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List of Abbreviations

ACIAR	Australian Centre for International Agricultural Research
AIAT(BPTP)	Assessment Institute for Agricultural Technology (Balai Pengkajian Teknologi Pertanian)
AIPD-Rural	Australia-Indonesia Partnership for Decentralization – Rural Economic Program
DFAT AID	Department of Foreign Affairs and Trade Agency for International Development
FAO	Food and Agriculture Organisation
FCHPA (BPTPH)	Food crops and horticulture Protection Agency (Balai Proteksi Tanaman Pangan dan Hortikultura)
FFS	Farmer Field School
F2F	Farmer-to-Farmer
IPM	Integrated Pest management
MoA	Ministry of Agriculture
ToT	Training of Trainers

1 Introduction

This review details various aspects of farmer to farmer (F2F) learning as part of a larger project to assess suitable and effective approaches to inform and support AIPD-Rural programs for pro-poor rural development in Eastern Indonesia. The report outlines the theory and principles of farmer to farmer learning. Various approaches of farmer to farmer learning are discussed with particular reference to the Farmer Field School as one of the commonly implemented and widely adapted approaches. Different delivery platforms for farmer to farmer learning are detailed including Government, NGO and the private sector examples and case studies of farmer to farmer learning in Indonesia and other countries. The report also includes a discussion of the benefits, costs and sustainability of farmer to farmer learning.

Agriculture in Indonesia

Agricultural development and adoption of new technologies has been identified as a principal pathway for poverty alleviation in Indonesia (Rajah and McCulloch 2012) and other parts of the world (de Janvry and Sadoulet 2002). A 1% growth in the agricultural sector can reduce rural poverty by almost 3%. Over the last 40 years agriculture's contribution to Indonesia's GDP has declined from 41% in 1970 to 15% in 2011 (Lee 2008; Collins Higgins Consulting Group 2012). Yet agriculture remains a pillar of Indonesia's economy, employing 42% of the total work force in 2011 (BPS 2012). Agriculture is an important income source for poor Indonesian workers with 63% engaged in the agricultural sector in 2008 (Rajah and McCulloch 2012). This is particularly so in rural areas where 75% of poor rural workers are employed through the agricultural sector.

Low incomes for poor farmers can be attributed to numerous factors. While these vary between locations and commodities, they generally comprise some or all of the following: poor agricultural practices; lack of quality planting material; productivity far below yield potential; poor infrastructure; expensive and irregular transport; long supply chains; lack of quality incentives in pricing; lack of numeracy, literacy and financial skills; inadequate access to credit for investment and operating; and a complex regulatory environment. Agricultural extension services are also a necessary component of any knowledge and technology adoption program for improved productivity, food security and rural livelihoods and the promotion of agriculture for pro-poor economic growth (Birner et al. 2006).

2 Agricultural Extension

Extension is the process of enabling change in individuals, communities, regions and industries, generally those involved in primary production or natural resource management (Coutts et al. 2005; APEN, 2014). It is a collaboration between partners for capacity building to empower people to make informed decisions and be responsible for the change process. There are a range of extension paradigms that can be used in agricultural development (Coutts et al. 2005; Vanclay and Leach 2011). These include one-way knowledge flows such as technology transfer and advisory services. These rely on research generated by the public sector which is then disseminated via a communication strategy involving demonstrations, field visits, farmer meetings and media for ultimate adoption by farmers. Two-way knowledge flows include non-formal education such as Farmer Field Schools and facilitation extension approaches. Multiple knowledge flows involve agricultural innovation systems which are 'bottom up' learning platforms involving networking and interactive learning with emphasis on communication, knowledge management and collective learning. Innovation systems involve different approaches and stakeholders compared with traditional extension models (Rajalahti 2012).

Programs based on traditional 'top down, one-way' approaches to adapt and promote technologies to smallholders, have had limited impact at the field level in Indonesia and other parts of the world (Tully 1964; van de Fliert et al. 2007a; Feder et al. 2010). These programs have been constrained by various factors including the unsuitability of innovations to specific agro-ecological and socioeconomic conditions, assumed homogeneity of farmers, discipline (not systems) based, delivery of small, disconnected segments with no consideration of farmer knowledge as well as physical and institutional separation between research, adaptation and local development stakeholders (van de Fliert 2007; van de Fliert et al. 2007a). Growth in development projects has led to increased implementation of participatory or 'bottom up' approaches which have been recognised as being more effective than traditional technology transfer pathways (Tully 1964; Braun et al. 2000; van de Fliert et al 2007a; Mungai and Llewellyn 2012, unpublished). Franz et al (2010) highlighted that extension needs to facilitate on farm research, farmer and industry relationships and farmer to farmer networking to be effective.

Participatory approaches have led to a growing number of programs focused on farmer driven innovation and experimentation in both developed and developing countries (Gianatti and Carmody 2007; Hafid and McKenzie 2012). Various studies have highlighted that the advice and experiences of other farmers are highly valued and even preferred as sources of information (Feder et al. 2004; Millar et al. 2005; Franz et al. 2010; Mariano et al. 2012; McKenzie 2013). This is the foundation for more modern extension approaches that are based on farmer to farmer learning. Franz et al (2010) reported the top six preferences for farmer learning as: hands-on; demonstration; farm visit; field day; discussion and one-one-one.

Scaling out and scaling up are terms increasingly used to describe the expansion of research and rural development impacts (Millar and Connell 2009). Previously, it has been assumed that if practices and technologies proved beneficial to farmers then technology diffusion would naturally occur. This may be the case for technologies and practices that are simple, low cost or address an immediate need such as feed shortages or pest

incursions. However, adoption and scaling up of complex management and farming system practices are likely to be limited without appropriate extension programs and approaches (Pannell et al. 2006). Facilitated, interactive learning that provides an opportunity for hands-on, experiential assessment within their environment will assist in scaling up (Pannell et al. 2006; Millar and Connell 2009). Fostering local innovation and effective peer learning have been found to contribute to a 50% reduction in the time required for farmers to see significant benefits from an effective scaling up and out process (Millar and Connell 2009). Millar and Connell (2009) conclude that any scaling up strategy should include farmer to farmer peer learning.

While, Franz et al (2010) highlighted that extension programs should capitalise on the value of peer teaching and learning in educational delivery methods, farmer to farmer learning approaches are not the ultimate in extension methodologies and do not form an extension system as such (Coutts et al. 2005; Gallagher et al. 2006; Braun and Duveskog 2008). There is still a role for conventional 'technology transfer' methods where broad application of generic recommendations or large scale communication of simple messages to a large audience is required (Coutts et al. 2005; Braun and Duveskog 2008). Farmer to farmer learning and conventional extension approaches can be complementary, achieving beyond what could be accomplished independently (van de Fliert et al. 2002; Gallagher et al. 2006). The extension theory and practices utilised contribute to program effectiveness and need to be considered in the design of any extension or agricultural development program (van de Fliert et al. 2002; Millar et al. 2005; Millar 2009), particularly in terms of accountability for publically funded programs (Andersen et al. 2006). Subsequently, rural development agencies are interested in improved approaches for extension and farmer education programs (Feder et al. 2004). The challenge for extension is to design the appropriate mix of methodologies at each stage of farmer learning while considering the characteristics of each village and farmer group (Millar et al. 2005).

3 Farmer to Farmer Learning: Theories and Approaches

This section outlines the theory of farmer to farmer learning as well as various farmer to farmer learning approaches. The Farmer Field School (FFS), in particular, is discussed in some detail as one of the most widely implemented farmer to farmer learning methodologies. Differences in learning approaches are essentially based on who controls and manages the process, whose interests are considered and the structure of relationships and processes (Braun et al. 2006). The various farmer to farmer learning approaches can be complementary at different stages (Millar et al. 2005).

3.1 The theory behind farmer to farmer learning

Farmer to farmer learning is based on the value that farmers attribute to information sourced from other farmers. Farmers view other farmers as a key source of information and knowledge on agricultural practices (Feder et al. 2004; Abbate 2007) and are a preferred pathway for learning (Millar et al. 2005; McKenzie 2013). This preference is fundamental to the concept of farmer to farmer learning. Farmer to farmer learning tends to be directed towards educational goals rather than knowledge transfer *per se* with most approaches based on non-formal education concepts (E. van de Fliert 2014, unpublished data). These include: building on the learner's existing knowledge and analysis of real life experiences; it must be reflective, experiential and experimental; and lead to action. Collective action is critical in sustainable development.

Farmers learn through processes that offer opportunities to solve management problems, acquire new knowledge, foster independence, creativity, self-reliance, self-criticism, and self-evaluation and by generating new knowledge themselves through experimentation for innovation or for adaptation (Tully 1973; E. van de Fliert 2014, unpublished data; J. Pontius 2014, unpublished data). Farmers typically utilise a range of strategies to innovate and generate knew knowledge (McKenzie 2013). For the successful adoption of complex management or farming system practices, farmers need to be involved in observation and adaptation of the technology to their unique agro-ecological conditions and farming system. Farmer to farmer learning is typically field based and experiential providing farmers with the opportunity to observe the technology in the field, analyse the benefits and gain insight into the practicality of implementation e.g. benefits, limitations, issues and challenges.

Farmer to farmer learning involves facilitators not teachers (Hamilton 1995; J. Pontius 2014, unpublished data). Farmer to farmer learning approaches are focused on training farmers as facilitators of the learning process. Farmers can in fact be more effective facilitators of the learning process, as they tend to be more practical, have insights into local issues, conditions and the community (Braun and Duveskog 2008).

Farmer empowerment is a key element of many farmer to farmer learning approaches and in particular the FFS model (Khisa 2004; Bartlett 2005; van de Fliert et al. 2007a). Farmers in Indonesia are typically at the bottom of a social and educational hierarchy. Programs acknowledging farmer's prior knowledge and experiences and supporting their role in identifying, assessing and adapting innovations therefore require significant adjustments to existing cultural attitudes, particularly in extension institutions (van de Fliert

et al. 2007a; Feder et al. 2010). This empowerment benefits farmers in other aspects of their agribusiness as they are constantly exposed to forces that potentially marginalise farmers if they are not proactive in their management (Pontius et al. 2002; van de Fliert et al. 2007a).

While farmer to farmer learning may be a preferred method for farmers to improve knowledge and technology adoption, there are still variables that need to be considered. Some farmers prefer to learn through one-on-one communication as opposed to group learning (Millar et al. 2005). In the case of some approaches e.g. cross visits, some farmers may prefer to learn from farmers within their own village that they already know and therefore will wait until local farmers are experienced with a given technology before they get involved. It has also been highlighted that the quality of farmer to farmer exchanges is important in creating informed awareness and confidence to trial new technologies.

3.2 Participatory learning and action

Participatory learning and action (PLA) refers to methodologies aimed at stakeholder participation in the processes of planning, implementing and evaluating development activities (Wageningen 2014). However, Arnstein (1969) and Pretty (1995) pointed out that development agencies interpret the concept of participation differently, which in the agricultural extension context, has implications for the level of farmer control over the processes. Pretty (1995) outlines seven typologies ranging from passive participation to self-mobilisation, with the latter being the situation whereby farmers take initiatives independent of external organisations when making changes. Some lower levels of 'participation' involve manipulation or tokenism, which do not value farmers ideas or give them power to make decisions as part of the process. Pretty suggests that at least functional participation is required for functional development, which involves a partnership between the farmers and the external organisations.

Participatory approaches are the foundation of farmer-to-farmer learning where the process is as valuable for learning as the results of the research and farmers are involved in both conducting the research and implementing outcomes. It is based on the premise that stakeholder participation results in consensus and support for technology adoption. Participatory learning methodologies ensure that farmers have some ownership of the learning process which can be motivating to continue the process of adapting and improving (Millar and Connell 2009). Typically, participatory approaches involve a group of farmers with assistance from a trained facilitator. Organising farmers to be participants in the process is a key element.

The principles of PLA include:

- A defined methodology and systematic learning process focused on communal learning through analysis and interaction
- Multiple perspectives reflecting the interpretations and solutions of different stakeholders
- A group learning process for group analysis and interaction
- Context specific methods and approaches, designed and adapted to the local situation, preferably by stakeholders
- Facilitating experts and stakeholders

- Leading to change through joint analysis and interaction to define changes and motivate stakeholders to take action (Wageningen 2014).

3.3 The Farmer Field School concept

The Farmer Field School is one model of farmer to farmer learning. FSS's are experiential, participatory and learner centred (Bartlett 2005). The FFS concept is based on the principles of non-formal education, that adult learning is optimised if it is based on observation, experimentation and analysis of real life experiences (Pontius et al. 2002; van de Fliert et al. 2007b). Braun et al (2000) described the FFS in terms of processes that comprise planning, the learning cycle (observation, analysis and action), the development of agro-ecological knowledge, the capacity for collective action, motivating and sustaining interest and facilitation. Farmers are expected to conduct observations, to analyse agro-ecosystems, to make decisions and to implement strategies based on the results of their field observations. It utilises a group learning process of problem solving for collective decision making and action.

Empowerment is an essential design feature of the FFS, empowering farmers to undertake their own analysis, make their own decisions, and organise their own activities for improved agro-ecosystem management (Pontius et al. 2002; Khisa 2004; Bartlett 2005; van de Fliert et al. 2007a). Interaction with research and extension staff is on a more demand driven basis with farmers seeking assistance where they are unable to solve a specific problem amongst themselves (Khisa, 2004).

Since it was first introduced, more than two million farmers across Asia have participated in this learning approach (Pontius et al. 2002; Bartlett 2005) and it was estimated that between 10-20 million farmers globally had graduated from FFS by 2008 (Braun and Duveskog 2008). The concept was first implemented in rice in Indonesia in 1989 by the Food and Agriculture Organisation (FAO) as part of a National Integrated Pest Management Program (van de Fliert et al. 2007b; Agricultural Extension Component, 2011). This was in response to devastating outbreaks of brown plant hopper resulting from overuse of pesticides and loss of natural enemies. The Green Revolution of the 1960's saw increased access to inputs such as water and fertiliser, as well as improved varieties, doubling average rice yields between the 1960's and the 1990's (Pontius et al. 2002; Bartlett 2005). By the 1970's there was concern that any gains from the Green Revolution would be eroded through pesticide resistance and recurring pest outbreaks as well as farm and macro level health and environmental concerns. Scientific research at the time was progressing biological pest control and IPM shifted from guidelines for field sampling and spraying based on centrally determined economic threshold levels to more ecological principles.

The initial FFS program was designed to address farmers' lack of agricultural ecology knowledge, particularly, the relationships between insect pests and their natural enemies. Smallholders are interdependent as ecological processes are not restricted by farm boundaries and therefore benefit from the collective decision making and action promoted through FFS (van de Fliert 2007). This is particularly so for areas such as conservation of natural crop pest enemies, suppression of rodent populations, prevention of groundwater contamination and disease prevention in livestock.

3.3.1 Description of the Farmer Field School

The following FFS description is based on the original model for IPM in rice. The typical features of a FFS for IPM includes the following: a group, a field, a facilitator; curriculum; programme leader; and financing (Braun and Duveskog 2008).

The Group

A FFS typically engages 25-30 farmers in field based, season long learning activities (Pontius et al. 2002; Winarto 2003; Bartlett 2005). Participants learn in small groups of five to maximise participation as larger groups can inhibit individual contributions. A field session typically average 3-4 hours with 10-16 sessions depending on the growing season of study crop (van de Fliert et al. 2002, 2007b).

The Field

The key learning material for a FFS is the field and it provides most training materials (Pontius et al. 2002). In the rice IPM FFS this includes comparison of an IPM and non-IPM (usual farmer practice) plot (Barlett 2005; van de Fliert et al. 2007b). Management of the IPM plot is based on agro-ecosystem analysis while the non-IPM plot would be managed according to the usual farmer practices, most likely prophylactic pesticide applications.

The Curriculum

The curriculum of the FFS follows the natural crop growing/production cycle (van de Fliert et al. 2002). Each session consists of at least three activities: agro-ecosystem analysis, a 'specialist' topic and a group dynamics exercise to promote group coherence, communication and collaboration (Bartlett 2005; van de Fliert et al. 2007b). Activities are based on experiential learning and involve action, field observations, analysis and decision making (Braun and Duveskog 2008). The FFS has a strong focus on farmers sharing their ideas and knowledge, presenting and discussing findings as part of the empowering process. Specialist topics are delivered by external service providers and facilitators to broaden knowledge of other aspects of the production system such as plant physiology, soil and crop ecology, pest and disease management and socio-economic aspects (van de Fliert et al. 2007b). Appendix 1 outlines the agenda for a typical FFS session.

The Facilitator

Extension workers or trained farmers facilitate the learning process, encouraging farmers to develop skills and understand key agro-ecological concepts through self-discovery activities practiced in the field (Braun et al. 2000). A key objective of most FFS's is to progress to trained farmer facilitators as they tend to be more effective given their knowledge of the community, its members and the local area as well as being recognised and accepted by the local community (van de Fliert et al.1995; Braun and Duveskog 2008). They are often a more cost effective option requiring less financial support than formal extension practitioners in terms of transport costs and the ability to operate independently.

Appropriate curriculum and maintaining the integrity of the learning process is critical for the FSS to avoid loss of quality and impact (Braun and Duveskog 2008). The FFS approach can be less effective if the key principles and components are not adhered to. Success is dependent on the FFS being facilitated in a manner that is consistent with its design i.e. facilitation of a learning and discovery process (where attendees are

responsible for identifying issues, designing demonstrations, monitoring and assessing) rather than a lecture based type approach (van de Fliert 2000; Braun et al. 2006; van de Fliert et al. 2007b). Training of trainers (TOT) is a critical element of implementing FFS to ensure sustained capacity building and behavioural change. Successful facilitators require skills in managing participatory, discovery-based learning as well as the appropriate technical knowledge to guide the learning and action process (Braun et al. 2006). Van de Fliert (2000) highlighted that developing trainer capacity can be achieved through linking with existing trained and experienced facilitators. However, mechanisms are required to ensure that skills can be upgraded to meet the requirements of a specific curriculum and target group.

The Programme leader

FFS's are primarily conducted as part of a larger government or NGO programme. The programme leader is an essential component to provide necessary training and support for facilitators, monitoring and evaluation and programme development (Braun and Duveskog 2008).

Financing

FFS's require financial support to fund the group learning activities (Braun and Duveskog 2008). Costs and financial requirements of FFS are discussed in more detail in Section 8.

3.4 Community IPM

Community IPM is a strategy aimed at institutionalising IPM at the local level to ensure sustainable management of a community's shared agricultural and ecological resources (Pontius et al. 2002; van de Fliert et al. 2002). There are three elements to Community IPM: learning, experimentation and organisation. The Community IPM model occurs via set activities. The first step is the FFS at the village level. As part of the Community IPM strategy FFS graduates are trained as IPM FFS facilitators with an emphasis on leadership skills, analysis, field studies and technical issues. These IPM farmer trainers then lead community level IPM programmes providing analytical tools, methods and opportunities to improve knowledge, skills and experience (van de Fliert et al. 2002, 2007b). Experimentation in the community IPM context is conducted for the purpose of research to address farmer identified issues as opposed to a process for learning as in the FFS.

Community IPM evolved over time from the basic IPM FFS model in recognition that sustaining IPM learnings or agricultural development required more than just acquiring ecological knowledge (Bartlett 2005; van de Fliert et al. 2007b). It also required the ability to generate, adapt and extend this knowledge within farming communities. This issue was first recognised and addressed by FFS graduates in Indonesia who developed their own networks and planned and implemented their own interventions (Bartlett 2005). Interventions ranged from research and training to marketing and advocacy supporting the concept of 'Community IPM'. Similar processes occurred in other countries (Bangladesh, Cambodia, Chine, Indonesia, Nepal, Sri Lanka, Thailand, the Philippines and Vietnam) with community led and planned follow up activities contributing significantly to sustained IPM knowledge, implementation and collective action in communities (van de Fliert et al. 2002, 2007b). Scaling up of the Community IPM approach was piloted in three provinces

in Vietnam with over 200,000 farmers reached through 3,400 farmer trainers (van de Fliert et al. 2007b).

3.5 Cross visits

Cross visits are a farmer to farmer learning approach which involves groups of farmers visiting host farmers that are trialling or implementing new practices or technologies in other villages (Millar et al. 2005). In a comparison of three extension methods (case studies, cross visits and champion farmer visits) cross visits were the preferred method of farmer learning and had the greatest impact on farmer awareness and problem solving (Millar et al. 2005). The cross visit approach allows farmers to observe the technology in a practical context, question host farmers, exchange experiences and gain valuable insights into the practical aspects of technology implementation. Cross visit attendees generally had a lower incidence of technical errors and demonstrated greater problem solving abilities than case study attendees, possibly attributable to less discussion of technical issues. The presence of champion farmers at cross visits reportedly enhanced discussion and demonstration of technical aspects. Limiting farmer numbers on a cross visit allows for more interaction and learning. This can also be a potential constraint for cross visits in that they may limit information exchange to small groups of farmers compared to more broadly reaching events. However, they can still be a cost effective option for successful technology adoption on a small scale.

Cross visits have proved to be an effective scaling out mechanism, successfully stimulating learning and action by farmers in addition to those attending cross visits (Stelling and Millar 2010; Millar 2012). While the process of scaling out intends to achieve technology adoption over as many participants as possible in the shortest timeframe, the benefits of the technologies must be significant enough to improve livelihoods (Millar et al. 2005). Cross visits are dependent on having demonstrable impacts at the field level. Farmer attendee selection is also important as they are responsible for communicating and inspiring other farmers in their local village on their return as part of the cross visit approach to scaling out. Follow up by extension officers to support farmer to farmer learning is important for farmers to convert initial motivation and enthusiasm created through cross visits into action for technology adoption (Stelling and Millar 2010). Based on evaluations of technology adoption following cross visits, Millar (2012) estimates that by 2010, 417 farmers had implemented improved management practices, improving income by an average 7 million kip per year. Stelling and Millar (2010) highlighted that cross visits must involve poorer farmers to ensure information is shared with networks at this level of the social system.

3.6 Agricultural innovation systems

An Agricultural Innovation Systems approach, focuses on changing the approaches used to identify, design and implement investments and in institutional arrangements, relationships and processes (Rajalahti 2012). It involves integrating traditional interventions with non-traditional approaches and stakeholders including the private sector such as buyers, input providers and credit agencies (Rajalahti 2012; McKenzie 2013). This approach generally involves learning alliances formed between various organisations (research institutes, government agencies, the private sector and non-government organisations) working with rural families in developing countries to identify, share and

develop agricultural practices (Stelling et al. 2009). Learning alliances are increasingly recognised as a key tool in agricultural development.

An example of a participatory innovations systems approach is a 'hub and spokes' model. This comprises a central hub (centre for information dissemination, experiments or research with semi-permanent facilitators) and 'spokes' (villages, farmer groups, NGO's local extension services and individual farmers) (Hafid and McKenzie 2012). The multiples 'spokes' indicate outreach via farmer technicians and farmer to farmer knowledge exchange. This model is based on the following principles: farmer driven; interactive and consultative; encourages farmer led experimentation; multidirectional communication flows; and multiple 'spokes' where different learning and knowledge exchange can take place.

3.7 Community based extension

Community Based Extension (CBE) is another approach with the potential to incorporate farmer to farmer learning. It was developed in recent years in response to failures in government and private sector extension programs (Gianatti and Carmody 2007; Feder et al. 2010). CBE refers to an extension service that is contracted by a community or a farmer organisation (Feder et al. 2010). Through CBE, farmer organisations can provide an opportunity to aggregate farmer extension demands and represent farmers in participatory models of extension management. Using this approach, farmers are able to participate in various stages of the extension chain, including trainers. Feder et al (2010) outlines the FFS as an example of the CBE approach.

3.8 Field day and demo-plot

Field days and demonstration plots are older extension tools that have been revitalised with participatory approaches to form simple processes for farmer to farmer learning. They tend to be less costly, typically provide broad exposure but are limited to simple technologies. Herianto et al. (2010) emphasised that demonstration plot methods have been proven too slow in achieving adoption of complex Best Management Practice (BMP) technology but were successful in stimulating interest in specific management aspects.

Demonstration plots have been utilised by various institutions and organisations as a means of illustrating the practical implementation and benefits of improved agricultural practices and for the delivery of technical information (Hafid and McKenzie 2012). They are most effective when established as a paired plot to clearly demonstrate the benefits of once practice relative to another. Demonstration plots must be associated with a participatory process that allow farmer to test their own alternatives in order to optimise learning potential. While demonstration plots are a platform for knowledge and technology adoption, they also function as the basic learning material in a FFS (Hafid and McKenzie 2012).

3.9 Agribusiness FFS

The FFS has been adapted from a crop production focus to address agribusiness management, marketing and supply chain development through various programs (ACDI/VOCA 2005; CRS – Philippines 2007; Horton et al. 2013; CARE 2013). Examples of these include Farmer Business Schools, Farmer as a Business, Farmer Field and

Business Schools (See section 6.2.1) which are all based on modified FFS approaches. The clustering approach to agroenterprise development used by CRS-Philippines (2007) and based on the Territorial Approach developed by CIAT (Lundy et al. 2005) is a model developed independently of the FFS approach and focusses on cluster marketing as a driver for business and technology development.

3.9.1 Farmer business schools

Farmer Business Schools (FBS) were developed and implemented as part of an ACIAR funded project in collaboration with the International Potato Centre (CIP) to improve the marketing of potatoes and other vegetables in West and Central Java (Horton et al.2013). This is described in more detail in section 6.2.1.

Horton et al (2013) also compared three approaches: FFS, FBS and Participatory Market Chain Approach (PMCA). While they all employ an action learning approach the process and focus of implementation varies. The FBS works with small groups of farmers to address the farm business rather than the cropping system as in the FFS and the market chain as in PMCA. It is intermediate in cost and complexity and duration. In the Indonesian context, the FBS may be the preferred methodology for small farmers to exploit well defined market opportunities.

3.9.2 Farmer as a business

Farmer as a Business (FaaB) was developed as part of the Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance 2003-2005, initially embedded in the FFS curriculum then expanded to a stand-alone training program (ACDI/VOCA 2005). FaaB evolved in response to limited marketing knowledge and skills amongst cocoa farmer's which was impacting on farmer's bargaining position, selling decisions and willingness to invest in improved cocoa production practices. This training program focused on improving farmer's knowledge of the cocoa market for improved marketing decisions and development of operational structures to support group marketing activities (ACDI/VOCA 2005). This program proved popular and contributed somewhat towards addressing limited marketing and business management skills. It provided opportunities for networking and information exchange. However, it was limited in its scope and was labour intensive. It was recommended that future programs practice the theoretical concepts and also focus on extending the market concepts to the next level of the cocoa value chain, cocoa buyers and traders.

3.10 Clustering approach to agroenterprise development

The *Territorial Approach to Rural Agro-enterprise Development* (Lundy et al. 2005) was developed by CIAT as a means of facilitating collective marketing by smallholder producers, but also to strengthen human and social capital so that they and their chains can compete in emerging markets. The Eight Step Clustering process adapted from the CIAT model by CRS-Philippines includes for example training in conducting market studies and negotiating with buyers, production and marketing planning, business planning, technology and natural resource management. The approach used participatory processes and includes local demonstrations, lead farmers and cross cluster visits. This process was evaluated with vegetable farmers in Mindanao, Philippines by an ACIAR research project (Rola-Rubzen et al. 2012) and found to have a positive economic impact through improvements in yields and prices when compared with non-participating farmers.

The process also improved cluster members' production, marketing and negotiating skills; bargaining power; and access to government, NGO and private sector services. The project also suggested processes to improve its success and to lead to an exit by donor agencies (Murray-Prior et al. 2012). The approach to conducting the research incorporated a participatory process of action research and action learning, a small-scale model for developing agricultural innovation systems.

3.11 Summary

Various farmer to farmer learning approaches have been tried and evaluated, with the main differences in the approaches being who controls and manages the process, whose interests are considered and the structure of the relationships and processes. A level of at least functional participation is necessary if sustainability is to be achieved. However, most approaches incorporate andragogical concepts and view farmers as a key source of information for other farmers.

The key features of F2F learning include:

- Farmers learn in groups (ranging from 5 -30).
- Many of the learning activities are field based.
- Up to about 15 learning activities occur through the growing season for the product.
- Learning activities are based on adult learning principles and experiential learning processes.
- Learning activities may include production, natural resource management, post-harvest, logistics, management and marketing topics.
- Involve farmer experimentation/demonstration sites and activities.
- Extension workers or trained farmers facilitate the learning activities.
- Programs are organised and financially supported by government, agribusiness or NGOs.

4 Delivery Platforms for Farmer to Farmer Learning

Extension capacity in Indonesia is provided by a range of organisations including Government, NGO's and the private sector, each of which has its own strengths and weaknesses (Millar 2009). Policy reform in Indonesia has reflected the evolving extension landscape. Subsequent to decentralisation, and in recognition of preferences for farmer to farmer learning and improved approaches for extension and agricultural development, the Indonesian Government established law No 16/2006 in 2006 (Agricultural Extension and Advisory Services Worldwide 2014). This law reunified three primary sectors (agriculture, fisheries and forestry) by establishing a new institution named the Agency for Extension Coordination (Badan Koordinasi Penyuluhan – BAKORLUH) with directives for farmer empowerment and capacity building through non formal education approaches to agribusiness and pro poor development (Herianto et al. 2010).

This law reflected the changing environment in extension and rural development recognising the roles of multiple providers including government, private sector and self-supporting extension volunteers (Herianto et al. 2010), a shifting extension focus from productivity to agribusiness and enabling farmers to seek advice and support from alternative sources other than the government (World Bank 2005). Prior to this F2F learning activities e.g. FFS, tended to be conducted separately in addition to regular nationwide extension activities (Feder et al. 2004).

While traditional pathways and methodologies for extension and technology transfer still exist, incorporation of participatory approaches and the concept of demand driven research has resulted in increasing attention directed towards recognition of farmers' needs (Hafid and McKenzie 2012). Programs are increasingly implementing farmer driven innovation and experimentation as key learning processes. Several models of farmer-to-farmer learning have been created by adapting and adjusting standard FFS to different commodities and targets, and sources of funding (Braun and Duveskog, 2008). There has also been increasing collaboration, incorporating various organisations and stakeholders as extension and rural development programs focus on sustainability of supply chains rather than individual sectors (VECO 2011). Increasing demand for quantity, quality and traceability has also stimulated greater involvement of the private sector. However, Hafid and McKenzie (2012) summarised a range of technology adoption and development programs for Indonesia's cocoa sector and highlighted that top down technology transfer methods still persist but most have incorporated participatory elements for research and technology adoption.

The following section outlines different delivery models of farmer to farmer learning by Government, NGO, the private sector and collaborative programs. The section also summarises examples of programs implemented by each sector in both Indonesia and other developing countries.

4.1 Government extension programs

Indonesian law obligates the local government to organise agricultural extension institutions at provincial and district levels. Most provinces and districts have established extension institutions with a budget to cover extension activities and the operational costs

for field extension staff. In 2013 total government-funded extension services comprised 51,228 personnel. Numbers are declining as most are over 50 years old and many extension workers are changing status to non-extension positions. Their effectiveness is limited due to a high dependency on special training funds from the central government (Chaidirsyah 2013).

Current government models of farmer to farmer learning are supported through the Indonesian Ministry of Agriculture's Indonesian Centre for Assessment and Development of Agricultural Technology/Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian (ICADAT/BBPPTP), which oversees technology development and assessment by the provincially based Assessment Institutes for Agricultural Technology (AIAT)/Balai Pengkajian Teknologi Pertanian (BPTP). BPTPs are responsible for technology testing innovations developed by the central research institutes and adapting them to local farm conditions. However, the BPTPs are not responsible for extension delivery, which is the responsibility of the provincial governments and district governments (van de Fliert 2007a). The consequent separation between levels of government and their overlapping responsibilities for research, development and extension has led to poorly adapted technologies; weak collaboration, coordination and communication between the various arms of government, the private sector and farmers; and a lack of strategy to scale up and scale out innovations.

Engagement and technology adoption is primarily through the Farmer Field School model and demonstration sites (Hafid and McKenzie 2012). Liaison officers in each district work primarily with farmer groups but are also available to individual farmers. BPTP collaborates with a range of organisations in extension delivery including district extension agencies, NGO's and the private sector e.g. Mars Inc.'s Prima Kakao Project in Luwu.

Government extension has typically involved top down approaches to improve productivity and market access of food crops. Training and visit was the primary extension approach for Indonesian Government extension services from the 1960s until the 1990s. A paradigm shift in Indonesian policy in 1999 from centralised to decentralised approaches resulted in extension services and associated funding being managed and allocated at the district level (Herianto et al. 2010; Agricultural Extension and Advisory Services Worldwide 2014). While the intention of the district level funding policy was was that traditional 'top down', linear 'research to farmer' relationships would be replaced with 'bottom up' participatory approaches based on farmer needs (Herianto et al. 2010), the risk was the redirection of funds toward routine programs rather than agricultural development. In practice, 'top down' models still predominate, there has been misdirection of funds and the new structure has exacerbated the poor linkages between institutions and reduced the potential impact (van de Fliert 2007a).

Government extension programs are publically funded but also utilise donor funding and soft loans from lending institutions such as the World Bank. Public funded programs typically operate within tight budgetary constraints as extension is one of the less visible avenues for rural development expenditure, compared to infrastructure such as roads, often attracting only weak political support (Anderson et al. 2006). Large scale donor agencies typically partner with government extension agencies as it provides a simple design model and reduced complexity (Anderson et al. 2006). External funding is also generally attractive to government agencies as it boosts resources for infrastructure, activities and organisational expansion albeit over limited timeframes. The National Centre

for Agricultural Development in the Ministry of Agriculture maintains linkages with district level government agencies and agricultural research, however, linkages with NGO's, banks and micro-credit institutions could be further developed, while only weak linkages exist with the private sector (Agricultural Extension and Advisory Services Worldwide 2014).

The following information outlines examples of Government based extension and rural development programs that comprise elements of farmer to farmer learning. In some cases the programs involved multiple extension components but for the purposes of this review only those comprising aspects of and approaches for farmer to farmer learning will be discussed.

4.1.1 National IPM program

Formal farmer to farmer learning approaches were first implemented in Indonesia through the FFS in rice in 1989 as part of a National Integrated Pest Management Program (van de Fliert et al. 2007b; Agricultural Extension Component 2011). Changes in government policy supporting IPM such as, prohibition of fifty-seven broad-spectrum insecticides for rice (Braun and Duveskog 2008; Fox 1991; Rolling and van de Fliert, 1994) and the removal of US$150 million in pesticide subsidies (Braun and Duveskog 2008), demonstrated the Indonesian Government's commitment to IPM and garnered donor support (Bartlett 2005). The National IPM program was funded from 1989-2000 through the World Bank ($37 million loan), Indonesian Government ($14 million) and United States ($25 million grant).

While the concept of farmer to farmer learning through the FFS model originated in rice systems it rapidly expanded in Indonesia to secondary food crops such as soybeans, maize and vegetables (sweet potato, cabbage, potato) and estate crops (cocoa, coffee) under various national programs (Khisa 2004; Braun and Duveskog 2008). The FFS approach has evolved to encompass a range of farm related topics in its curriculum including multiple aspects of crop production and management as well as in non-crop/forest systems including livestock production, natural resources management (soil, fertility, water conservation) and socio-cultural aspects of communities (food security, nutrition, health, savings, literacy) (Feder et al. 2004; Khisa 2004). The FFS approach has also been extended beyond Asia to several countries in Africa and Latin America, the Middle East, North Africa, Eastern, Central and Western Europe and the USA (Khisa 2004; Braun et al. 2006; Braun and Duveskog 2008).

4.1.2 Decentralized agricultural and forestry extension project 2000-2005

The Decentralized Agricultural and Forestry Extension Project (DAFEP 2000-05) coincided with a dynamic political environment and decentralisation of public services and incorporated modern participatory, farmer led approaches (World Bank 2005). Funded through the World Bank, DAFEP aimed to enhance farmers' capacity for participatory, farmer led extension and to strengthen the capacity for integrated district level extension services. The project involved 'bottom up' participatory planning and farmer led extension activities (FMA's) based on 'learning by doing'. Farmers were involved in the process of developing village, farmer group and family agribusiness action plans and establishing priorities for FMA's. Each participating village received an allocation of IDR 75 million over 3 years (with the exception of Kulon Progo villages which received IDP 37.5 million) to fund FMA's. The project also facilitated farmer to farmer learning, training a minimum of two people from each village as farmer trainers for project activities. Extension services

were provided by government agencies, farmer trainers and NGO's at the sub district level. Project activities were not limited to specific crops and commodities.

4.1.3 Farmer empowerment through agricultural technology and information 2007-2011

The World Bank funded (US$ 123 million) FEATI (Farmer Empowerment through Agricultural Technology and Information) program 2007-2011 approach was similar to that employed in the Decentralised Agricultural and Forestry Extension Project (DAFEP 200-2005) (World Bank 2013). While both projects were based on bottom up participatory, farmer driven extension agendas, DAFEP focused on technology adoption and improved extension pathways at the village level and FEATI at the district level. The FEATI approach also involved the submission of grant proposals by farmer groups, based on their priorities and technical needs, to district level extension agencies. Grants were exclusively for learning activities. BPTPs coordinated the provision of technical assistance for approved grants (Hafid and McKenzie 2012).

A key goal of this project was empowering farmers to drive the extension agenda and build their capacity to adopt new technologies, develop agribusiness management skills and engage in public-private partnerships (World Bank 2013). The project achieved this to a certain extent, implementing a process for farmer driven extension agendas which also facilitated improved linkages between researchers, extension and farmers for improved service delivery. Trained farmer group leaders enabled improved leadership in group learning activities and in the development of agro-enterprises through enhanced needs identification, decision making and implementation.

In practice, project implementation and outcomes were constrained by various factors that could have been addressed through improved project planning and design. The project would have been more successful in its goal of assisting farmer groups to upscale agro-enterprises to district levels if the project design had facilitated increased partnering with the private sector. A one-village-one-product approach limited the farmer organisations that benefited through the project. Implementation at a local level was by sub-district and village extension workers, however, a lack of marketing and agribusiness development skills limited the development of agribusiness partnerships. The project did not have an effective monitoring and evaluation (M&E) design and consequently M&E reports focus on project outputs rather than an assessment of meaningful outcomes.

4.2 NGO/donor programs

NGO extension services have tended to focus on projects for community development, sustainable agriculture and biodiversity conservation projects (Millar 2009) rather than a single commodity focus (van de Fliert 2000). International and national NGO's have been involved in farmer to farmer learning through FFS's since the 1990s and are largely dependent on donor funding (Braun and Duveskog 2008). Donor agencies and NGO'S are generally more enthusiastic and supportive of funding extension activities than the public sector and are often perceived as more effective, although, they cannot realistically be scaled up to a national level (Anderson et al. 2006).

4.2.1 CARE farmer field and business school and CIP farmer business school (FBS)

CARE's Pathways program has developed a Farmer Field and Business School (FFBS) approach aimed at improving the food security and livelihood resilience of poor smallholder women farmers and their families (CARE 2013). This program has been implemented in Ghana, Malawai, Bangladesh, India, Mali, and Tanzania and is targeting 150,000 poor women smallholders in its first phase. Based on the FFS approach it is a hands-on 'learning by doing' program involving experimentation and learning about production practices and marketing options over a cropping or livestock production cycle. The Pathways program engages with men and boys for improved gender and social relations to support women's empowerment through this approach. The program also incorporates community approaches to facilitate change at the community level.

The International Potato Center, (CIP) has been active in the Farmer Business School (FBS) arena. In Indonesia they work with potato, soybean and broccoli farmers and provide training on marketing and processing activities. Previous Participatory Market Chain Approach (PMCA) work in the Andes, Uganda and Indonesia identified limited business skills and ineffective farmer organisations as key constraints to market access and development for small farmers. The CIP model of FBS is based on the principle of FFS, but the approach was expanded to build farmer capacity to work with other market chain actors, strengthen farmer organizations, and promote development of new agribusinesses. The FBS combined elements of Farmer Field Schools (FFS) and PMCA in a facilitated action learning process. The FBS is implemented over the production and marketing cycle and covers the following key areas: Identification of market opportunities; assessment of market chains; development of market-oriented innovations; development of business plans; provision of business support services (Horton 2013).

FBS cycles (5 FBS groups in total) were directed towards marketing of fresh and processed potatoes, black soybean (for soy sauce) and broccoli (Horton 2013). Of the five FBS farmer groups, three had been successful in producing and marketing new products. The less successful groups were involved in marketing of fresh potatoes. Recently they expanded the approach to the Philippines under The Second Cordillera Highland Agricultural Resource Management Project (CHARMP2), this is a US$66 million International Fund for Agricultural Development (IFAD) investment project for sustainable agricultural livelihoods that will initially work with 32 farmers' groups (approximately 700 farmers) in 6 Cordillera provinces. The project complements FBS with facilitated microfinance and development of business development support services (Campilan 2013).

4.2.2 Indonesian NGO networks

The Institute for Rural Technology Development (LPTP) was part of a network of Indonesian NGO's funded by World Education to conduct FFS programs in the early 1990's (Braun and Duveskog 2008). Other NGO participants in this program included Gema Desa (Lampung) and Gita Pertiwi (Central Java). These NGO's had small budgets but the FFS projects they implemented comprised substantial farmer numbers. The LPTP project involved training and employing FFS alumni as FFS facilitators. In addition to the requisite participatory methods and IPM technical information, LPTP also provided training in other skills areas such as computer literacy. The focus of the FFS was determined by village requirements. For example, LPTP facilitated a soybean FFS for women in one

village where women were required to undertake the majority of farm management responsibility in the absence of younger and middle aged men who migrated to the city to work for 10 months of the year. Another successful farmer to farmer approach implemented by LPTP involved FFS alumni visits to other villages for facilitated farmer discussions regarding useful technologies, although Millar et al (2005) has shown that this method (champion farmers) was less successful than cross visits in Lao. World Education has also been involved in additional programs involving FFS approaches such as Farmer Learning and Environmental Stewardship in Indonesia 2002-2006 funded by USAID.

4.2.3 Farmer Initiatives for Ecological Literacy and Democracy (FIELD), Indonesia

FIELD Indonesia is an NGO established by former members of the FAO Programme on Community IPM in Asia in during the 2000s. Their role was instrumental in the development of Indonesia's National IPM (Integrated Pest Management) Programme, local farmer organizations and the Indonesian IPM Farmers Associations (FIELD 2014). FIELD is a strong advocate of Farmer Field Schools & Studies, Community Action Research, and Farmer Advocacy. FIELD estimates that approximately one million farmers graduated from FFS in Indonesia (FIELD 2014).

The current activities of FIELD include contracts with FAO, UNDP, the International Institute for Environment and Development (IIED), the International Plant Genetic Resources Institute (IPGRI) and the Government of Victoria, Australia. FIELD is one of the partners in USAID's IPM Collaborative Research Support sub-program at Clemson University. FIELD is assisting the Clemson University team to conduct farmer field research and Field Schools in IPM technologies and approaches for vegetables and citrus in collaboration with farmer communities and local governments in North and West Sumatra (FIELD 2014). However there is no information on the budget or number of farmers connected to this activity.

4.3 Private sector extension

Private sector extension services (e.g. animal health service providers, crop fertiliser or chemical companies) can fill niche services not covered by other organisations and can be an option for contracted farmers and smallholders that can afford their services (Millar 2009). The private sector is also increasingly involved in extension and development programs targeting specific commodities. Private sector value adding companies e.g. processors, are face increasing challenges in securing supplies both in terms of quantity and quality (VECO 2011). Private sector development programs are a strategic move by these companies to establish and maintain relationships with supply chain stakeholders to guarantee supply and/or to put in place programs to meet quality requirements for commercial processing or manufacturing.

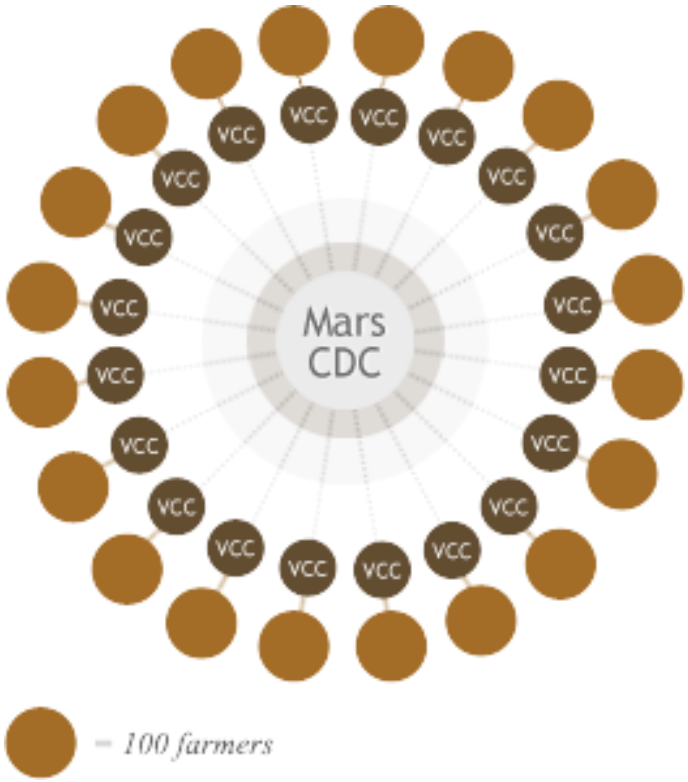
The following outlines some examples of privately funded F2F activities. Recent field work conducted by Collins Higgins Consulting Group and ACIAR indicated that Unilever (soybean), Mars (cocoa) and the Roundtable on Sustainable Palm Oil (RSPO) are not alone in the arena of direct purchasing. ABC Heinz is active in East, West and Central Java developing direct supplies of chilli for their chilli sauce operation. Indofood in cooperation with Fritolay, a multinational chips producer, are working with potato farmers in East Java, NTB and West Java to secure their potato chips under "Lays" brand. In the dairy sector, Danone are reportedly active in West Java, while Nestle and Fonterra are

working with dairy farmer groups in East Java to secure their national supply base. However, the intensity of farmer to farmer principles in their program is unknown.

4.3.1 Mars Incorporated

The Indonesian cocoa subsector has benefited from multiple private sector programs (VECO 2011; Hafid and McKenzie 2012). Mars Incorporated has been working with cocoa producers in Indonesia since 2003 (Hafid and McKenzie 2012). In 2005, Mars introduced a 'hub and spoke' model for cocoa development (see Figure 1) consisting of Cocoa Development Clinics (CDC which are demonstration and training sites) and village cocoa clinics (VCC which are farmer enterprise extension service providers) run by trained farmers (Cocoa doctors) (Hafid and McKenzie 2012; Mars 2014). This model is essentially based on farmer to farmer learning through various processes such as: on farm trials at the VCC, field visits, training courses, demonstration plots (CDC's), farmer meetings, cocoa doctor farm visits and technical advice, farmer to farmer training in services such as grafting, and farmer working groups (Hafid and McKenzie 2012).

As of 2012 Mars had five CDC's and 51 VCC's across Indonesia (Hafid and McKenzie 2012). CDC's provide support to and monitor the VCC's with an individual CDC supporting up to 20 VCC's (Mars 2014). Each VCC is expected to work directly with approximately 100 farmers. While the CDC's are funded and managed by Mars, each site was established as part of an alliance of companies and organisations (Hafid and McKenzie 2012). The VCC's operate as businesses providing various services such as the propagation and sale of planting material, grafting skills and supply of agro-inputs and the ultimate goal is for them to become self-supporting (Hafid and McKenzie 2012; Mars 2014).



Source: Mars 2014

Figure 1. The 'hub and spoke' model of CDC's and VCC's

4.3.2 Unilever Indonesia

Kecap Bango, is a brand of sweet soy sauce made from black soy beans that has been manufactured since 1928 by a local company in Java. In 2000, PT Unilever Indonesia, the local arm of multinational Unilever, acquired the brand and began expanding its distribution and sales. Given the Bango brand was identified as 'local' and Unilever's need to access a growing and sustainable supply of high-quality black soybeans, the company invested in a farmer development programme (Oxfam 2009). The black soybean farmer development programme is based on a mutually beneficial partnership. Unilever benefits from a new and growing source of high quality beans while farmers have the opportunity to increase their income by including black soybean as a rotation in their rice systems.

Technical assistance was provided by Gadjah Mada University (UGM) particularly in relation to good agricultural practices from planting through to harvest. To reduce the cost of direct support from Unilever and UGM, specific farmers have been selected to train others in the community on better agricultural practices, creating a self-reliant extension service for the future (Oxfam 2009; FIELD 2012). The Black Soy Bean Farmers Development Program has grown from 450 smallholders in 2003 to 6,600 smallholders in 2008 which supply approximately 25–30% of the black soy beans used to produce the Bango brand (Unilever 2014). The estimated cost to Unilever to deliver the programme is between IDR 700 million to IDR 1 billion annually. Unilever have confidence that the business model is commercially viable, since it enhances brand sustainability and value, consumer loyalty, and also secures their expansion of production to meet any future growth. In addition, it believes that it enhances the company's social 'licence to operate' in Indonesia (Unilever 2014).

4.3.3 Palm oil- RSPO driven

Smallholders are an important part of the palm oil supply chain, supplying the majority of palm oil on a global scale. Currently, the productivity of palm oil smallholders is estimated to be 40% below average compared with larger enterprises. Although many receive support from government schemes and/or local CPO mills, there are large numbers of independent smallholders that remain essentially unsupported (IFC, n.d; Solidaridad 2014; WildAsia 2014).

Independent smallholders, while varied in their situation, are characterized by their: freedom to choose land use, crop choice and management; being self-organised, self-managed and self-financed; and by not being contractually bound to any particular mill or any particular association (RSPO 2014). As the palm oil industry works to become more sustainable and the demand for palm oil increases, these independent smallholders can play a significant role in satisfying productivity gaps. Enhancing smallholder capacity to employ sustainable palm oil production practices is expected to lead to higher palm oil fruit yields and increased farmer incomes (IFC, n.d.; Solidaridad 2014; WildAsia 2014).

The Roundtable on Sustainable Palm Oil (RSPO) is a not for profit association created by organisations active in and around the palm oil supply chain and funded primarily through its membership. The focus is on promoting the growth and use of sustainable palm oil through co-operation within the supply chain and open dialogue with its stakeholders. Its members comprise growers, processors, traders, retailers, NGOs, and other investors. The RSPO is committed to smallholders through its Smallholders Support Fund (RSSF) where 10% of income generated from the trading of Certified Sustainable Palm Oil (CSPO) will be allocated for smallholders. In addition to this, 50% of any surplus income

within the financial year for RSPO will be channelled through the same mechanism (RSPO 2014).

Utilisation of the RSSF is directed towards the promotion and increased production of CSPO. The deployment of the RSSF is decided by a panel comprising selected members from the Smallholders Working Group (SHWG). Its key function is to develop strategic plans and develop, review, process and identify projects for approval (RSPO 2014).

4.4 Mixed/collaborative extension

In recent years there has been an increasing focus on sustainable supply chain development as a whole, rather than individual sectors (VECO 2011). This has resulted in broader collaborative efforts by a range of supply chain stakeholders and participants. Factors driving this include increasing consumer demand for traceable products (based on food safety, environmentally sound production practices and economic sustainability of smallholders), increasing demand and declining production of specific commodities, as well as improved methods and processes for extension that facilitate co-operation. Collaborative projects are predominantly commodity specific. The cooperation and collaboration achieved through these projects generates positive outcomes for scaling up production through improved management practices and meeting product demands for the private sector (VECO 2011).

4.4.1 VECO Indonesia

Using cocoa as an example, it has been recognised that the issues that threaten the livelihoods and sustainability of smallholder producers require large programs of collaborative action including governments, national and international institutes, NGO's and producers (VECO 2011). VECO (2011) details a collaborative initiative between VECO Indonesia (the Indonesian branch of Belgium NGO Vredeseilanden), PT. Mars (Subsector of Mars Inc. food manufacturer, confectionery and pet care company) and the cocoa farmer organisations JANTAN and SIKAP. A component of this intervention program involved 6 series of FFS for the farmers of JANTAN and SIKAP from 2010-2011, encompassing a range of topics related to different aspects of the supply chain from production to post harvest handling and process and farm diversification. The FFS were financed by PT. Mars, but organised by VECO Indonesia in cooperation with Swiss Contact (Swiss NGO) and other Indonesian NGO's Aya Tani and Tana Nua. Production increased following the FFS's from 30 fruit per tree to 40 fruit per tree through implementation of improved practices (PsPSP) and reduced losses (VECO 2011). The value chain co-operation and partnerships facilitated through this project also resulted in improved cocoa prices for farmers from US$0.92/kg to US$1.13/kg. Other impacts from this collaborative approach included contributions to income security and biodiversity through intercropping practices, sustainable handling and application of pesticides, improved knowledge on water use efficiency, social and cultural aspects such as improved living standards, clearer roles for women in the cocoa value chain, addressing consumer demands and safer farming environments (reduced risk of pesticide exposure).

4.4.2 Sustainable Cocoa Enterprise Solutions for Smallholders Alliance 2003-2005 and the Sustainable Cocoa Production Program

The Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance was a joint initiative comprising ACDI/VOCA, USAID, Mars Incorporated and the World Cocoa Foundation (WCF) with additional implementation support from a range of governmental,

academic, NGO and private sector organisations (ACDI/VOCA 2005). The cost of the SUCCESS Alliance program was US$5.9 million. SUCCESS Alliance activities expanded on the achievements and methods of the SUCCESS program 2000-2003, including FFS's, directed towards management of the cocoa pod borer (CPB). The SUCCESS Alliance program predominantly comprised FFS activities as well as demonstration plots for side-grafting and as the learning field for FFS demonstrating PsPSP (frequent harvesting, pruning, sanitation and fertilising) practices (ACDI/VOCA 2005; Hafid and McKenzie 2012).

The FFS component was delivered by SUCCESS Alliance facilitators and also through partner organisations including government (Department of Estate Crops), NGO's and trained farmer facilitators (ACDI/VOCA 2005). The primary FFS curriculum was based on the PsPSP method for cultural control of CPB. Additional FFS training was provided for FFS alumni in the areas of bio-control, side-grafting and Farming as a Business (FaaB – based on FFS approach but focused on business management, marketing and economics). The SUCCESS Alliance program resulted in 30,000 cocoa farmers being trained through the FFS approach (ACDI/VOCA). FFS trained farmer's demonstrated improved yield and income relative to untrained farmers and increased implementation of PsPSP practices following the FFS. However, the short timeframe between baseline data collection and the project evaluation limits the conclusions that can be drawn in terms of longer term technology adoption. Improved practices are labour intensive and adoption may decline as enthusiasm developed through the program wanes.

Additionally, a subsequent assessment of value chain developments in Indonesian cocoa did identify that it is unlikely that the SUCCESS Alliance program had a rigorous monitoring and evaluation system in place based on the small sample sizes reported in the final report (n=<600 out of 30,000 trained) (de Wolf 2013). This would limit the ability to provide a detailed comparison of the effectiveness of the FFS approach compared with the mass media campaign. There was also no evidence of any of the Alliance partners or follow up projects monitoring developments beyond the life of the project. Various studies have found that despite numerous programs in cocoa, implementation of improved management practices is not widespread (Nielson et al. 2005; USAID, 2006).

The SUCCESS Alliance was a foundation for the subsequent cocoa projects in Eastern Indonesia. Following the Success Alliance, the International Finance Corporation (IFC) cocoa project was implemented in 2004 and then followed by the USAID funded AMARTA, Nestle Cocoa plan. SwissContact currently leads the Sustainable Cocoa Production Program (SCPP) and is the latest form of partnership comprising the Swiss State Secretariat for Economic Affairs (SECO), the Sustainable Trade Initiative (IDH), Embassy of the Kingdom of the Netherlands (EKN), SwissContact and private cocoa sector companies (Armajaro, ADM Cocoa, Cargill, Mars Inc. and Nestlé). The Program targets 60,000 cocoa farmers for capacity development and improved productivity and quality of cocoa production, through comprehensive training in on-farm and post-harvest Good Agricultural Practices (GAP), Integrated Pest Management (IPM), responsible use of inputs, improved planting material and strengthening of Cocoa Producer Groups (SwissContact, 2013).

4.5 Summary of delivery models

The following table summarises characteristics of the various F2F delivery models.

Table 1. Comparison table of the various farmer to farmer delivery models: Government, NGO's, private sector and mixed/collaborative programs

	Government	NGOs/donor	Private	Mixed/ collaboration
Examples	• District/ province/ National funded extension system • Dinas and AIAT regular services	• FAO sponsored FFS • VECO, JANTAN and Wasiat cocoa program in Sulawesi • FEATI – World bank • ACIAR/USAID funded participatory research	• RSPO smallholder trust fund • MARS Cocoa Development Center • Syngenta learning centre • Unilever Soybean activities • Indofood and ABC Heinz on vegetables	• Success alliance – ACDI COCA • Sustainable Cocoa Production Program SCPP
Covered by scientific publication	• Yes, widely	• Yes, widely	• Not well covered	• Not well covered, project documents sometime are available as grey literature.
Typical commodity	• All sectors but focus on Food crop (grains, cereal)	• All sectors. • Plantation, food crop, fisheries, animal husbandry,	• Plantation crop. • Horticulture crop.	• Plantation crop,
Cost	• Not clear	• The cost of FFS implementation varies with location, stage of implementation • US$7 -77 for IPM* • 150-1500 US$/season**	• ***Unilever soybean operation 6600 farmers: 70-100,000 USD/annum	• Not clear

Required pre-conditions	• Work with both individual and group of farmers. • Linked to Research agencies (BPTP, BB) and Universities	• Work with both individual and group of farmers • Linked to National and international research agencies and Universities	• Normally works via farmer group or key traders • Linked to own research team and sometime to individuals at Research agencies (BPTP, BB) and Universities	• Normally works via farmer group • Linked to National and international research agencies and Universities
Management	• Simple. • Typically top down with army of extension worker on the ground (declining)	• Complex • Typically combination of bottom up and top down with a few of field based staff on the ground	• Complex • Typically combination of bottom up and top down and link with their purchasing department. Sometime also work with financing institution.	• Complex • Typically combination of bottom up and top down with a few of field based staff on the ground and link to buyers/suppliers
Economic Benefits		• Reduced cost/less pesticides • Yield increase • FFS participants saved $40/ha /season****		
Non-economic benefits **Gender** **Environment** **Social** **Community Capacity building**	• Improved farmer capacity • Gender? • Social? • Environment?	• where women farmers and housewives involved in the rice ICM FFS enabled them to be more involved in rice farming decision making+ • the FFS has triggered further development beyond IPM, in the field of experimentation, collective action, leadership, planning, and organization++.	• Improved farmer capacity • Gender? • Social? • Environment??	• Improved farmer capacity • Gender? • Social? • Environment??
Adoption/ Sustainability /replication	• National wide • Depend on government budget	• National wide • Depend on donor/NGO budget	• Only to supply base area • Depend on trade volume	• Supply base area and in some case new expanding area • Depend on trade volume

Source: Author analysis

5 Benefit:Costs and Sustainability of F2F Learning

Agricultural extension and farmer education programs are often policy tools for governments and as such attract scrutiny regarding their impact and cost effectiveness (Feder et al. 2004). As farmer to farmer learning, predominantly through FFS, has expanded across the world there has been increasing interest in the applicability, cost effectiveness and impacts of the approach. The following section discusses the benefit costs and sustainability of farmer to farmer learning. The majority of the discussion is centred on the impacts of FFS delivery (unless otherwise stated), particularly IPM FFS, as the most well documented model for farmer to farmer learning.

5.1 Benefit cost assessments

The substantial investment in farmer to farmer learning approaches, FFS's in particular, since the 1990's has prompted significant interest in the benefit cost of these programs. Cost is directly related, not only to the cost of implementing the program, but also to the impacts and achievements of FFS, how they contribute to national goals and ultimately the cost of doing nothing (van den Berg 2004). The FFS approach has been criticised by a minority based on its relatively high operational cost and questions regarding its economic impact (Quizon et al. 2002; Feder et al. 2004). The cost of FFS implementation varies with location, stage of implementation i.e. pilot versus established program, length of program (i.e. as trainers get more experienced), and topic (number of sessions) (DANIDA 2011). The cost of FFS in Bangladesh varied from US$10-35 per household depending on crop, number of sessions, project phase and what costs were included. An added difficulty in assessing the benefit cost of FFS is that there has been no agreement on the factors that should comprise the analysis (Bartlett 2005).

Reported costs of FFS have been variable (see Table 2) and problematic to compare due to inconsistencies in their content (DANIDA 2011). Costs associated with implementation of FFS can be categorised as base (institutional overheads, monitoring and evaluation), start-up (facilitator training preparation of materials), recurrent (running FFS, field day cost of facilitator) and follow-up. Braun et al (2000) cited the average cost of a FFS facilitated by a professional extension worker as US$532 and for farmer facilitated (two facilitators) US$586 in 1996-97. This included cost of the facilitator, preparation and coordination expenses, travel, materials, catering, host farmer compensation, participant stipends (US$0.43 per person equating to 25% of the budget) and field day expenses. Other reports have cited FFS costs ranging from $150 to $1,000 depending on the country and the organisation (Barrett 2005) and from US$150 in Sri Lanka up to US$1300 in Armenia per FFS (Braun et al. 2006). Details of cost calculations are often not provided.

Table 2. Costs to run a season-long FFS per country (not including ToF costs)

			Costs per FFS (US$)			
Country	**Type of FFS**	**Year**	**Min**	**Max**	**Average**	**Source**
Armenia	Vegetable-IPM, fruit, organic farming	2003	1,000	1,600	1,300	Pers. Comm Nune Sarukhanian
Bolivia	Nda	1999	500	700	600	PROINPA (2000) Annual report
China	Vegetable, Yunnan province	2004-2005	Nda	Nda	426	Pers. Comm Elske van de Fliert
Egypt	IPM	2005	nda	nda	318	Pers. Comm Hans Feijen
Kenya	Extension-led FFS	2005	nda	nda	600	Pers. Comm Deborah Duveskog
Kenya	Farmer-led FFS	2005	nda	nda	400	Pers. Comm Deborah Duveskog
Mozambique	Food-security FFS	2004	600	700	650	Pers. Comm Eugenio Macamo
Nicaragua	Vegetables, grains, livestock	2004	77	249	163	Pers. Comm Francis Porras
Nigeria	Farmer-led FFS	2005	nda	nda	150	Pers. Comm Anthony Youdeowei
Sri Lanka	IPVM FFS	2005	nda	nda	180	Pers. Comm Jayasundara
Thailand	nda		250	500	375	Pers. Comm Hein Bijlmakers
Vietnam	Livestock (pig, chicken, duck)	2004	408	624	516	Dalsgaard et al. 2005
Vietnam	Vegetables	2003-2005	nda	nda	410	Pers.comm Elske van de Fliert

nda = no data available

Source: Braun et al. 2006

In terms of the average cost per farmer, or FFS household, these have reportedly varied from US$7 for rice IPM FFS in Sri Lanka (recurrent costs only), US$20 in Bangladesh and up to US$77 for cocoa IPM FFS in West Africa (including recurrent and start-up costs) (DANIDA 2011). Other estimated costs include US$62 and US$48 per participant in Indonesia and the Philippines, respectively (start-up and recurrent) (Quizon et al. 2001). Braun and Duveskog (2008) highlighted that expensive FFS's (US$30-50 per farmer) generally involve high allowances, transportation costs and multiple layers of supervision,

however, running costs can be considerably lower (US$1-20 per farmer) when the FFS is implemented by a local organisation and farmer facilitators and where existing infrastructure can be utilised. Training and transport are typically the key costs associated with FFS programs. Van den Berg (2004) emphasised that although farmer education is labour intensive these costs are generally recovered quickly at the farm level through increased yields and/or quality or reduced inputs. DANIDA (2011) concluded that the FFS approach in Bangladesh was a very efficient development investment with a benefit cost comparison indicating that FFS interventions at a household level show a return on investment within a year.

A range of cost cutting avenues such as prioritisation of curriculum, partnerships with existing training programs, use of mass media for components of the FFS and amendment of FFS content to better suit informal farmer communication have been proposed (Feder et al. 2004). However, this risks compromising the participatory processes integral to the principles and purpose of the FFS and could be viewed as implying that the FFS is synonymous with a technology transfer approach. However, it is not possible to involve all farmers in a FFS process, so other strategies are required to assist those farmers not involved to access the results arising from the participatory FFS processes. If effective use is made of farmers, as part of for example of a mass communication program, the approach can be viewed as a valuable and cost effective adjunct to the more comprehensive FFS process.

Other options have also been suggested without compromising the integrity of the FFS process such as sponsorship for field training or broadening the institutional basis of FFS to education, environment and public health (van den Berg 2004) or partnerships with other organisations (Feder et al. 2004), self-funding or partially self-funding (Braun et al. 2006; Braun and Duveskog 2008). Braun and Duveskog (2008) have reported examples of self-funding in East Africa where commercial plots adjacent to the FFS plot fund the FFS and cost sharing through provision of workshop materials e.g. workbooks, training sites, labour, planting materials. Similarly, Gockowski et al (2006) reported a large majority of non-FFS participants were willing to pay to attend FFS training while van den Berg (2004) highlighted that self-funding, even partially, contributes to local ownership of the program.

Cross visits can also be a costly approach depending on the number of farmers involved and the extent of travel between villages (Millar et al. 2005). However, there are options to minimise the costs associated with this method by limiting visits to within districts and/or provinces. Cross visits may also prove cost effective if learning through this method requires less frequent follow-up from extension staff. Despite comprising small groups of farmers, cross visits have also proven to be an effective scaling out mechanism, successfully stimulating learning and action by farmers other than cross visit attendees (Millar 2012; Stelling and Millar 2010). Transfer of simple messages and technologies require less resources as they can be transferred through less costly approaches such as field days and demonstration plots that typically provide broader exposure.

The other consideration in the benefit cost equation is the impacts of the FFS. While some may be easy to identify e.g. yield increases, pesticide reductions, others may be more indirect and/or longer term and/or difficult to cost in monetary terms e.g. social, educational and environmental impacts (DANIDA 2011). The other aspect of monetising benefits is that they can be allocated to different stakeholders such as FFS participants, community and participating households. Unless impact assessment occurs from various

perspectives then some benefits may not be captured (van den Berg 2004). This review was unable to source any comparison of FFS with other appropriate farmer education approaches to inform an analysis of cost effectiveness.

The considerable investment in extension systems and specifically FFS has necessitated assessment of impact and sustainability (van den Berg 2004). Impacts of farmer to farmer learning programs tend to be categorised as either immediate (farmer knowledge, pesticide reduction, yield, farm income) or developmental impacts over longer timeframes (farmer to farmer extension, poverty reduction, reduced contamination/poisoning by pesticides). Evaluation has not been conducted on anywhere near the same scale as FFS implementation and existing studies only provide limited assessment of medium and long-term impacts (van den Berg and Jiggins 2007). In the case of the FFS the training impact is broader than knowledge transfer and technology adoption, encompassing educational and social goals (van den Berg 2004; van den Berg and Jiggins 2007; Mancini and Jiggins 2008). Consequently, a broad range of impacts could be expected including economic, health, environmental and other socio-political benefits (Braun et al. 2006). This introduces additional degrees of complexity in any assessment. The majority of earlier impact assessments concentrated on immediate impacts (van den Berg 2004); however, more recent studies have looked at development aspects (Mancini and Jiggins 2008; Erbaugh et al. 2010; Dawson 2011; Singleton and Camisero 2011).

Erbaugh et al. (2010) reflected that technology adoption is not an all or nothing situation. Non-adoption is not necessarily an indication that the transfer strategy has failed, rather that there are other factors that determine adoption such as climate, agro-ecology, labour availability, market access and relevance of the innovation to a farmer's context. A strategy and package of information that provides for partial adoption of different aspects more accurately reflects the reality of farm level decision making and implementation.

5.1.1 Assessment methods

Agricultural technology contributes to poverty alleviation through direct and indirect effects. Measuring these is extremely complex but necessary if technology is to effectively reduce poverty (de Janvry and Sadoulet 2002). There has been widespread debate regarding the how, what and who of program assessment with no agreed framework for measuring impacts (van den Berg 2004; Braun et al. 2006). To fully and accurately measure the impact and sustainability of FFS requires incorporation of a range of options and methods (Mancini and Jiggins 2008). This supports previous recommendations by van den Berg (2004) from an evaluation of 25 FFS impact assessments (which varied in focus, methodology and robustness) including emphasis on development impacts through participatory and qualitative methods and the implementation of diverse perspectives to increase scope and rigour. A study evaluating IPM FFS in India utilised a mix of complementary participatory and conventional approaches and concluded that this increased the depth and relevance of the findings (Mancini and Jiggins 2008). A range of participatory methods have been trialled including photo visioning, where cameras are provided to participants to capture their views on the impacts FFS has made to their lives (Braun et al. 2006), but this has not been widely adopted.

Poorly designed or timed monitoring and evaluation plans limit the opportunities for extraction of learnings, experiences and impacts (DANIDA 2011). Braun et al. (2006) identified flaws in the comparison groups of previous impact assessments (Feder et al. 2004) and advised that evaluation design requires considered selection of comparison

groups to minimise flaws and bias that could potentially influence results. More recent studies have seen more robust methods of evaluation with pre- and post-FFS and with and without FFS comparisons. The breadth of FFS impacts and various levels of causation require considerable resources for effective evaluation and it is important that this is factored into project design and budgeting (Mancini and Jiggins 2008). Most programs allocate only limited resources to impact evaluation, potentially missing out on capturing additional outcomes (Braun et al. 2006).

5.1.2 Human and social aspects

The human and social impacts of F2F learning have only recently received increased attention (Braun et al. 2006). Prior to this any assessments were limited to qualitative and anecdotal evidence with very few meaningful indicators. Where there has been some assessment of developmental impacts it has been suggested that continued learning, group action, and socio-political benefits are prompted by the FFS (van den Berg 2004).

Human and social capital

Human capital has reportedly been one of the FFS outcomes most valued by graduates (Braun et al. 2006; Mancini and Jiggins 2008; Dawson 2011) in terms of self-regard and social interactions (van den Berg 2004; Dawson 2011). Dawson (2011) reported that 50% of respondents claimed they were more confident in voicing their opinions following a modified FFS approach in potatoes in Indonesia. This has led to greater involvement in village affairs e.g. planning, activities and conservation efforts. Stronger social relationships have been reported from participation in FFS's (van den Berg 2004; Mancini and Jiggins 2008; Dawson 2011; Singleton and Casimero 2011). Mancini and Jiggins (2008) examined the ecological, social and human impacts from cotton IPM FFS's in India. This study noted the clear appreciation farmers have for the stronger networks and social trust that is created through FFS. This facilitates greater co-operation and co-ordination for mutual benefits e.g. increased collaboration between villages and has the potential to contribute to increased political capabilities (van den Berg 2004). Almost 90% of participants in a cocoa FFS indicated that they shared information with an average of two other people, primarily in the areas of cocoa pruning, shade management and phyto-sanitary harvesting (Gockowski et al. 2006).

A study of the impacts of a FFS for crop husbandry and input use also measured the impact of sensitisation exercises on hazardous child employment (Gockowski et al. 2006). The study identified significant reductions in the hazardous employment of children, specifically 540 fewer children in heavy field transport, 440 fewer children in clearing fields with machetes, and 170 fewer children in pesticide application from the 2,800 Atwima cocoa producers sensitised in a three year period.

Capacity impacts

Key to the effectiveness of the FFS approach is the increased knowledge, analytical skills and collective action that it engenders (van de Fliert 2007). In addition to increased technical and analytical capacity of FFS participants, Singleton and Camisero (2011) also identified improved capacity of AIAT and BPTP staff through training in participatory adaptive management research, training and facilitation skills and project management. This has implications for more rapid uptake of production technologies and integration of NRM technologies on a wider scale. AIAT staff training should also facilitate improved

capacity to evaluate and benchmark emerging technologies and improved ability to document findings from adaptive research.

Community

The contribution of FFS to human and social capital has implications at the community level as the analytical and communication skills and social confidence acquired through the FFS are subsequently applied to broader areas of participant's lives. Group action and communication are key elements of the FFS (Pontius et al. 2002) and requirements for successfully addressing a range of issues such as IPM, Natural Resource management, rice stem borer pests (Braun et al. 2006).

A legacy of FFS training has been spontaneous group activities following completion of the FFS (Braun et al. 2006; van den Berg and Jiggins 2007; Dawson 2011). These spontaneous activities have been related to innovations, dissemination, social gains, marketing and policy changes (van den Berg 2004). Dawson (2011) reported the emergence of a range of farmer groups following FFS approaches including: seed potato production groups capable of supplying seed for their own members, other groups in the village and in one instance outside the district; farming input groups that provide and sell farming inputs, act as a credit union for members and potentially market both fresh and processed potato products; and independent farmer learning groups with activities based on FFS principles. The concept of community IPM has also resulted in the initiation of farmer organisations at local, provincial and national levels, which provide a platform for lobbying at these different levels of government (van de Fliert et al. 2002).

Similarly, Singleton and Casimero (2011) evaluated the impacts of a rice ICM FFS and reported the revival of "Tidung Sipulong" village farmers' meetings for planning of farming activities e.g. synchronous planting, and community actions as well as district level "Tidung Sipulong". This has had several outcomes for the local farming community such as: commitment for group action on community issues such as rodent and weed management, repair and cleaning of irrigation canals, opportunities for lobbying local and national leaders; road paving facilitating easier market access for produce; field days attracting significant media attention allowing for promotion of sustainable IPM and water management practices that were implemented by the local rice farmers for increased production and food security.

Gender

Dawson (2011) outlined gender roles in potato production in Central and West Java, South Sulawesi and West Nusa Tengarra. Despite a significant role in farming (selecting seed, planting, harvesting and maintaining potato crops) women were primarily considered homemakers. Women were not involved in any of the heavier farming jobs such as digging and spraying. Responses from the impact assessment indicated that women were rarely involved in decision making related to farming. There has been some changes in decision making involvement with a small percentage of FFS participants. This was supported by Singleton and Camisero (2011) where involvement of women farmers and housewives in the rice ICM FFS enabled them to be more involved in rice farming decision making, though this may be a subtle involvement by influencing male farmers. The process of personal growth achieved through FFS was found to be particularly relevant to women (Mancini and Jiggins 2008; DANIDA 2011). DANIDA (2011) reported that women's involvement in FFS had contributed to improved confidence, ability to earn

an income for enhanced food security and participate in decision-making on smaller production issues.

Gender was also identified to be a factor in division of labour by Mancini and Jiggins (2008). While total, labour requirements did not vary post FFS, the tasks performed did, requiring a higher female labour contribution in the area of plant protection tasks. Limited availability of female labour could limit adoption in some cases.

DANIDA (2011) made several recommendations based on the FFS approach in Bangladesh to challenge restrictions on women and socio-cultural aspect to improve outcomes for gender and socio-cultural issues. This included incorporating gender analysis into the technical training to highlight it as an integral component for poverty alleviation rather than a mere add-on to the FFS program.

5.1.3 Socio-cultural aspects

To date there has been limited analysis of socio-cultural variables such as religion and social class (Mancini and Jiggins 2008; DANIDA 2011), although this appears to be increasing in more recent studies. Where socio-cultural issues are incorporated into the FFS they are generally viewed as an add-on for awareness-raising, rather than an integral part of livelihood management that can be addressed through the analytical skills developed through the FFS process (DANIDA 2011). It was also highlighted that time allocation for different socio-cultural issues in the FFS, tends to be too short to generate notable impact with presentations too broad, with limited coverage and Farmer Trainers/Facilitators only 'touching' on the issues.

Livelihood impacts

The FFS approach can be linked to a range of livelihood impacts attributable to increased income and/or knowledge. Dawson (2011) reported a change in the way villagers use farming proceeds. Following potato ICM FFS, families have started putting aside some of these proceeds as farming capital for the following season. Another example is the changes in household nutrition and food security reported by DANIDA (2011). FFS households increased intake of most food items relative to control households and estimate a reduced risk of food shortage from 20% to 11% compared with a 31% to 30% decline within control households. It was evident that FFS households were also diversifying their production system (product diversification was a component of the FFS) producing significantly more agricultural products than non-FFS. Cross visits have also prompted a range of wealth and wellbeing indicators including housing construction, hand tractors, paddy rice stocks, rice field land, motor cycles, furniture, school, clothes and medicine (Millar 2012).

Erbaugh et al. (2010) examined factors that contributed to whether or not farmers were likely to adopt new practices following a cowpea IPM FFS in Eastern Uganda. IPM knowledge was found to be the most important variable explaining adoption of IPM practices. Farmers with less income were more likely to adopt IPM strategies, which was attributed to wealthier farmers having other sources of income, reducing their interest, time and willingness to risk adoption of new cowpea management practices. Larger acreage cowpea farmers were more likely to adopt IPM strategies as cowpea is a priority crop for them and therefore their interest was higher. Women and younger men and those less educated were more likely to be FFS participants. This was also supported in a study

by Mancini and Jiggins (2008) who noted that differences in livelihood impacts were based on gender and wealth.

5.1.4 Environmental impacts

Improved environmental awareness has been reported as a result of FFS activities (Dawson 2011). Reduced pesticide applications, more selective pesticide options and improved handling and application indirectly contribute to environmental and human health outcomes. Singleton and Camisero (2011) identified a range of improved practices with environmental benefits resulting from the rice ICM FFS including: reduced insecticide, herbicide and rodenticide applications with ecologically based management practices; adoption of improved irrigation practices ranging from 19% to 80% within a village with a 10–30% reduction in irrigation frequency per cropping season; improved fertiliser recommendations and application timing led to reduced contamination of ground and surface water sources. It is also planned that NRM technologies will be integrated into the ICM-FFS curriculum and implemented provincially and nationally, facilitating adoption of NRM technologies on a wider scale. Mancini and Jiggins (2008) also identified environmental benefits from cotton FFS in terms of reduced input use and a reduction in carbon depleting practices such as burning of organic matter in the field. While the majority of reported environmental impacts are linked to IPM FFS and pesticide use reductions, Singleton and Camisero (2011) noted that the improved social interactions and communication engendered by the FFS process are likely to lead to enhanced adoption of other NRM technologies.

5.1.5 Farming practices and income

Much of the published literature on the impacts of FFS have been focused on the IPM FFS and have almost unanimously demonstrated significant impacts in terms of pesticide use and yield in a range of crops, rice, cotton, vegetables (van den Berg 2004; van den Berg and Jiggins 2007). Evidence suggests these effects were sustained years after the FFS (Rola et al. 2002; van den Berg 2004). In contrast to the raft of reports identifying significant gains in IPM knowledge, Feder et al (2004) identified only quantitatively small gains in IPM knowledge. Flaws in the control group were subsequently identified and may have contributed to these findings (Braun et al. 2006). In a review of 25 impact assessments, economic benefits from IPM FFS were mostly attributed to yield not reduced pesticide applications (Van den Berg 2004). While economic benefits may not always be substantial, FFS participants are generally appreciative of the knowledge and skills gained through the learning process (van de Fliert et al. 2007b).

There have been numerous studies on the impact of rice IPM FFS in Indonesia and other parts of Asia. Within Indonesia Van den Berg (2004) reported a 61% reduction in insecticide use from one case study and reduced applications from 2.8 to 0.2 per season with a 21% yield increase from another. Singleton and Camisero (2011) identified increased rice yields that ranged from 10 to 126%. Elsewhere in Asia, IPM FFS in rice resulted in reduced insecticide applications from 1.7 to 0.3 per season in Vietnam, from 2.2 to 0.4 in Sri Lanka and a 60% and 64% reduction in pesticide use in Thailand and Cambodia, respectively (van den Berg 2004). Only the Sri Lanka case study discussed yield and profit with 23% and 41% increases, respectively, which were attributed to FFS training. Van de Fliert et al (2007b) reported a 38% reduction in pesticides, a 60% reduction in insecticides only, in community IPM provinces in Vietnam. Associated pesticide input costs were reduced by 8%, with average rice derived income up by 16%.

Typically pesticide reductions and farm level returns were greater in non-rice crops (vegetables and cotton) (van den Berg 2004). IPM FFS in Bangladesh resulted in a reduction in pesticide applications in eggplant from 7 to 1.4 applications per season with consistent yield increases. Likewise tea growers in Vietnam achieved a 50-70% reduction in pesticide use. Results from cotton in China revealed reduced insecticide use from 6.3 to 3.1 applications per season within 12 months of the FFS compared with non-FFS farmers who continued to apply up to 6 applications per season. Similarly, cotton IPM FFS's in India reportedly reduced pesticides in IPM systems by 78% (Mancini and Jiggins 2008). Yield of IPM cotton was 30% higher than conventional cotton while organic cotton was 20% lower than conventional cotton. Bartlett (2005) reported variable pesticide savings from zero up to $40 per hectare per season depending on the extent of pesticide use prior to training and yield increases up to 25% due to crop management improvements. DANIDA (2011) identified substantial increases in household income post FFS in Bangladesh. Income increased by BDT 20,000 in a comparison of pre- (2007) and post-FFS (2010) compared to a BDT 10,000 increase within comparison village households over the same period.

In addition to improved rice yields, Singleton and Camisero (2011) also noted the adoption of various farming practices in their evaluation of rice FFS's. These include improved irrigation practices saving 1-4 irrigation events per cropping season (equivalent to 10-30% reduction in irrigation frequency), reduced rodenticide applications, enhanced fertiliser programs (rates and timing) while maintaining or improving yield, use of the IRRI Super Bag to store seeds up to 10 months without impacting seed viability and improved herbicide options. As a result of the increased yields and these management changes FFS participant income averaged IDR 1.8 million/season higher compared with non-FFS villages. There was no discussion on how these benefits compared with the cost of the training program.

Dawson (2011) examined the impacts of a modified ICM FFS approach in potatoes; termed FIL (FIL involved testing of individual crop management practices rather than an ICM approach so that improvements from each could be assessed). The modification of the FFS approach was necessary as the ICM FFS model developed for potatoes was not followed initially, resulting in issues in assessing impacts from ICM practices (E. van de Fliert, 2014 pers. comm.). Yield benefits included an increase in yield from 8 tonnes/ha to 26 tonnes/ha with associated increases in costs from IDR 25 million per ha (gross margin IDR 5 million assuming potato price of IDR 2,500) to IDR 38 million per ha (gross margin IDR 27 million). Other reported benefits were reduced insecticide costs with the implementation of IPM practices. Previously, insecticide applications cost IDR 9.4 million per ha while following IPM adoption costs were reduced to IDR 6.2 million. Farmers reported that insecticide reductions may arise through reduced number of insecticides (in mixes) rather than reduced applications per se. Collective input purchases and collective marketing resulted in lower input costs and better prices and conditions than when farmers acted individually. Farmer groups have also established networks and worked with other organisations such as Bank of Indonesia to secure capital. While the study provides a cost benefit analysis of income and production costs between the conventional and ICM or FIL managed plots, there is no information on the cost of the training program in achieving the previously mentioned outcomes.

Gockowski et al. (2006) assessed the implementation of a Sustainable Tree Crops Program (STCP) FFS on the integrated management of the cocoa cropping system. The

curriculum focused on the control of black pod disease, capsids, post-harvest techniques and the social issues surrounding child labour. The evaluation identified that the average productivity of FFS farmers' tree stock was more than double that of the comparison group, plus there were notable increases in the planting of hand pollinated hybrid cocoa seedlings and the area planted to hybrids. These changes in management practices were estimated to have prompted a net production increase of 14% among participants, however, additional labour requirements would have to be considered in this increase.

Miller (2012) assessed the impact from a program of cross visits conducted for improved livestock production in Lao. This farmer to farmer learning approach proved effective in improving livestock management practices with 70% of cross visit attendees adopting some changed practices to some extent. Based on feedback from cross visit attendees, Millar (2012) estimated that 417 farmers were using improved management practices within 3 years with an average 7 million kip in income per year. Of 48 farmers who had attended cross visits in 2007 and 2008, 80% increased livestock numbers (cattle, buffalo and pigs) with a range in income from 3 million kip (poultry and pig) to 29 million kip (cattle) over two years post cross visits. This study also identified variability in farmer capacity and motivation in relation to changing practices. The report highlighted that informal farmer communication between cross visit attendees and other farmers was successful with an additional 163 farmers identified as having adopted improved livestock management practices.

5.2 Sustainability

5.2.1 Adaptability of F2F learning

Farmer to farmer learning programs are funded through a range of sources. These include government funding at district, provincial and central levels, donor funding such as World Bank and various international aid organisations (USAID, ACIAR, ADB) self-financed learning through FFS's (A. Rauf et al. 2012, unpublished data) and the private sector. On the ground implementation also encompasses a range of organisations, both public and private sector. It is evident from program reporting that collaborative programs incorporating a range of program partners have been increasing in recent years to target development along supply chains (ACDI/VOCA 2005; SwissContact 2013).

The educational concepts underpinning the FFS approach have been proven to be relevant across diverse countries and cultures and to be empowering to farmers (Braun and Duveskog 2008). The FFS model has been widely adapted and implemented by various government, NGO's and the private sector and remains a major learning approach for rural development (van de Fliert et al. 2007b; DANIDA 2011; Dawson 2011; Mars 2014). By 2008 FFS's had been expanded to 87 countries worldwide (Asia, Latin America, the Middle East, North Africa, Eastern, Central and Western Europe and the USA) (Khisa 2004; Braun et al. 2006; Braun and Duveskog 2008), with an estimated 10-20 million FFS graduates (Braun and Duveskog 2008). The original IPM FFS has been modified and applied to other food and industrial crops such as soybeans, cowpea, cocoa, maize and vegetables (potato, sweet potato; cabbage) (Khisa 2004; Erbaugh et al. 2010).

Despite being developed for transfer of IPM concepts in rice based systems the FFS approach has evolved to encompass a range of farm related topics in its curriculum (Feder et al. 2004; Khisa 2004). FFS variants cited in the literature include Integrated Production and Pest Management (IPPM) in Africa, integrated disease management

(IDM), integrated crop management (ICM), integrated plant nutrient management (IPNM), Good Agricultural Practices (GAP) and integrated water and soil management (IWSM) (A. Rauf et al. 2012, unpublished data). ICM FFS has been developed for rice, soybean, corn and potato (Dawson 2011; A. Rauf et al. 2012, unpublished data). FFS has also been adapted to non-crop/forest systems including livestock production, natural resource management (soil, fertility, water conservation, climate) and socio-cultural aspects of communities (food security, nutrition, health, savings, literacy) (Khisa 2004; Braun and Duveskog 2008; A. Rauf et al. 2012 unpublished data), for example the Junior Farmer Field and Life School (JFFLS – incorporating HIV-risk reduction and agricultural components) (A. Rauf et al. 2012, unpublished data).

The adaptability of the FFS approach is evident in its application to diverse agricultural systems and ecological and socio-economic situations (Winarto 2003). Adapting the original FFS model from rice IPM for use in other cropping systems requires necessary changes based on key growth stages, local cropping patterns, management issues and conditions (van de Fliert et al. 2002; Winarto 2003; Bartlett 2005). However, it is the content that changes, while the participatory, discovery learning process used remains the same (Pontius et al. 2002; Waddington et al. 2012). For example, a rice curriculum commences following planting and continues with weekly sessions until harvest. In comparison, a sweet potato IPM FFS commences with soil preparation to emphasise field sanitation for pest control and continues through to marketing and even processing and end use as a stock feed, requiring weekly and bi-weekly sessions at different stages. This adaptation requires that facilitators upgrade both their technical and facilitation skills to meet the demand for new methodologies and learning activities as the curriculum changes (van de Fliert et al. 2002). For more complex pest and disease scenarios (e.g. vegetable IPM) and different crop management issues the process of location specific problem solving and collective decision making and action is even more important. The FFS has developed into a platform that achieves various outcomes other than IPM learning such as advanced learning and adaptive research (van de Fliert et al. 2002).

5.2.2 F2F diffusion and scaling out

Much of the debate regarding the financial viability of the FFS has centred on the potential for FFS content to be scaled out and up to the broader farming community through informal farmer to farmer communication. Several studies have reported limited evidence of significant diffusion of FFS knowledge beyond FFS participants (Rola et al. 2002; Feder et al. 2004; Edbaugh et al. 2010). This lack of evidence has been attributed to the complexity of information, the involved decision-making processes and ecosystem concepts that comprise the FFS curriculum (Feder et al. 2004). The complexity of topics (e.g. IPM) that are suited to the FFS approach and the associated analytical skills are not easily adapted to informal farmer to farmer communication or addressed by generally applicable solutions (Feder et al. 2004; van den Berg 2004; van den Berg and Jiggins 2007). However, it is probably a bit much to assume that informal diffusion will occur any more from a FFS program than from a traditional transfer of technology program without communication programs to assist the diffusion. Simple practices and technologies that are readily transferrable may not require intensive educational approaches such as the FFS, but could benefit from the lessons learned from a FFS process and from extensive use of farmers to promote the lessons. Other possible explanatory factors include increased difficulty in measuring farmer to farmer diffusion and ensuring that assessment timeframes are sufficient to register the impacts of informal farmer communication and

diffusion of more complex technologies which only become apparent over time e.g. subsequent cropping seasons (Edbaugh et al. 2010).

This has serious implications for the financial sustainability of the FFS approach. Donor funded FFS programs generally operate under the expectation that at the end of the project follow-up activities will become the responsibility of local government or the private sector. Analysing particular project costs will provide insight into whether such projects are likely to be scaled out. If farmer to farmer diffusion post FFS is negligible, substantial farmer numbers will need to be trained through the FFS to have any impact at a national level (Feder et al. 2004) and cost may be a significant constraint to implementation of a national FFS program. Quizon et al. (2001) concluded that the substantial cost of up-scaling the FFS is beyond publically funded systems and cannot be achieved through solely farmer led IPM FFS.

Braun et al (2006) noted that there have been instances where some components of FFS have been adopted by non-FFS farmers indicating that some elements of FFS are more easily transferred than others. Similarly, Edbaugh et al (2010) indicated that technology adoption is not and all or nothing situation. The FFS provides a package that allows farmers to adopt individual aspects reflecting the context of farm level decision making. This raises additional questions regarding the sustainability of diffusion benefits if the change is limited to imitated behaviour rather than the result of analysis. Consideration of FFS as a method of knowledge diffusion and technology transfer discounts the role of adult education in adaptation of technologies to the local level, empowerment and social impacts (Braun et al. 2006). Based on the attributes of FFS, only in rare instances could FFS be expected to achieve wide scale diffusion, as complex, less visible innovations do not diffuse easily, raising the question of how FFS impacts can be scaled up.

5.3 Summary

Costs of F2F approaches include base, recurrent and follow-up. Documented estimates of average costs range from US$150 to US$1,300 per year, with costs per farmer ranging from US$7 to US$77 per year. Various methods have been assessed to cut costs, but in some cases this involves changing to a technology transfer rather than a participatory process. No documented studies were found assessing the benefit costs of the approach.

The F2F approach has been implemented across a range of countries, cultures and ecological and agricultural systems. Documented benefits of the approach have included:

- increased in human and social capital leading to other non-project benefits
- women have benefited through increased involvement in decision making, income and effects on gender roles
- some evaluations have found improvements in a range of livelihood indicators including income, nutrition and food security
- other projects have had significant environmental and human health impacts from adoptions of NRM technologies

However, there is limited evidence of significant diffusion of benefits beyond those involved in the process. This could be due to the complex nature of the practices and technologies assisted through F2F processes, but also due to short assessment timeframes and the difficulty in attributing change to the process. Another factor could be that the processes were not linked to well-constructed programs to scale out their effects and to effective communication strategies.

6 Conclusions

This review summarises a range of farmer to farmer learning approaches; Farmer Field School (FFS), Community IPM, cross visits, participatory learning and action research, innovation systems, community based extension, agribusiness Field School, field day and demonstration plot. In Indonesia, F2F learning has been funded and delivered through a range of platforms including Government, NGO and the private sector. As whole of value chain attitudes to rural development have evolved, the involvement of the private sector and collaborations across a range of organisations has been increasing.

Of the farmer to farmer approaches, the FFS is the most widely implemented and documented F2F learning approach, with most literature from the 1990s to early 2000s. The FFS model of F2F learning has been extensively adapted to various curricula, cropping and non-cropping systems in numerous countries. Central to the effectiveness of the FFS is adherence to its principles as a non-formal education process. Selection and training of trainers is also critical to successful facilitation of the FFS process. Implementation of multiple approaches can reportedly be complementary, achieving more than individual approaches on their own. Less complex technologies and practices are most suited to simpler methodologies such as field days or demonstration plots while more complex farming system and agro-ecological technologies require more comprehensive educational approaches.

While the effectiveness of the FFS model in achieving adoption of complex farming system and agro-ecological technologies is almost unanimously recognised in the literature, evidence suggests that diffusion to non FFS farmers is limited which brings into question the potential scalability of the FFS. The FFS approach is generally considered to be a comparatively high cost model of F2F learning and there has been significant debate regarding the cost effectiveness of the FFS model when the aim is scaling up and out.

Numerous studies have reported on the impacts of farmer to farmer learning. To fully capture the benefits of F2F learning requires assessment of immediate and longer term development impacts. This needs to be considered, planned and budgeted for at the commencement of any F2F program. While this review identified only limited assessment of longer term development aspects from F2F learning, it would appear that awareness of these impacts and the need to assess them is increasing. Similarly, it has only been recently that more participatory approaches to evaluating impacts of F2F learning have been employed. Ideally this would involve impact assessment from various perspectives using a range of conventional and participatory methodologies.

This review was undertaken as a component of the DFAT AID funded, ACIAR delivered Eastern Indonesia-Agribusiness Development Opportunities (EI-ADO) project to inform the Australia Indonesia Partnership for Decentralisation (AIPD-Rural) program which aims to increase the income of poor farmers in Indonesia. Programs for rural development and technology adoption are effective pathways for alleviating rural poverty. The information on farmer to farmer learning approaches presented in this review will be used to inform the implementation of pro poor value chain interventions for various commodities by AIPD-Rural.

7 References

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8 Appendixes

8.1 Appendix 1:

The description of a day in FFS training in a rice-based agro-ecosystem (Braun et al. 2000):

Field Observation: 7:30-8:30a.m. Farmers form small group, make observations of the whole field and then examine 10 plants per plot, recording the number of tillers per plant, the type and number of insects, and any other relevant details.

Agro-ecosystem analysis: 8:30-9:15a.m. Each group prepares drawings of their field observation including information on the condition of the plants; pests and diseases; natural enemies of insect pests; soil and water conditions.

Presentation and discussion: 9:15-10:00.a.m. Each group presents its drawing and discusses its observations and conclusion. The whole group reaches consensus about the crop management practices that they will carry out during the coming week.

Break: 10:00-10:15am. Refreshments

Group dynamics exercise: 10:15-10:30.a.m. This activity aims to stimulate attention and participation, as well as strengthen group communication and increase solidarity.

Special topic: 10:30-12:00.a.m. The trainer guides the group in experiments, lessons, exercises and discussions on special topics related to what is actually occurring in the field.