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Is the farmer field school still relevant? Case studies from Malawi and Indonesia

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ABSTRACT

The capacity of farmers to adapt to changing environments is critical for sustainable, economically viable and resilient rural development. The Farmer Field School (FFS) was developed by FAO in the late 1980s to build farmers' knowledge and skills for adaptive management. The FFS was subsequently implemented in over 90 countries by a multitude of stakeholders. We conducted case studies in Malawi and Indonesia to answer contemporary questions about the FFS, regarding its relevance at field level, its position in the institutional environment, and its contribution to rural development. We show that the FFS remains relevant at field level, helping farmers to adapt their agricultural practices and livelihood situation to changing circumstances. Differences in institutional arrangements between the two countries highlight the importance of a coordinated support for the FFS. Long-term impacts were found at farmer and institutional level. This study provides insight into the FFS, regarding the causal factors of change, institutional factors, and the role in continued development. As an approach that empowers rural people, the FFS thus contributes to achieving the Sustainable Development Goals.

1. Introduction

Sustainable food, agriculture and rural development are at the heart of the 2030 Agenda for Sustainable Development – and a key to achievement of that agenda will be an approach that empowers rural people as agents of change (FAO, 2017a; UN, 2018).

Rural populations that make up the vast majority of the global poor are confronted with an array of challenges, including population growth, food insecurity, land degradation, climate change effects, pressure on natural resources, and rapid rural transformation. In this changing rural environment, farmer and pastoralist communities alike need – more than ever before – to be able to adapt, innovate, connect and respond. Capacity to adapt would enable farmers to become or remain self-reliant, make sustainable use of ecosystem services, and adjust to dynamic markets.

Nonetheless, the reality is that farmers in the developing World remain poorly educated (Acker and Gasperini, 2009), whilst agriculture is losing its appeal among the younger generation – being attracted to different lifestyles, and migrating to urban areas (White, 2012). Also, agricultural extension services are poorly funded, and ill-equipped to strengthen capacity for adaptive management at field level – unless these services reorient towards the education of farmers (Swanson and Rajalahti, 2010).

The capacity of farmers for adaptive management to respond to a changing environment is crucial for a sustainable and economically viable rural development (Röling and Wagemakers, 2000). In the past, the value of adaptive management has most clearly been demonstrated through integrated pest management (IPM), a concept that requires informed decisions on crop management according to local and contemporary conditions of plant growth, weather and natural enemy action (Matteson, 2000).

Farmer Field Schools (FFS) were developed by FAO and other partners in the late 1980s as an educational tool to enable Asian rice farmers to understand complex systems and to adapt their decisions on IPM according to the field situation based on understanding of agroecological processes, rather than following the standard protocols of

Abbreviations: FAO, Food and Agriculture Organization of the United Nations; FFS, Farmer Field School; FISP, Farm Input Subsidy Program (Malawi); IPM, Integrated Pest Management

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input-intensive crop production that came with Green Revolution technologies (Gallagher et al., 2009; Kenmore et al., 1995). IPM proved invaluable for the prevention of pest outbreaks, and the FFS became the main tool that brought IPM to the farmer level.

The FFS was based on proven educational foundations that seek to empower its participants (Pontius et al., 2002). At its core, the FFS emphasized ecological learning, systems analysis, and experimentation, for groups of farmers who meet routinely for field-based sessions during an entire production cycle to learn how to make adaptive management decisions, find local solutions, and work together as group (FAO, 2016). As an educational investment, the FFS has a purpose to enable farmers to make improved agricultural decisions and, hence, to bring about a process of continued learning and action in rural development (Pontius et al., 2002; FAO, 2016). Accordingly, the FFS is envisioned to have diverse and long-term effects.

Since the 1990s, the FFS has been promoted as a tool in rural development. FFS methods have been adopted for use in crops other than rice, and for topics other than IPM, and the FFS spread to over 90 countries from Asia into Africa, Latin America, the Mediterranean, the Near East and Central Asia (FAO, 2016; Braun et al., 2006; FAO, 2019). Worldwide, the FFS has become a sizable intervention in rural development, with approximately 0.4–1 million farmers graduated per year (Braun and Duveskog, 2008; Waddington et al., 2014), but the FFS has not become more mainstream in the past decade (van den Berg et al., 2020a). Also, there are concerns about quality assurance, with signs of programmes in which the FFS does not follow the educational methods as was originally intended (Waddington et al., 2014; van den Berg et al., 2020b).

A systematic review of the published outcomes of the FFS concluded that the FFS generally had a beneficial effect on agricultural knowledge, practices and endpoints (e.g. pesticide use optimization; yield increase) (Waddington et al., 2014). However, the importance of measuring the effects of the FFS in the empowerment domains has frequently been emphasized but remains under-studied (Pontius et al., 2002; Braun et al., 2006; van den Berg et al., 2020b; Tripp et al., 2005). Systematic review is an invaluable tool for informing policy, but the generalized statements it produces do have their limitations, and can be deceptive when other relevant aspects defining the context have not been described, measured or included (Muller, 2018).

Contemporary questions about the FFS go further than the immediate outcomes of the FFS and seek answers on how the FFS helps farmers to improve their livelihood situation, how the FFS interacts with its institutional and political environment, and how the FFS contributes to rural development. Such questions regarding the relevance and position of the FFS require in-depth studies on a case-by-case basis (Settle et al., 2014; Sherwood et al., 2012). This paper provides case descriptions of experiences with the FFS in two countries.

2. Methods

Two countries for study were selected from two regions. Africa and Asia stood out as the regions with most FFS activities, both in terms of responses to a global FFS survey (van den Berg et al., 2020a), and in terms of the number of published impact studies since 2005 (van den Berg et al., 2020b). For Africa, Kenya was pre-selected as the country with most FFS initiatives within the past two decades. However, because of an ongoing meta-analysis of FFS impacts in the Eastern African Region, a country outside this sub-region was selected. Malawi was considered the appropriate choice, as a country with recent and expanding FFS initiatives. From Asia, Indonesia was selected because it was where the FFS was first developed, and the long time-span of the FFS would allow for evaluation of long-term developments and effects.

Field visits were made, and meetings held in the selected countries to obtain information about the past and current developments of the FFS. Factors that supported or hindered its development and implementation were explored, and the outcomes and impacts of the FFS were identified. In addition, relevant literature was reviewed.

In Malawi, field visits were made in April 2018 to field activities and alumni FFS groups of ongoing and recent projects in Mzuzu, Mzimba, Kasungu, Phalombe and Zomba districts. In total, nine FFS groups were visited, three of which facilitated by lead farmers who were trained as FFS facilitators. Also, two training-of-facilitators courses and a farmer cooperative were visited. Meetings were held with the Director of Agricultural Extension, the Programme manager for Blantyre Agricultural Development Division, district authorities and agricultural officials in Mzuzu, Mzimba, Kasungu, Phalombe and Zomba, representatives from implementing agencies and bilateral donor agencies.

For the country visit to Indonesia, in May 2018, meetings and field visits were facilitated by ngo FIELD-Indonesia and the FAO Representative's office. Four provinces (North Sumatra, West Sumatra, South Sulawesi, East Java) were shortlisted for field visits because of evidence of continued positive support for the FFS. Out of the shortlisted provinces, East Java was selected primarily for logistical reasons. Field visits were made to the Plant Protection Centre in Pandaan, East Java, IPM-FFS alumni groups, and alumni groups from spinoff projects on watershed management, wastewater management, and sustainable intensification of crop production and diversified farming systems, including rice-fish culture. Also, meetings, interviews and focus-group discussions were held at Brawijaya University (Malang), FIELD-Indonesia Foundation, FAO, National Plant Protection Directorate, Plant Protection Centre in Pandaan (East Java), and ngo's. In addition, telephone interviews were held with coordinators of the Indonesian IPM Farmer Association, researchers, extension officers, and plant protection officers.

3. Case description: Malawi

3.1. Context

Malawi has a growing, and mostly rural, population, the majority of which live below the international poverty line; the extensive reliance on subsistence farming and rain-fed agriculture, together with an increasing pressure on natural resources, has made food insecurity a widespread problem (IMF, 2017). Land degradation through soil erosion, nutrient mining, and deforestation is prevalent (Beedy et al., 2015). Moreover, recent consequences of climate change, with floods in 2015 and prolonged dry spells in 2016, have aggravated the situation, particularly in the populated South of the country.

Maize-based farming systems are dominant across the country (Kankwamba et al., 2018), whilst agroecological conditions are diverse (Benson et al., 2016). Crop diversity is poor, with increased planting of monocultures - despite the low drought tolerance and limited nutritional benefits of maize (Kankwamba et al., 2018; Kerr, 2014; National_Statistical_Office, 2010). Stunting among children, as indication of undernutrition, is common, particularly in rural areas, and only a minority is consuming adequate foods from all the food groups (Compact 2025, 2016Compact 2025, 2016). Moreover, there is a clear gender gap in agriculture, with women farmers having 28 % lower productivity than men (IMF, 2017).

Agricultural extension services in Malawi have been under-resourced, currently with one extension officer per 3000 farmers, which is low compared to other countries (Ragasa, 2018). The system of extension services, which has been decentralized to the district level (Government_of_Malawi, 2006), has shown low adoption rates of the promoted technologies (Ragasa and Niu, 2017).

The FFS was first introduced into Malawi in the mid-1990s, and five phases of development can be identified (Fig. 1). Initially, the FFS was focused on IPM (Phase I), however, the activities were not mainstreamed within, nor supported by, government programmes (Masangano et al., 2007). Also, the usefulness of a narrow focus on IPM had been questioned (Snapp and Minja, 2003; Orr and Ritchie, 2004). Eventually, the quality of the FFS was compromised, and the FFS was

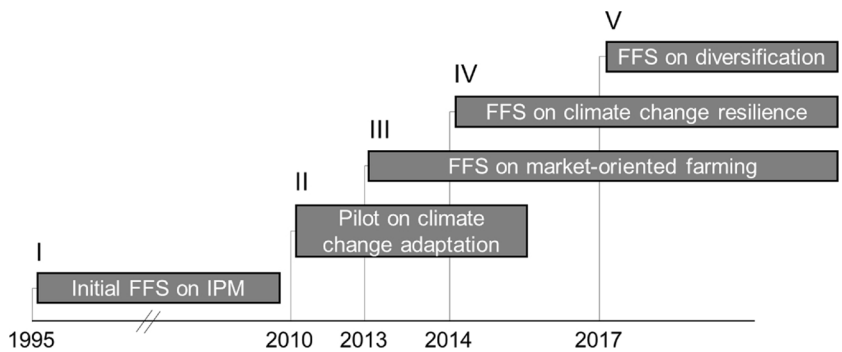

Fig. 1. Schematic timeline of the use of the FFS in Malawi, indicating five phases as explained in the text.

Table 1
Topics added to the FFS curriculum in Malawi in Phase I-V.

Discipline	Topic	I	II	III	IV	V	Details
Agriculture	Production	+	+	+	+	+	Agronomic technologies
	Crop protection	+	+	+	+	+	Botanical, chemicals, push-pull
	Conservation agriculture				+	+	Pit planting, box ridging, mulching
	Nutrient management				+	+	Composting, use of manure
	Livestock				+	+	Pass-on programme for livestock
	Soil & water management				+	+	Water harvesting, dikes, etc.
	Traditional crops, vegetables					+	Learning plots
	Diversification		+		+	+	Multiple/intercropping, gardening
	Agroforestry		+		+	+	Intercropping, tree nursery
Economics	Marketing			+	+	+	Gross margins and prices
	Village savings & loans			+	+	+	Communal fund
	Income generating initiatives				+	+	Value addition, processing, etc.
Social	Gender			+	+	+	Household roles sharing
	Group building	+	+	+	+	+	Group dynamics exercises
	Outreach			+	+	+	Farmer-to-farmer activities
Health	Nutrition		+	+	+	+	Food groups, food preparation
	General health		+		+	+	Sanitation, reproductive health
Environment	Natural resources management		+		+	+	Communal forest, woodlot planting, energy-saving stoves

perceived as a failed intervention (J. Nkhoma, pers. comm. 2018).

In 2010, the FFS was adopted for climate change adaptation, to cope with recurrent droughts and floods (Phase II). This programme gave the FFS a broader scope. The assessment of problems in farmers' livelihoods was used to design appropriate solutions. The FFS curriculum included a range of topics, such as crop management, nutrition, gender, income generation, and livestock (Sibale et al., 2016). After it became clear that farmers needed business skills to produce for the market (Tiggelman, 2009), initiatives on marketing-oriented farming added this element to the scope of the FFS (Phase III), using gender analysis to design the interventions.

Then, in 2014, a programme used the FFS to improve the resilience of smallholder farmers to cope with climate change (Phase IV). Satellite imagery was used to target hotspot areas prone to drought or floods, and FFS units were clustered within these areas. Problem analysis enabled each farmer group to identify problems, express needs and prepare their action plan, resulting in a locally-tailored curriculum of the FFS.

The most recent FFS initiative is taking on board the components and lessons learnt of previous projects to promote agricultural diversification, with the aim to reduce food and nutrition insecurity and increase household income (Phase V). Under the umbrella of the FFS group, care groups on health and nutrition are established for women of child-bearing age in collaboration with health and education sectors.

Hence, over the years, the FFS in Malawi has evolved from having a narrow focus on IPM to being increasingly adapted to local problems and needs, with a farmer-driven agenda, while adding various topics to the FFS with relevance to farmers' livelihood situation (Table 1). A potential concern of having many topics is that the principles or quality of the FFS may be compromised.

3.2. Policy and institutions

The food-security crisis has put pressure on the government for policy reform towards sustainable agricultural transformation, to support agricultural diversification and to strengthen the resilience of vulnerable communities. Nevertheless, implementation of Malawi's Growth and Development Strategy has reportedly seen limited progress over the past decade (IMF, 2017).

Case in point is the national-level Farm Input Subsidy Programme (FISP), which has since its conception in 2005 provided subsidized seed and inorganic fertilizer inputs to poor farmers in support of national maize production. Even though a positive effect on maize yields has been shown (Kawaye and Hutchinson, 2018), FISP has reportedly had little impact on poverty reduction (IMF, 2017; Chibwana and Fisher, 2011)[1] .

[1] This flagship programme, which has received the lion's share of the government's agricultural budget, continues to have a strong focus on maize, despite recent calls for restructuring and for increased investment in agricultural extension and farmer education, to address local and emerging challenges [38] C. Chibwana, M. Fisher, The impacts of agricultural input subsidies in Malawi. Policy Note 5, IFPRI, Washington DC, 2011, [Snapp et al., 2014] S. Snapp, T.S. Jayne, W. Mhango, T. Benson, J. Ricker-Gilbert, Maize yield response to nitrogen in Malawi's smallholder production systems. Working Paper 9, IFPRI, Washington DC, 2014, [40] C. Ragasa, J. Mazunda, M. Kadzamira, The national extension policy of Malawi – lessons from implementation. MASSP Policy Note 23, IFPRI, Washington DC, 2015. The government's strict pricing policy for maize has caused large price fluctuations between seasons, thus discouraging farmers to engage with markets [Barbier, 2000] E.B. Barbier, The economic linkages between rural poverty and land degradation: some evidence from Africa, Agriculture, Ecosystems & Environment, 82 (2000) 355 – 370.

The agricultural extension system, strained by its low and uncertain level of base funding, is at the crossroads of two approaches (Ragasa et al., 2015; Simpson et al., 2012). On the one hand, it retains its main duty of service delivery for the top-down input subsidy programme. On the other hand, the extension policy of 2000 envisaged a bottom-up, demand-driven system with pluralistic service providers, although the key elements of this policy remained largely unimplemented (Ragasa et al., 2015). The extension policy outlined the use of participatory approaches, including the FFS, the model-village approach and the Lead-Farmer approach.

Model villages have been promoted as an integrated approach for solving wide-ranging problems and challenges faced by communities. A model village is established through participatory rural appraisal to create development plans, aiming to provide a structure for delivery of tailored interventions by actors from various programmes and sectors (Simpson et al., 2012; Cai and Davis, 2017). In practice, however, the model-village approach is not functioning as planned, reportedly because of lack of coordination and focus between the actors involved (pers. comm. at district agricultural offices).

The Lead-Farmer approach, as a form of farmer-to-farmer extension, was introduced in Malawi two decades ago. Lead farmers are local volunteers who received a short training on one or two specific technologies, and who disseminated information on these technologies to groups of farmers in their locality (Ragasa and Niu, 2017; Simpson et al., 2012; Khaila et al., 2015). However, recent surveys indicated that the coverage of the farmer population by lead farmers has been low and the outcomes rather limited (Ragasa and Niu, 2017). Also, lead farmers have received inadequate training on technical and facilitation skills to address local challenges (Khaila et al., 2015; EU, 2016).

The FFS has become by-and-large accepted within the decentralized government structure as an 'extension approach'. As the programme manager of a Regional Agricultural Development Division stated, "the FFS is the way to go"; but reportedly, scepticism remains at senior level.

The recent FFS initiatives operate within government structures and institutions, intended to facilitate mainstreaming of the FFS model. Capacity building and quality assurance are overseen by the national-level agricultural extension department and FAO. Planning and implementation has been anchored in the District Agricultural Extension Service System (Government_of_Malawi, 2006), with agricultural officers providing supervision to the extension workers. Extension workers trained on facilitating the FFS also serve as 'mentors' to ngo projects that also use the FFS.

The FFS initiatives have recently been used by the extension department to complement the model-village approach and Lead-Farmer approach (EU, 2016), both of which have shown limitations when implemented on their own. Hence, the FFS was placed within model villages, and involved lead farmers as FFS facilitators. The notion was that the FFS adds value to these two extension approaches.

Interviews with district agricultural authorities and district commissioners indicated their support for the FFS. The interviewees reported first-hand observations of improved farmer practices in FFS alumni groups. Further, they reported that the FFS introduced content and actors that strengthened the model-villages. One district commissioner described the FFS as a platform for integration on topics like production and nutrition, where officers from previously-separated programmes worked together with the same farmer groups (Fig. 2). The most recent FFS initiatives have embraced the lead-farmer approach by training and upgrading lead farmers as the main cadre of FFS facilitators. This strategy, with external donor support, could allow for upscaling of the FFS where the number of extension workers is small.

Human capacity building for the FFS consisted of the training of government extension workers in four-month residential courses to become master trainers. These courses included practical field work, with field and tree crops, and field experiments that had been developed jointly by the participants and researchers. Group facilitation skills were an integral part of the training, and the trainees recurrently practiced their skills in six 'outreach' groups, or 'pilot' FFS's.

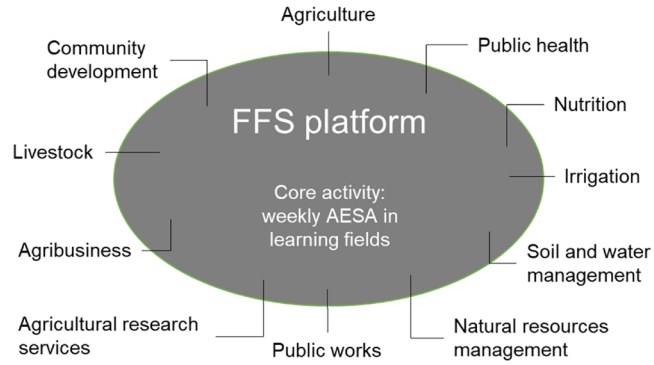

Fig. 2. Public sector agencies that have been involved in implementation of the FFS at district level in Malawi, essentially using the FFS as platform for demand-driven interventions. AESA denotes agroecosystem analysis.

The master trainers trained lead farmers who, after having graduated from the FFS and after follow-up training, acted in pairs as the next cadre of FFS facilitators. The master trainer took a supervisory role. Under the recent programme, lead farmers took a regular facilitator's training and implemented several outreach-FFS units.

The role of the research system in supporting the FFS approach has been rather limited. A top-down mechanism for adaptive research exists whereby the Ministry of Agriculture depends on the topics proposed by Subject Matter Specialists at district level. Prioritized topics are investigated by the Agricultural Research Services Department to develop and test techniques and technologies for their potential use by farmers. Examples are equipment for land preparation or improved planting techniques. A national committee is tasked to provide clearance of the developed techniques or technologies for use in extension. However, this clearance procedure takes several years, which delays the response to emerging needs. For instance, technologies such as the 'push-pull' cropping methods against stemborers (Cook et al., 2007), or the use of metal silos for post-harvest storage, have reportedly been ready for use, but await clearance. Only cleared technologies receive the political backing for large-scale adoption, with the intention to protect farmers against flawed or deficient technologies. However, the approved technologies do not consider the variation in ecological conditions faced by farmers. For seeds and fertilizers, the guidelines differentiate between only three major ecological zones of Malawi, while for other aspects, such as planting methods, the recommendations are the same across the entire country.

The centralized agricultural guidelines can put extension workers at odds when confronted with the need for local adaptation of farming practices. Essentially, the FFS decentralizes the process of decision making on farming practices, by making farmers the 'experts' in their own fields. Some research agencies have been supporting the FFS model, through their involvement in participatory field experiments in conjunction with the master trainer courses. Local adaptation, decisionmaking and ownership could reduce the 'burden' of accountability by the government.

3.3. Production and marketing

In central and northern Malawi, population density is relatively low and, consequently, farmer access to markets is relatively poor. In these regions, the FFS has been used to promote production and marketing by farmers. The FFS groups consisted of 25–30 farmers, more women than men, and have been facilitated by lead farmers using the outreach model.

As an example, a group of lead farmers was visited in Kasungu District. The lead farmers had graduated from a soybean-FFS the preceding year (2016/17 season) and, in parallel, they had implemented

five outreach-FFS's in their locality. These FFS groups included weekly agroecosystem analysis in field plots with comparative planting methods, taking yield measurements, and calculating gross margin and break-even price. Additional topics included crop varieties, crop nutrient management, conservation agriculture, seed multiplication, pest management, nutrition, home gardening, gender, reproductive health, savings-and-loans and marketing. To gain access to the market, these lead farmers teamed-up with their five outreach groups, to form a group of 180 farmers, and collectively produced 256 bags of soybean (50 kg each) which they sold directly to a vegetable oil processing company. The group voted that in the subsequent year (2017/18 season) the main commodity for FFS training would be maize. Accordingly, with support from their master trainer and resource persons, the lead farmers conducted an FFS on maize, with five parallel outreach-FFS's, comparing the effect of manure application and intercropping to raise soil fertility. The group planned to continue their annual FFS learning cycles, with groundnut as selected commodity for the 2018/19 season.

Observations through visits of outreach groups in several districts confirmed that farmer groups, facilitated by their lead farmers, continued to learn through annual FFS cycles to improve their agronomic practices in communal fields. Reportedly, farmers reduced the amount of seed, changed the timing of fertilizer application, introduced manure or compost, and increased productivity. Calculation of gross revenue and break-even price invariably helped farmer groups to negotiate the sale of their produce to cooperatives. Hence, farmers were able to fetch a higher price than when they used to sell as individuals to vendors. A much-stated benefit was that more money was available at household level, allowing them, for example, to purchase iron roof sheets, a calf or goats. Each visited FFS group had started its village savings-and-loans scheme, enabling farmers to borrow money for buying agricultural inputs or making investments.

Several farmer cooperatives were starting to emerge from the FFS. The most advanced marketing offshoot, in Mzimba district, was a cooperative that developed out of an FFS in 2009. Member entry fees, shares, and nine hectares of communal land provided the start-up capital. A warehouse was constructed in 2016, after successful application for funding from a grants project. Membership grew from 150 in 2010, to 352 in 2017, with members having fortnightly meetings. The cooperative sells the produce from its members directly to a vegetable oil-processing company.

Consequently, the FFS appears to have shown its value in strengthening production, cooperation and marketing by farmers in central and northern Malawi.

3.4. Climate change resilience

In southern Malawi, where rural population density is high, the FFS supports farmers to cope with degraded soils and recurrent dry spells and floods. Satellite imagery had been used to target hotspot localities most vulnerable to drought or floods. In targeted villages, problems were analysed, FFS groups formed, and learning plots established.

Several recently-started groups were visited. One group identified dry spells as their main problem and started by studying the water harvesting technique of box ridges versus their farmer practices of planting on linear ridges. The farmer practice plot nearly failed, whilst the box ridge technique produced a reasonable harvest. Another group observed first-hand that plant growth was better when adopting the recommended low plant density instead of the farmer practice of high plant density. Other groups focused their experiments on drought-resistant crops like sorghum or intercropping.

Each FFS included a range of additional topics, such as nutrition, home gardening, fruit tree nurseries, gender, agroforestry, HIV, livestock production, control of fall armyworm. Each group established a village-level savings-and-loans scheme. Moreover, the FFS groups initiated natural resources management at community and landscape level, by developing or regenerating nearby forest patches, planting seedlings of natural trees, and grafting seedlings onto existing rootstock. In some FFS groups, village bylaws were developed against logging or burning of natural forest. These groups were planning for their second FFS season, with focus on other crops or techniques, and to further develop their home gardens, nurseries and community forest, expressing "the work is not yet done" and "we want to continue learning".

In addition, two alumni groups were visited who conducted their first FFS three or four years ago. Both groups were still meeting weekly. They mentioned having conducted studies every season in their communal fields, using frequent agroecosystem analysis for making crop management decisions. They reported that they increased their on-farm crop diversity to cope with drought and floods. Preparation of home gardens and compost heaps, and planting of fruit trees, which had been initiated at communal level, had reportedly been replicated by most households in the villages, including by non-FFS households.

Women explained how the FFS contributed to improved nutrition, by becoming aware of the essential food groups, introducing methods of food processing (e.g. drying of tomatoes; preparing soybean milk) and growing groundnut as snacks for children. Village savings-and-loans schemes in each group built up over the years, providing members with a financial buffer. As a group investment, these FFS groups established pass-on schemes for goats and cattle.

Furthermore, these groups had been protecting their forest and water resources, by developing bylaws against logging, keeping tree nurseries, and by planting woodlots through engagement of schools. Also, locally available energy-saving cooking stoves had been introduced through the FFS and were reportedly used by group members. The farmer groups expressed their plan to continue working on common goals and enterprises.

4. Case description: Indonesia

4.1. Context

The Farmer Field School was conceived in Indonesia, in 1989, in response to pest outbreaks in irrigated rice, the country's main staple crop. Agricultural technologies that had brought the Green Revolution during the 1970s and 1980s, and that helped Indonesia become self-sufficient in rice production, were accompanied by an over-reliance on broad-spectrum insecticides. These chemicals had a negative effect on populations by killing beneficial organisms, thus disrupting the mechanisms that kept plant-feeding insects in check in the natural rice ecosystem (Kenmore et al., 1984; Settle et al., 1996). Extensive pest outbreaks occurred, particularly of rice brown planthopper, causing severe damage to the rice crop, to the degree of threatening the country's self-sufficiency in rice (Van de Fliert, 1993).

Recognition of the cause of the problem led to a Presidential Decree in 1986 to ban the use of broad-spectrum insecticides in rice, phase out pesticide subsidies, and build human capacity on IPM (Thorburn, 2014). After recognition that the solution laid in educating farmers on IPM and field ecology, the FFS was developed and implemented through an externally-funded National IPM Programme (Pontius et al., 2002) (Fig. 3). Pest observers from the Plant Protection Directorate (Department of Food Crops) were trained as FFS facilitators. Between 1989 and 1999, an estimated 1.1 million farmers (i.e. 2% of Indonesia's farmers) graduated from IPM farmer field schools in Indonesia (Pontius et al., 2002). The majority of FFS were on rice cultivation, with 10 percent on soybean and 3 percent on cabbage, shallot or potato. In total, almost 30,000 farmers became farmer trainer as FFS facilitator.

In 1999, the National IPM Programme was succeeded by 'Community IPM', an FAO programme seeking to institutionalize IPM at community level, using post-FFS activities for alumni groups to support farmer-to-farmer training, experimentation and organization (Pontius et al., 2002). The emergence of farmer-based institutions would make the 'IPM movement' less dependent on government policies and

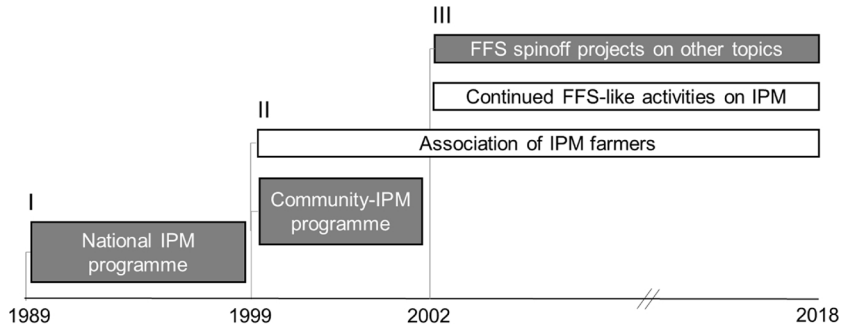

Fig. 3. Schematic timeline of the use of the FFS in Indonesia, indicating three phases (I-III). Grey horizontal bars signify activities that relied on external funding.

leadership changes (Dilts, 1998). The Indonesian IPM farmer association emerged during this period.

Funding for Community IPM was terminated in 2002. In the absence of a major externally-funded national FFS programme from 2002 to date, the custodians of the FFS in Indonesia have been the alumni farmers, governmental agencies, and ngo's (Fig. 3). We examined the continued use and relevance of the FFS in present-day Indonesia.

Despite recent strides made in Indonesia in poverty reduction (World_Bank, 2018), farmers continue to confront challenges regarding the availability of water and land, effects of climate change, and environmental degradation. Moreover, history is repeating itself regarding the pesticide-induced pest outbreaks in rice. Damage due to brown planthopper and the plant viruses they spread has been a major concern in recent years[2] . Reported reasons for this pattern are the promotion of chemical-intensive rice technologies, including hybrid seed, and the deregulation of pesticides, with large numbers and volumes of pesticide formulations cheaply available on Asian markets (Thorburn, 2014; Sogawa, 2015; Normile, 2013). The 1986-prohibition of broad-spectrum insecticides largely lost its relevance, because new insecticides, many of which with broad-spectrum effects, filled the void (Eveleens, 2011). Moreover, degraded soils under intensified continuous rice cultivation affect plant health, and cause farmers to react by overuse of chemical fertilizers and pesticides.

From 2000, national developments triggered the transfer of political power and financial resources, including for agriculture, to the districts and municipalities (Nasution, 2016). In theory, decentralization could engage farming communities more actively in decisions taken by local government, much depending on local leadership. In practice, local government commonly lacked commitment to agricultural extension. However, with the enactment of legislation on participatory extension in 2006, the extension services gained a legal basis to be undertaken by local authorities (Lubis, 2012; Cahyono, 2014). The policy on participatory extension is potentially supportive of the FFS, but regional extension services are believed not to be prepared to adopt a participatory approach (Cahyono, 2014).

4.2. Policy and institutions

Two conflicting paradigms for crop production have long operated in parallel in Indonesia, as they have been in the global debate. The first, the ecological base, fosters agroecology and local decision-making by farmers; the second, the technological base, emphasizes the transfer of technology and directives to farmers.

The ecological base was widely accepted in the 1990s during the National IPM Programme[3], when the failures of input-driven rice farming had become evident. In 1997, the programme was placed within the Plant Protection Directorate and thus bypassed the agricultural development and extension divisions. To date, the ecological base continues to be supported by the Plant Protection Directorate and senior scientists represented in the National Plant Protection Committee, but not or much less so by other divisions.

Other contemporary agricultural programmes have by-and-large adopted the technological base, using subsidy schemes to promote input-intensive production. Another recent development in Indonesian agriculture is a shift towards commercialization and agribusiness. Increasingly, rice farmers in selected areas are being offered to rent out (or sell) their land to private companies, while being offered wages for working the same land. In this construction, the farmers are no longer the decision makers on what or how to grow. Inevitably, this trend favours the technological over the ecological base, with the private sector having a major stake by providing seed, fertilizers, pesticides and machinery.

The two conflicting paradigms apparently coexist within the Ministry of Agriculture under an organizational culture which does not foster interaction between the government agencies and their programmes.

The Plant Protection Directorate has been the custodian of 'genuine' FFS within the public sector. It continues to implement the IPM-FFS, albeit on a much smaller scale as during the time of the National IPM Programme (DPTP, 2018). Remarkably, they no longer use the FFS-brand name ('*Sekolah Lapangan*') because this name was in 2016 appropriated by the agricultural extension division. The extension division, with 28,000 extension workers, uses the FFS to denote a nationwide intervention that lacks the basic FFS principles[4] . Hence, the FFS-brand name may soon lose its appeal among farmers.

Another pattern is that the cadre of Pest Observers and Field Leaders who received training in the 1990s and who have first-hand experience with the FFS, are reaching retirement age, while investments in season-long training of a new generation of Pest Observers is beyond the scope of current planning.

Advocacy for the FFS by those with the first-hand FFS-experience has apparently had little influence on policy and strategy at Ministerial level where other countervailing forces may have been stronger. Out of more than 3000 Pest Observers and Field Leaders from the National IPM Programme, only very few climbed the ranks within the Department of Agriculture at central level, suggesting that their

[2] However, data on the extent of damage are not publicly available.

[3] The National IPM Programme FFS (1989 – 1999) was, after an initial pilot phase by the National Planning Agency (BAPPENAS), administered under the Secretary General's office of the MoA, with the training component implemented by the Plant Protection Directorate and its Pest Observers. In 1997 (*footnote continued*) the programme was placed fully under the Plant Protection Directorate after its leadership and structure adopted supported the IPM paradigm. It was not until 1999, that the job descriptions of Pest Observers formally included the task of IPM training (World Bank: *Integrated Pest Management Training Project. P004009.* Washington DC: World Bank; 2000)

[4] This intervention provides farmer groups with a limited number of teaching-style sessions on integrated crop management (ICM) that do not include agroecosystem analysis.

positions did not allow for easy promotion.

The FFS has had more effect on policy at decentralized levels. For instance in West Sumatra, where authorities have championed the FFS, farmers are paid to plough rice straw back into their fields instead of burning it; the sale of certified organic produce is subsidized; and several districts claim to be pesticide-free (Thorburn, 2014, 2009). Elsewhere, districts have established zones for 'organic rice cultivation', or have restricted the sale and use of insecticides, to name some examples.

4.3. Integrated pest management

At national level, the IPM-FFS has been institutionalized within the Plant Protection Directorate, where leadership recognized the benefits of the FFS in changing farmer practices. The scale of implementation, however, has been limited to 10–15 % of that during the National IPM Programme in the 1990s. A national commission is guarding the quality implementation.

The IPM-FFS model has evolved to incorporate new elements. Biological control agents (e.g. bacteria, fungi, parasitoids) are produced in laboratories in the regions, and provided to farmer groups for multiplication for use in their FFS study plots[5] . Other additions are the use of organic manure, and flower-rich refugia as 'safe havens' to support populations of beneficial insects.

Besides implementing the FFS, the Directorate has recently developed a new model coined 'landscape-IPM', which is being tested in areas prone to pest outbreaks (mainly brown planthopper). The purpose is to accelerate adoption of IPM by a group of 25–30 neighbouring farmers in a contiguous area with 20–30 hectares of rice (Irham and Winarto, 2015)[6] . Several variations in the landscape-IPM model, and their sustainability at community level, are being critically evaluated to inform government policy (Irham and Winarto, 2015).

At provincial level, in East Java, the Plant Protection Directorate has several regional field stations from which the FFS is managed. Genuine IPM-FFS's are reportedly conducted throughout East Java, with approximately one unit per subdistrict per year, whilst landscape-IPM is carried out in outbreak-prone areas. FFS-alumni groups reportedly continue their experimentation in the field, but the extent to which this takes place remains unknown. The preparation and use of organic fertilizers, biological agents, and plant refugia, is actively promoted in the FFS, as observed at sites visited[7] . Plant protection field stations have been supplying isolates directly to FFS groups and provided support for establishment and quality control of 60 farmer-run hubs (*Pos Agen Hayati*) across East Java that mass-produce the biological agents. These hubs, one of which was visited, supply biological agents to IPM farmers in their area, for free or for sale. An unknown number of farmer groups has started to produce biocontrol agents on a self-help basis.

In the spirit of 'Community IPM', which was to institutionalize IPM at community level, a strategy on 'IPM Villages' was recently developed in East Java. This strategy takes advantage of decentralized governance by tapping into local resources. The entry point is the village head, the funding source is the budget allocation from provincial authorities, and the core intervention the FFS. To initiate an IPM Village, a village-level IPM task-force and a team of local 'specialists' are established, consisting of farmer trainers, a pest observer, and a person who produces biological agents for use by villagers. The village is technically supported until it is certified as 'IPM Village' that can continue with its own financial and human resources. Started in 2013, every season six new 'IPM Villages' are being added in East Java.

Despite these promising developments at provincial level, human resources are a key concern for the future of the FFS. The cadre of Pest Observers who received their season-long trainings in the early 1990s are progressively being replaced by a new generation. Their replacements do not receive season-long training on the FFS, but are trained on-the-job, with short annual refresher trainings. Hence, the quality of the new generation of government FFS facilitators is questionable.

Apart from the public sector, alumni farmer groups have become a major force promoting the IPM-FFS. Back in 1999, in a workshop that marked the end of the National IPM Programme, FFS alumni decided to start a national farmer association on IPM. Their objectives were to establish Community IPM across the country, create a network of IPM farmers, and strengthen cooperation with service providers and other stakeholders. This farmer-based institution, which has been active for almost twenty years at the time of writing, continues to hold semi-annual meetings, and organizes farmer congresses once every four years at national, provincial and district level. In 2018, the association formally counted 1.2 million members from 70,000 IPM farmer groups (K. Adinata, pers. comm., 2018).

The farmer association, which is a-political, has advocated for farmers' rights at National level. Member farmers have learnt to acquire financial support from local government, the private sector and external donors for their outreach activities. Examples include FFS projects on organic farming, climate change adaptation, participatory plant breeding, and marketing. Since the year 2000, members of the association have formally implemented 4830 units of sponsored FFS's (excluding self-help FFS's) on various topics – training an estimated 125,000 farmers. Reportedly, 2340 farmers remain active as farmer trainers, and in many cases farmer trainers have been promoted to the position of village head, with political influence over agricultural development (K. Adinata, pers. comm., 2018). In conclusion, the Indonesian IPM farmer association that emerged from the FFS has persisted for almost twenty years to execute its self-proclaimed mission on community-based IPM and farmers' rights country-wide.

4.4. Spinoff initiatives

Soon after the National IPM Programme, the FFS model was adopted for topics other than IPM in various spinoff initiatives in Indonesia. The FIELD-Indonesia Foundation, an offshoot from the FAO-supported National IPM Programme, played a pivotal role in taking the FFS model and its principles to help farmers address the broader challenges and problems affecting their livelihood situation. Other ngo's and institutions have followed suit.

Some spinoff initiatives have added methods of 'vulnerability assessment' and 'sustainable livelihoods assessment' to the FFS model (Scoones, 1998; Kelly and Adger, 2000). These additional methods have broadened the scope of farmers' observations and analyses, from farming to the natural environment, physical infrastructure, financial situation, and human and social capital. In cases where agricultural crops were the main subject of the FFS, agroecosystem analysis and decision making continued to drive the experiential learning cycle, as is considered essential to the FFS. But in cases where the main subject of the FFS was not on crops, the experiential learning cycle drew on observations, analysis and action planning of the subject in question, for example, on a watershed or on a village sanitation system.

The FFS has been adopted for marketing purposes and to cope with climate change effects by several farmer initiatives, ngo's, academic

[5] The biological control agents include the entomopathogen *Beauveria bassiana*, a fungus infecting brown planthopper, *Trichogramma* spp. egg parasitoids against stemborers, and *Trichoderma* fungi as plant symbiont.

[6] Landscape-IPM involves four farmers per group as voluntary 'pest observers', who do weekly agroecosystem analysis, not in FFS study plots, but directly in the fields of individual farmers. They interact weekly with individual farmers and have monthly meetings for the entire group. Landscape-IPM was designed, with FAO support, as follow-up activity for FFS alumni, but in reality, part of the participants has no FFS background, which has been identified as a shortcoming of the approach.

[7] For example, Pandaan field station in collaboration with Brawijaya University, Malang, has over the past 15 years, maintained laboratory cultures of a range of biological control agents and plant symbionts, and received an ISO-9001 certification for quality control.

institutions, and the Ministry of Agriculture, although not all initiatives have used FFS principles (Siregar and Crane, 2011).[8] One example is the so-called Science Field Shops, whereby selected farmers from a number of locations in a district are trained as rainfall observers who also do agroecosystem observations, to advice farmers in their own communities, for example, on what to plant or when to plant (Winarto and Stigter, 2017; Winarto et al., 2017). In monthly meetings, scientists provide climate predictions in the form of seasonal rainfall scenarios, which is used to help farmers with decision making. Another recent initiative has shown the use of the FFS for sustainable intensification and diversification of rice production landscapes, including for the promotion and development of rice-fish culture (Ketelaar et al., 2018; Ketelaar and Abubakar, 2018).

The following two examples describe the use of the FFS for wastewater management and watershed management.

4.4.1. Example 1: watershed management in Argosari

Argosari is an uphill village that borders the Bromo-Tengger-Semeru National Park, a protected highland forested area in East Java. In the past, forest logging had been rampant along the perimeter of the park, causing flash floods, landslides and drying of streams. Back in 2006, 25 neighbouring farmers formed one of the groups conducting an FFS on watershed management. In 12 weekly sessions, they learnt about their interactions with the natural environment, and about the environmental services provided to them. Financial support for their activities stopped after completion of the FFS.

The entry point was exercises on problem analysis and participatory mapping, which revealed that the forested vegetation upstream was critical to provision of clean and constant supply of water from springs and streams. However, this vegetation was being logged to provide timber and cooking fuel. They also experienced social strive over the availability of clean water downstream.

In 2007, after completing their FFS, the group began to implement their action plans, observing the effects, and making further adaptations. A continuous process of learning and adaptation followed. The farmers maintained the ownership over this process, whilst external stakeholders provided advice.

Regarding upstream vegetation, the farmer group and fellow villagers established a forested buffer zone between the village and the protected area. Crucially, a multi-stakeholder forum was in place to engage stakeholders in the planning and implementation of the activities. The forestry department, as major stakeholder, advised the group on watershed management along the slopes at the perimeter of the park. A buffer zone was developed by planting a mixture of endemic trees, fast-growing introduced trees, multipurpose trees (e.g. fruit trees), and tree crops (arabica coffee, or cocoa). On lower slopes, terracing was introduced to grow agricultural crops. Over the years, the buffer zone was progressively restored from degraded grasslands into a biodiverse community forest. Under the leadership of the village head, the group formed an association with the village's three other farmer groups, to share innovations and experiences. Together, they planted 1.4 million trees.

Regarding water resources, the village used to have unlimited water flowing to their houses, without consideration of the needs by those downstream. However, social strive with downstream villages caused a change of mindset to value the water source as a limited commodity for fair sharing. To implement fair sharing of water, the group bought and installed water pipes and water meters at household level. They developed a system of token payments into a village fund for the environmental service of clean water provision. Under village leadership, the water meter system was expanded to all households in the village. The funds generated were used by the village to support further activities; for example, a water reservoir was constructed to ensure uninterrupted water supply.

Despite fair sharing of water, water quality remained a problem for downstream villages. The group identified the problem of poor sanitation due to cow dung leaching onto roads and into water ways. After considering possible solutions, installation of small biogas plants was considered most appropriate, because it improves sanitation and simultaneously removes the need for cutting firewood. Also, bylaws were established at village level to protect water sources. Biogas installation has been a step-wise learning process. The group started using low-cost, plastic installations, with some material support from the District level, but gas production was poor, and installations broke down within six years. Extension officers and private sector stakeholders advised on the construction of concrete biogas installations. Households gradually upgraded their biogas installations. Slurry and concentrated sludge produced by the biogas installations in the village were used as organic manure, replacing chemical fertilizers.

The example of Argosari village showed how the FFS, implemented in 2006, prompted a process of innovation and learning that continued until 2018, with occasional technical support from their extension worker and multi-stakeholder forum. The group continued to learn and adapt, for example, to produce pasteurized milk, yoghurt and kefir, and to process cassava flour. Upon regular request, members of the group provided outreach assistance to neighbouring villages and more distant villages in East Java, to guide them through the initial FFS process of learning and planning, to become empowered to improve their livelihood situation.

Other farmer groups covered by the same intervention during 2006–2008 have reportedly generated similar types of impacts in the technical, natural, social, and financial domains, suggesting that the example of Argosari was not unique.

4.4.2. Example 2: wastewater management in Kebonagung

In East Java, poor drainage and wastewater management is a common problem in villages along the coastal plain of the Madura Strait. In one village, Kebonagung, open defecation along the little stream traversing the village was habitually practiced by its inhabitants. This habit was accompanied by bad odour and a high reported incidence of gastrointestinal diseases.

District authorities had previously attempted to construct a septic system in the congested village, consisting of a hundred households living along narrow alleys, but due to challenges of the flat and low-lying terrain, combined with poor coordination and collaboration among the villagers, their efforts had failed.

An externally-funded project used the FFS model to improve access to clean water and to manage wastewater. District authorities were partner in the activities, through a multi-stakeholder forum. In 2014, an FFS was conducted in Kebonagung. Twenty-five selected villagers met during twelve weekly sessions to identify problems and develop solutions for their village. These sessions involved a series of observations of the 'village ecosystem', to produce a plan and vision statement for solving the wastewater problem through collective action. To engage all households of the village, the group decided that each participant should convey what was learnt each week to four other households.

Activities involved participatory mapping of the village, inserting measurements taken of the gradient along alleys to design an optimal septic system that connected all households. From external sources they found out that the decline of the main pipes must be minimally 6 cm per meter. The plan was verified and approved by a specialist prior to implementation.

Because burrowing and construction of the main pipes along narrow alleyways that traversed the congested village was bound to cause social tensions, a meticulous step-wise schedule was developed by the group for a phased implementation. Small sections of a few meters were

[8] These interventions included FFSs with curricula on climate-smart farming, testing of new varieties, participatory plant breeding, intercropping, home gardening, crop diversification, coastal shrimp farming and mangrove forest restoration.

to be dug out, constructed, tested and covered, before moving on to the next downward section; a glass ball was used to test the gradient. This procedure demanded coordination and collaboration among the villagers. To initiate the actions, the group organized a village-wide campaign to prepare other villagers.

The main pipes and construction of a large sceptic tank at the edge of the village were provided by the donor agency. Each household contributed by paying for the elements that connected their house to the main pipes; only the poorest households were assisted financially. The construction activities were implemented as planned, with participation of the entire community. It was a success, with all households connected to a functional septic system. As a result, sanitation conditions were substantially improved.

The district authorities, who had been a partner in the activities, learnt that active community engagement using the FFS was essential for construction of infrastructure for water and sanitation in congested villages. To make optimal use of this success, the District donated a centre, which was built on top of the septic tank, for education of groups from other villages. The district changed its strategy for wastewater management from its top-down approach to the FFS model. By 2018, the district had successfully completed an infrastructure for water or sanitation in 57 other villages.

The example of Kebonagung has shown how the FFS model was successfully piloted in a non-agricultural setting to solve the problems of poor sanitation at village level. The pilot was readily adopted and rolled-out by the public sector who were partner in the activities.

5. Discussion

Our findings from contemporary and past FFS programmes in Malawi and Indonesia show that the FFS continues to be used and adapted in various contexts. This section synthesizes the two case studies according to three themes: (i) the relevance of the FFS at field level; (ii) the position of the FFS in institutions, and (iii) the role of the FFS in rural development.

5.1. Relevance at field level

Given the urgency of farmers gaining ecological literacy and engage in experimentation and collective action; and given the proven ability of the FFS to advance these aspects, the continued relevance of the FFS at field level is beyond doubt. In Malawi, farming communities are increasingly challenged by population pressure on the use of lands and natural resources, combined with dry spells and floods, resulting in food insecurity and persistent poverty. In Indonesia, there are similar challenges of population pressure on the use of diminishing arable land and natural resources, although poverty has been much reduced. To cope with these challenges, farmers are compelled to be creative and adapt their agricultural practices, diversify their income sources, and conserve their natural resources. Hence, it is plausible that adaptive management approaches such as the FFS are needed to help farmers develop their skills of observation, experimentation and critical analysis.

How, then, did the FFS help farmers learn, and use their acquired knowledge to improve their situation?

In the Malawian case, FFS alumni learnt to make comparative assessments of agricultural techniques, and their experiences suggested that there was much room to improve prevailing farmer practices. Acquired marketing skills helped farmers to fetch better prices for their produce, raising their incomes after the FFS. In Malawi, the FFS took on board a variety of topics, including health, agriculture and the environment. The risk of adding topics to the FFS is that the main purpose, which is, to learn from observations and analysis, is compromised. The results, however, suggested that the diversity of added topics reinforced the FFS, by providing farmers with relevant opportunities for development and diversification. An enabling factor was that the FFS was not restricted to one season, but generally continued as self-help group activity over several years.

The weekly agroecosystem analysis in study plots was the core activity of the FFS. The additional topics like nutrition, crop diversification, natural resources management and marketing appeared to encourage farmers to think more holistically about their livelihood situation. Specifically, home gardening, tree nurseries and composting have been 'low-hanging fruit' technologies, readily taken up by participants, and disseminated to non-FFS households. Marketing and savings-and-loans schemes have contributed towards people's financial resilience. In short, the variety of special topics has benefited the adaptation and diversification of farming and income sources in the Malawian context.

In the Indonesian example, the FFS started with a focus on IPM, which was (and still is) relevant, because of the prevailing problems of insecticide overuse in rice. The recent situation with renewed pest outbreaks is a reminder that inappropriate insecticide use can threaten production of Indonesia's main staple crop. Hence, FFS on IPM continues to have an important purpose in Indonesia.

Furthermore, the FFS in Indonesia had been adopted in disciplines beyond agriculture. The examples of innovative pilots on watershed management and wastewater management demonstrated how the experiential learning cycle put communities in charge of planning of actions to address the problems they face. This led to tangible improvements in their livelihood situation. These initiatives each had their own multi-stakeholder forum, intended to facilitate the adoption of successful pilots by other stakeholders.

In both countries, the experiential learning cycle was of central importance to the FFS. Observations and analysis led to an increased understanding, and this experience gave farmers the confidence and inspiration to make further improvements. The experiential learning cycle, labelled as a non-negotiable element of the FFS (FAO, 2016; CIP-UPWARD, 2003), has been compared to the process of empowerment (Bartlett, 2004).

The FFS used a group approach, which had several advantages. Learning and empowerment taking place within the farmer group conferred benefits of mutual support, sharing of ideas and experiences, and access to communal land, markets and local authorities. As groups, farmers confronted area-wide challenges, by managing agricultural pests, developing sanitation infrastructure and establishing community forests. Visited groups had bonded into entities that appeared to have common values and objectives, and that continued to meet, mostly on a weekly basis.

5.2. Position in institutions

In spite of the rather unique ability of the FFS to foster learning and action among farmers, there continues to be resistance to the FFS from public and private sectors and research institutions (Sherwood et al., 2012; Nederlof and Odonkor, 2006), possibly due to the concept to increase farmer autonomy and empowerment. In both Malawi and Indonesia, agricultural development has been torn between two paradigms: technology transfer, and ecological learning and adaptation by farmers (Röling, 2002). The FFS played a pivotal role in supporting the second paradigm. But it has been a persistent battle, as the experience from Indonesia has shown. In the absence of major donor support for the FFS, the forces that drive the technology transfer (i.e. centralized control, expert-based institutional culture, input provision) are strong as ever, whereas institutional memory about the FFS is fading.

Despite the technology transfer paradigm being prioritized at ministerial level, Indonesia's Plant Protection Directorate institutionalized the FFS within its mandate of IPM. During the 1990s, the Directorate assimilated into its role of supporting the IPM-FFS, and reoriented the job descriptions of its field officers accordingly (World_Bank, 2000). It drew on its cadre of 3000 field officers who had all been intensively trained on the FFS. A very few field officers climbed the ranks and

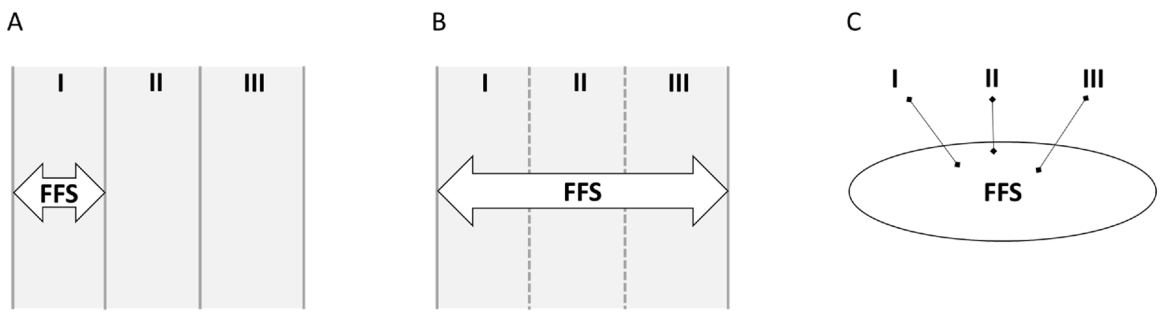

Fig. 4. Diagram illustrating three models for adopting the FFS within public sector agencies (I-III). A, FFS implemented by one agency, without coordination on the FFS between agencies; B, coordination on the FFS between agencies; C, FFS used as platform for interaction by multiple agencies.

brought experience to the top. What has reportedly helped the Directorate stick with the FFS was the positive feedback received from farmers. Moreover, the Directorate has enhanced its stake in farmer-driven IPM through its support to produce biological agents through existing FFS networks. Arguably, the programme's placement within a specialized agency, in line with the scope of IPM, prevented creation of FFS ownership among other institutions.

In Malawi, the input-subsidy programme has competed for core funding with the side-lined agricultural extension services. However, the relentless food insecurity crisis and its underlying causes are exposing the limits of input packages in solving food insecurity. On paper, the extension policy has been in favour of farmer-driven approaches, but in practice, extension services have been severely under-resourced. Recently, an influx of donor support for the FFS has added weight to agricultural extension, particularly, because the FFS programmes have been implemented through the government's decentralized structure and using the FFS to complement existing extension approaches.

The FFS is becoming accepted by Malawian district authorities as an approach to improve the resilience of farming communities. As one district-level Member of Parliament put it, "the FFS breaks the dependency syndrome; (previously) farmers did not use their opportunities to produce". Nonetheless, a conflict remains between the government's centralized guidelines on agricultural techniques or practices and the FFS objective to make farmers the 'experts' in their own fields. This calls for attention for institutional change to foster greater creativity and adaptation among government agencies and other stakeholders.

The two case studies revealed dissimilar institutional arrangements regarding the FFS. In Indonesia, the 'genuine FFS' was implemented by one division (Plant Protection Directorate), through its cadre of Pest Observers, without interaction on the FFS with other divisions (Fig. 4A). The lack of transparency and coordination between divisions obstructed the harmonization of agricultural strategies (Fig. 4B). The extension division used the FFS brand-name for an instructive-type of intervention, thus confusing its farmer audience[9] . The lack of coordination on the FFS between public sector agencies does not work in favour of the FFS. Still, the genuine FFS continues to 'survive' government bureaucracy.

Conversely, in Malawi, FFS programmes were embedded within a decentralized system of agricultural services, with district offices as implementing agency. The addition of topics to the FFS curriculum enabled the collaboration with subject-matter specialists from various district programmes. Hence, the FFS offered a platform for coordination between previously segregated district programmes at field level (Fig. 4C). The multi-stakeholder forums in some projects in Indonesia provided a similar platform that enabled successful pilots to be adopted by others.

The decentralization that took place in both countries could prove to be a factor in support of the FFS, if the local authorities welcome the farmer educational approach. However, there is a risk that local authorities lack political will to support agricultural development, despite its farmer constituency, and instead give precedence to manufacturing and non-agricultural industries (Lubis, 2012). The concept of 'IPM Villages' developed in East Java, Indonesia, underscores that opportunities for connecting the FFS with decentralized governance systems should be explored[10] .

Capacity building of FFS facilitators in season-long (or multi-season) courses is a logistically- and financially demanding prerequisite for FFS programmes (FAO, 2016). Malawi is receiving generous external support for the training of a large cadre of FFS facilitators, which will be an investment for the future (depending on staff retention). In Indonesia, capacity building of Pest Observers and Field Leaders was conducted 25–30 years ago, during the National IPM Programme; no major season-long trainings have since been conducted. In retrospect and judging by the services of this cadre of FFS facilitators, most of whom were retained until retirement age, this has been a worthy investment for the long-term. Considering the renewed pest emergencies, however, a new generation of FFS facilitators is urgently needed. As an educational investment, the relative high unit cost of the average FFS (Braun and Duveskog, 2008; van den Berg and Jiggins, 2007) and the low to moderate scalability through diffusion effects (Waddington et al., 2014; van den Berg et al., 2020b) means that institutional budget allocation must recognize the range and sustainability of effects to farming communities and their environment.

Advocacy has been a weakness of FFS programmes, particularly in Indonesia. Only few experienced field officers were promoted to senior level where they could exercise their influence within the boundaries of plant protection or within their province, but not at national policy level. This cadre of field officers had been selected as a homogeneous group with similar background. Future programmes should consider selecting FFS facilitators from several government divisions and including researchers and ngo staff. A more pluralistic cadre could enrich mutual interactions, harnessing each other's strengths, and increase the prospects for advocacy at national level. Apart from advocacy, the sphere of influence of the FFS can also be expanded through the scope of its curriculum, and use of social media, as has been taking place through diversification of themes reaching into non-agricultural disciplines and social life.

5.3. Role in rural development

Looking at the bigger picture, what is the relevance of the FFS in strategies on rural development? In this regard, the FFS should not be

[9] Still, the segregation of divisions might have helped the FFS survive amidst a technology-centred sector.

[10] However, hurdles will have to be overcome. For example, efforts to implement the FFS-like Science Field Shops through local government in Indonesia were unsuccessful because the budget items of the regional development planning agency did not make reference to farmer education (Y. Winarto, pers. comm, 2018).

viewed as an extension method but as a form of adult education that builds human, social and natural capital (Röling, 2002).

A common feature in Malawi and Indonesia was that FFS alumni groups continued with their learning, experimenting, planning and acting from year to year, and they had future plans. In Malawi, alumni groups who graduated 3–4 years ago had developed to a more advanced level on a range of topics as compared to recently graduated groups who were still planning and testing. Some groups had developed entrepreneurship, farmer cooperatives and market linkages, which helped them raise income and adapt their farming decisions to market demand. In Indonesia, the visited alumni groups kept developing in the realms of farming, environmental services, and village infrastructure development. These findings support the concept of 'local institutionalization' as was envisaged in the spirit of 'Community IPM' (Pontius et al., 2002).

Both case studies involved a strategy that relied on farmers as the main facilitators of the FFS, with government or ngo staff providing supervisory support. A recent global survey indicated that this is mirrored in most FFS programmes (van den Berg et al., 2020). Having FFS run locally by peer farmers increases the scope for upscaling, creates 'critical mass' in localities where farmer facilitators live, supports local ownership, and can sustain the support for alumni groups. Hence, this strategy reinforces the relevance, feasibility, acceptability and sustainability of the FFS.

To advance sustainable development, field officers in Indonesia have been creative by taking advantage of the opportunities offered through decentralization of government. Moreover, ngo's conducted innovative pilot projects that took the FFS model from agriculture into new disciplines, while adding valuable planning tools. Such innovative pilots, when combined with multi-stakeholder forums, are an effective mechanism for introducing participatory methods within programmes of other stakeholders.

The Indonesian IPM farmer association is another example of durable impact of the FFS. This example demonstrated that the FFS has not only influenced existing institutions but has also led to creation of new institutions, with their own mandate, norms and values. Established almost two decades ago, this farmer-based institution and network is active as ever, with a growing coverage and membership, and with numerous small spinoff projects implemented by capable farmer groups, either as self-help or funded initiatives. The long-term impacts demonstrate that an FFS programme, if well designed and implemented, can become a self-propelling movement. Nevertheless, the association apparently has insufficient coverage or influence to facilitate a judicious use of pesticides by farmers at national scale.

Awareness is growing that the technological, or industrial, paradigm to agricultural development cannot continue to be dominant, because the adverse side effects increasingly become manifest and pose serious sustainability concerns (Cassou et al., 2018; FAO, 2017b). Sustainable rural development strategies depend largely on the natural resource base, environmental services, and on the capacity of farmers for adaptive management. In this respect, the FFS model has proven its value for capacitating farmers to make better management decisions and, consequently, for transitioning towards a greener agriculture.

A limitation of this study was that the FFS groups were purposively selected for field visits. However, unlike a programme evaluation, we were principally interested in the potential of the FFS, when implemented according to its key principles. Another limitation was that the information obtained from respondents may have overstated the benefits of the FFS. However, part of the statements could be verified through records or field evidence.

6. Conclusions

The case studies disclosed that the FFS remains highly relevant at field level, to institutions and to rural development in both countries.

At field level, intensified pressures on land and natural resources and the effects of climate change were some of the factors that forced farmers to improve their resilience and adapt their livelihood situation. In the examples, the FFS's gave farmers the opportunity to improve their practices, diversify their farms and income sources, and work together as groups to connect and adapt to markets or manage their natural resources. The experiential learning cycle fostering the skills needed for adaptive management was a central feature in all case examples. In the Malawian context, a wide scope of topics added to the FFS curriculum was crucial for the diversification of farming and income sources. The Indonesian situation with pesticide-induced pest outbreaks indicated that the FFS on IPM were still needed, while in addition, the FFS model was successfully extended to non-agricultural disciplines, with tangible impacts on communities, their villages and their natural environment.

At institutional level, the FFS had been adopted by one government agency in Indonesia, which suggests that the FFS can survive for decades even amidst a predominantly technology-centred agricultural sector. In Malawi, the FFS was 'embedded' and accepted within a decentralized administrative system at district level, where the FFS offered a platform for coordination between previously segregated district programmes. Hence, the FFS has shown to transform the way agricultural services are provided. The difference in institutional arrangements between the two countries highlights the importance of a harmonized support for the FFS among departments or sectors.

As for its contribution to rural development, the FFS and its adult educational methods introduced a process of continued learning and empowerment, thus developing capital in the human, social, natural and financial domains and, in doing so, improved the quality of life and economic well-being among rural communities. Apparently, a learning process also took place among the implicated government agencies and ngo's, because they adapted the FFS to new components and settings and ventured into disciplines beyond agriculture. In the examples provided, the quality of the FFS, the scoping of the curriculum, but also the institutional environment were all elements that determined whether long-term impacts occurred in a given location.

The evidence that the FFS can have valuable and durable contributions to global sustainable development –particularly SDG2 to end hunger, achieve food security and improved nutrition and promote sustainable agriculture– calls for renewed advocacy among national and international stakeholders for policy support of this empowering intervention.

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HvdB and MD declare that they have no conflict of interest. JWK and MF are employed by the Food and Agriculture Organization of the United Nations, an organization which has developed and promoted the Farmer Field School method.

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