components, which was *a priori* expected. But, the level and scale of such benefits vary by the FFS site, and with several other internal and external factors in the communities.

Major impacts of FFS on physical capitals of participant-farmers, and as perceived by the FFS participants, have been summarised in Table 1. Over two-thirds of the farmers surveyed have expected that they would be using 25 per cent of less of chemical materials on their chilli plot in

the coming year than what they have been using so far. After the FFS, farmers perceived that they would be using fewer material inputs (chemical pesticides and chemical inputs) on chilli, except

for organic materials. On an average, over 20-25 per cent of farmers expected to reduce use of chemical materials by 20-25 per cent.

Table 1: Impact of FFS on Physical Capitals

Changes in inputs and output	Aceh Besar (120)		Pidie (90)		N. Aceh (60)		Total (270)	
	n	%	n	%	n	%	n	%
Increase in use of bio-pesticides	20	17	20	22	0	0	40	15
Decrease in chemical fertilisers use	90	75	60	67	30	50	180	67
Reduced use of chemical pesticides	80	67	70	78	0	0	150	56
Rise in production	30	25	60	67	20	33	110	41
Rise in organic fertiliser	20	17	20	22	20	33	60	22

Note: n is the number of groups providing response on the respective variables/physical capitals.

They preferred to use more of organic materials instead of inorganic materials in chilli farming. In the surveyed sites, synthetic pesticides could also be partly replaced with botanical pesticides. Inorganic fertilisers will be partly substituted with composts. However, farmers considered that production level would still be expected to increase by 10-25 per cent with these substitutions and trade-off on the application of inputs. All of them are very positive about the impacts of FFS on physical capital. In Aceh Besar and Northeast Aceh, farmers' expectation on increase in productivity is relatively low, but their expectation on lower use of chemical inputs and reduced production cost is substantially high in Aceh Besar than in other two regions surveyed.

The level of labour input used on chilli is expected to increase after attending FFS. This is because of increased number of hired labour

used for preparing organic materials, and increased number of regular monitoring and observation of pests and diseases on the field. Farmers perceived that increase in labour input is considered as negative impact as it requires additional labour and costs. This is particularly true if farmers have to pay wage for hired labour, or spend extra time such that they lose opportunity to earn additional sources of money from alternative sources. When there is a rampant unemployment in the village, creation of additional employment is good for the social objective of development projects, because there is already high level of uncertainty of employment in the urban areas nearby. These peasants in Aceh are not likely to migrate to urban area in the near future soon. In fact, another negative impact related 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 have

potential to reduce plant growth and in turn, reduce crop productivity. The increased weeds level also leads to increased labour use for weeding-related activities, thus an increased inputs cost.

Overall, more positive benefits of FFS than negative effects were perceived by a large number of farmers in the communities surveyed. Increase in labour use on farming due to adoption

of new technologies could be positive effects for some households, while a negative factor for others.

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 summarised in Table 2.

Table 2: Impact of FFS on Financial Capitals

Financial aspects	Aceh Besar (120)		Pidie (90)		N. Aceh (60)		Total (270)	
	n	%	n	%	n	%	n	%
Fall in fertiliser cost	40	33	20	22	30	50	90	33
Fall in pesticide cost	50	42	20	22	10	17	80	30
Fall in production cost	80	67	30	33	00	0	110	41
Rise in produces value	20	17	30	33	10	17	60	22
Rise in profit/income	50	42	60	67	10	17	120	44

Note: n is the number of groups providing response to respective issue.

Positive impacts of FFS relate to saving of costs for materials use, particularly chemical materials that farmers could not produce locally and they need to purchase from the nearby markets. Its substitution with organic material may also save scarce capital of the farming communities. The majority of farmers attended reported that they perceived increase in value of production after the FFS training, as farmers would get cost saving on external inputs and increased crop productivity at the same time. Percentage fall in total costs of fertilisers and pesticides to be used on farming ranges from 15 to 25. But they still expected that gross return or value of production at the same time would rise by around 25 per cent. Eventually, more efficient use of agrochemicals and enhancement of productivity

means an increased level of profit to farmers from per unit of land. On an average, such increase on produce value is about 20 per cent. In Aceh Besar, farmers perceived more benefits from saving of labour cost due to reduction in inputs use. In Pidie, farmers expected increased benefits largely from higher productivity after adoption of the improved technology components learnt in FFS.

Negative impacts of FFS on financial capital were related to opportunity cost of employment and increased wage rate structures. After the FFS training, labour wage rate in many villages increased due to more labour uses and more time to be devoted to collect organic materials for compost and for preparation of botanical pesticides. Farmers used compost and

botanical pesticides to substitute inorganic fertilisers and synthetic pesticides. Because of more time spent in securing organic products, farmers also perceived that they have lost chance to earn additional wage income from the local markets. Overall, the FFS participant- farmers' groups have an expectation that their net financial return from growing chilli in the coming season

(impacts of FFS) would be increased by 45 per cent. Labour cost saved from reduction in external material use has also been offset by labour cost associated with collection of organic materials. Collecting raw material of compost also involves substantial opportunity cost for farmers, when the labour market is relatively tight in Aceh.

Table 3: Impact of FFS on Human Capitals

Enhanced knowledge	Aceh Besar (120)		Pidie (90)		N. Aceh (60)		Total (270)	
	n	%	n	%	n	%	n	%
Seed technology	20	17	30	33	10	17	60	22
Pest and disease management	70	58	90	100	40	67	200	74
Soil fertility & fertiliser	40	33	20	22	30	50	90	33
Natural fertiliser and pesticides	60	50	20	22	00	0	80	30
Economic and market	20	17	20	22	0	0	40	15
General farming on chilli	70	58	20	22	20	33	110	41

Note: n is the number of groups providing response to respective issue.

Within a crop season of training, impact of FFS on human capital was also very positive and identified/reported by all the farmers' groups surveyed (Table 3). The increase in human capital is strongly related to enhancement of knowledge on vegetable farming in general, and chilli production in particular. More achievement in human capital mostly came from improved knowledge on plant-protection and crop management related factors. Increases in human capital were intangible and farmers could not provide exact value of change for several elements related to human capitals, and in quality terms (Table 3). Overall, all of these issues related to human capitals were positive, suggesting for a positive impact of the FFS on farmers' overall increase on farming knowledge base and improved skill on growing chilli.

Among three production sites in Table 3, there is no major difference related to farmers' expectation on positive impacts of FFS on human capital. The greatest impacts of FFS felt by participant farmers were on pest and disease control strategies, and soil fertility management. Likewise, recognition of several kinds of pests, diseases and natural enemies were other positive impacts of the FFS initiatives in FFS. Farmers in Pidie felt better on pest and disease management than in the other two places.

The farmers' groups surveyed identified no noticeable negative impact of FFS on the factors related to human capital. Nevertheless, few farmers' groups also reported that the negative impact on human capital increased

jealousness among farmers who were left out of the FFS training in the village. Among the farmers participating in the FFS, not all have same interest on subject (technologies) on different aspects of vegetable farming. Some farmers wanted to focus more on certain topics of chilli farming (e.g., pest management), and some wanted on other issues. These envy and internal conflict of heterogeneous interests were not so serious but were a natural course in a development intervention, which will gradually disappear as knowledge diffusion takes place across the

farmers and communities.

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 (or cohesiveness) among farmers within group as well as between groups becomes more coherent and strong than before. Out of 270 FFS surveyed, farmers reported on an average increased cohesiveness by over 75 per cent.

Table 4: Impact of FFS on Social Capitals

Impacts	Aceh Besar (120)		Pidie (90)		N. Aceh (60)		Total (270)	
	n	%	n	%	n	%	n	%
Communication among farmers	10	8	40	44	20	33	70	26
Information sharing	10	8	30	33	10	17	50	19
Cohesiveness	110	92	30	33	60	100	200	74
Relationship with extension officers	40	33	20	22	20	33	80	30

Note: n is the number of groups providing response to respective issue.

This is the most noticeable impact on social relationship. The level of communication among farmers has also become more frequent and with more effective information as available 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 now 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 consult agricultural officers if they find 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, as noted earlier.

Positive impacts of FFS on natural capital of farming were also identified by the several farmers group, because of high level of 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 in soil fertility, increased biodiversity, and human health. There was also a high similarity between perceived impacts reported by farmers in Aceh Besar and in Pidie. About 37 per cent of the surveyed FFS sites reported positive impacts on

agro-ecosystem, largely due to balanced population of pests and their natural enemies. FFS also led to improved soil fertility and more balanced 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 the risk of pesticide poisoning. Farmers in Pidie and Northeast Aceh perceived higher impacts of FFS on chilli farming than those in Aceh Besar. All of them contributed to positive impacts on human health.

Table 5: Impact of FFS on Natural Capitals

Impacts	Aceh Besar (120)		Pidie (90)		N. Aceh (60)		Total (270)	
	n	%	n	%	n	%	n	%
Agro-ecosystem	60	50	40	44	0	0	100	37
Soil fertility	50	42	70	78	50	83	170	63
Natural enemies	20	17	0	0	0	0	20	7
Human health	30	25	20	22	20	33	70	26

Note: n is number of groups providing response to respective issue.

However, as noted earlier, 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, was lower than that of chemical pesticides. Farmers also believed that the use of compost, the substitute of inorganic fertilisers, carries several seeds of weeds, thus increased use of compost in the community might also increase weeds infestation on the crop field.

In general, after completing FFS, farmers have realised that they have seen more benefits out of FFS, and the negative aspects of FFS are only minor, not so important ones. In a short time, skill and knowledge on farming have been improved for many of the FFS participating

farmers. These participants were interested, and also capable now, to adopt in the following crop season many of the technology-components learned during the FFS sessions. Likewise, farmers were willing to continue to learn more agricultural technology through FFS in the following season, if it were organised. Many of the participants even agreed to pay for part of the cost.

Conclusions and Policy Implications

A chilli crop based FFS on integrated crop management was implemented in selected communities in Aceh that were devastated by the 2004 tsunami in the region. FFS does not only help farmers to enhance know-how and their skill on crop production but also help to enhance empowerment of the farmers' groups. At community level, the findings from the impact assessment suggest that the FFS has provided a very positive impact on all five categories of

livelihood capitals of the average farming households in the project implemented sites. Some of the major impacts of the FFS, as perceived by the majority of farmers, are listed below. After participating in the FFS, farmers believe that they would use farm inputs more efficiently, without any loss of crop yield and they think that they will be able to reduce the level of chemical inputs that are environmentally unfriendly (reduce level of application of chemical pesticides), and/or would replace them with inputs that are environmentally friendly (organic in origin or less toxic compounds). The farmer participants also believe that they can reduce cost of chili production by over one-third than the cost incurred now simply by following some of the techniques learnt at the FFS, which will ensure more productivity and more profit from the chili farming. Likewise, in terms of social implication of the FFS, majority of the farmer participants also feel that participation in the FFS has further

enhanced solidarity and interaction among farmers, and between farmers and agricultural officers in the surveyed areas. After the FFS, sharing of crop production and extension related information became more effective as the number of farmers' groups meeting in a year has increased substantially. These kinds of impact were also due to improvement in human capital of the FFS participants, and an increased farming related knowledge base of the participants. There are some indications that the local agricultural extension (and partner agency of this project in Aceh) would also continue some of the FFS in selected few locations in the future. We also believe that the farmers' suggestions and feedback on the process of FFS, and results from impact evaluation as documented in this study, will be useful to any future FFS programme for vegetable production to be implemented in Aceh or other parts of Indonesia.

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