

The Impact of Agricultural Extension Services

3ie Synthetic Reviews – SR009

Protocol

January 2010

Review team:

Hugh Waddington, 3ie – Lead Reviewer

Birte Snilstveit, 3ie – Reviewer

Howard White, 3ie – Senior Advisor

Jock Anderson World Bank – Senior Adviser

Contact information:

hwaddington@3ieimpact.org

bsnilstveit@3ieimpact.org

Funding: 3ie

1. Background

In 2002, three out of four poor people in developing countries lived in rural areas, with the majority of them relying, either directly or indirectly, on agriculture for their livelihoods (World Bank, 2007, p. 26). Agriculture plays an important role in both poverty reduction and economic growth. Agriculture remains the main source of income for around 2.5 billion people in the developing world (FAO, 2003, p. 1). The impact of the agricultural sector is wide-ranging and extends to economic growth, food security, poverty reduction, livelihoods, rural development and the environment (Green et al., 2005). Moreover, the poorest half of the population benefits significantly more from agricultural growth than growth in other sectors of the economy (UN, 2008; World Bank, 2007). Nevertheless, despite evidence that investment in agriculture has beneficial impacts on agricultural growth and poverty reduction (Fan and Rao, 2003), since 1980 there has been a decline or stagnation in public expenditure on agriculture in most developing countries (Akroyd and Smith, 2007).¹ Likewise, the proportion of official development assistance (ODA) going to agriculture has also declined from around 18 per cent in 1979 to 3.5 per cent in 2004 (World Bank, 2007, p. 41).

Agricultural extension and advisory services play an important role in agricultural development and can contribute to improving the welfare of farmers and other people living in rural areas. Anderson (2007) defines the terms agricultural extension and advisory services as “the entire set of organisations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods” (p. 6). Extension services can be organised and delivered in a variety of forms, but their ultimate aim is to increase farmers’ productivity and income. According to Anderson and Feder (2003) productivity improvements are only possible when there is a gap between actual and potential productivity. They suggest two types of ‘gaps’ contribute to the productivity differential – the technology gap and the management gap. Extension can contribute to the reduction of the productivity differential by increasing the speed of technology transfer and by increasing farmers’ knowledge and assisting them in improving farm management practices (Birkhaeuser et al., 1991; Feder et al., 2004b). Additionally, extension services also play an important role in improving the information flow from farmers to scientists (Anderson, 2007; Birkhaeuser et al., 1991).

A range of approaches to extension delivery have been promoted over the years. Early models focusing on transfer of technology using a ‘top-down’ linear approach were criticised due to the passive role allocated to farmers, as well as the failure to factor in the diversity of the socio-economic and institutional environments facing farmers and ultimately in generating behaviour change (Chambers and Ghildyal, 1984; Birner et al., 2006). A number of models have been implemented since the 1970s, combining approaches to outreach services and adult education, including the World Bank’s Training and Visit (T&V) model (Anderson et al., 2006), participatory approaches (for example, Hagmann et al., 1999), and most recently farmer field schools (FFSs) (van den Berg and Jiggins, 2007). Additional extension modalities include ICT-based delivery which provides advice to farmers on-line and other approaches such as the promotion of model farms (Birner et al., 2006).

While there is a large literature dealing with issues related to agricultural extension in developing countries, rigorous impact evaluations (IEs) of agricultural extension interventions are less common. This is partly due to the complexity of evaluating such

¹ Asia is the only region where real public expenditure on agriculture increased between 1980 and 2002 (United Nations, 2008).

interventions in the face of the wide range of additional factors that influence agricultural outcomes – including agro-ecological climate, weather events, availability and prices of inputs, market access, farmers' characteristics, and so on. In addition, biases inherent in attributing the impact of extension services on agricultural production mean that measured effects might result from pre-existing differences rather than the programme under evaluation (Wu et al., 2005). Romani et al. (2003) highlight three common types of bias. Endogenous placement bias may occur where programmes are situated in areas seen as more likely to be receptive to extension services. Selection bias occurs where skilled and knowledgeable farmers are more likely to seek out extension services and, although this source of bias may be reduced if extension agents initiate contact with the farmers, agents themselves may also rather work with more experienced farmers. Simultaneity bias arises in the sample of farmers visited by extension services if farmers only contact extension agents when they have problems. These biases are well known, but nevertheless, the analyses used in most evaluations do not allow for their control.

Nevertheless, evaluations and meta-evaluations have been conducted, as summarised in a number of literature reviews (Birkhaeuser et al., 1991; Evenson, 1997; Purcell and Anderson, 1997; Anderson and Feder, 2003; Anderson, 2007; van den Berg and Jiggins, 2007) and one meta-analysis (Alston et al., 2000). Most of these studies draw on data that were not collected to high quality standards of impact evaluation – that is, utilising experimental or quasi-experimental design in attributing the impact of extension services on outcomes of interest.

Birkhaeuser et al. (1991) identified 48 studies conducted in 17 countries assessing the effect of several aspects of extension, including knowledge diffusion, adoption of improved technology and productivity. Their analysis suggests that extension can have a significant relationship with these outcomes and while only five studies from developing countries included estimates of the rate of return to investments, these suggest rates of return to extension can be very high. However, most of the included studies rely on survey data from one point in time and typically use multivariate (limited dependent variable) estimation techniques, with inadequate control for sample selection bias. Purcell and Anderson (1997) assessed the impact of World Bank support to the development of national research and extension systems in the 1980s and 1990s. The study concludes that, despite serious limitations in the systems receiving support, there have been significant positive effects of World Bank interventions. However, this is also based on a review of project completion reports rather than impact evaluative evidence.²

Alston et al. (2000) provide an extensive review of the economic returns to investment in agricultural research and development. The analysis included over 1,128 estimated rates of return, and while 512 of these were for research and extension, only 18 were from extension-only investments. The results of the analysis showed an average rate of return of 47 per cent for research and extension investments, while for extension-only investments this was 80 per cent. However, as with other reviews, the methodology of the included studies is varied and few follow high quality impact evaluation methodologies. In a review of 57 studies, Evenson (1997) reported rates of return to extension of greater than 50 per cent for the majority of countries but also found that returns varied widely.

² Project completion reports are outcome monitoring documents produced by the Bank's project management teams. They provide an internal evaluation of the project's effectiveness and provide an overall rating of 'unsatisfactory', 'satisfactory' or 'highly satisfactory' depending on the extent to which the project's objectives have been achieved.

Anderson (2007) includes a critical review of the formal, grey and emerging literature on the impact of different approaches to extension, including various governance structures, approaches to capacity and management and advisory methods. The review highlights the lack of knowledge of the impacts and cost-effectiveness of new reforms and concludes: "the existing studies do not make it possible to identify which of those reform elements is effective under which circumstances" (Anderson, 2007, p. 26). In a review of the training and visit (T&V) system, including some evidence based on rigorous impact evaluations, Anderson et al. (2006) analyse the challenges and causes of its lack of sustainability and eventual abandonment. They identify a number of limiting characteristics of public extension systems, and suggest that high costs combined with the lack of convincing evidence of major gains attributable to extension are the likely factors that induced the fall of T&V.

Since the 1980s, the approach to extension service delivery has drawn increasingly on more participatory methods. The main objective of participatory approaches to agricultural extension is to empower farmers where the role of extensionists shifts from 'teachers' to 'facilitators' in this process.³ Unfortunately, evidence assessing impact of such methods appears limited at best, but initial searches identified an evaluation of a participatory group extension approach in Egypt (Hannover and El Wafa, 2003).

Since the emergence of the Farmer Field School (FFS) approach in Indonesia in the late 1980s, this approach to extension has become increasingly widespread and has been introduced in some 78 countries (van den Berg and Jiggins, 2007). The FFS approach draws on the participatory approach in terms of its focus on farmer experimentation and problem solving. Van den Berg (2004) provides a synthesis of 25 evaluation studies of integrated pest management (IPM) FFSs. Most studies focused on rice and measured immediate impact of the FFSs in terms of reduced pesticide use and changes in yields, reporting considerable reductions in pesticide use, with some studies also showing an increase in yields. However, in common with other reviews of extension services, the methodology of the studies is varied, highlighting the complexity of estimating impact for such interventions and the lack of an agreed conceptual framework for doing so. The review revealed that studies were either designed to be statistically rigorous, but with limited scope, or comprehensive, but with limited coverage. Van den Berg (2004) argues that by combining the results of different sources the comprehensiveness of the overall evaluation was improved. Building on the latter, Van den Berg and Jiggins (2007) review studies evaluating FFS and pest management, finding that FFSs have had additional benefits to that of IPM including facilitating collective action, leadership, organisation and improved problem-solving skills. Noting that discussions on the fiscal sustainability of FFSs should include considerations of who will pay for the externalities of pesticide use, they conclude that the evidence gathered in the review suggests that FFSs can be a cost-effective way of increasing farmers' skills and thus contributing towards escaping poverty.

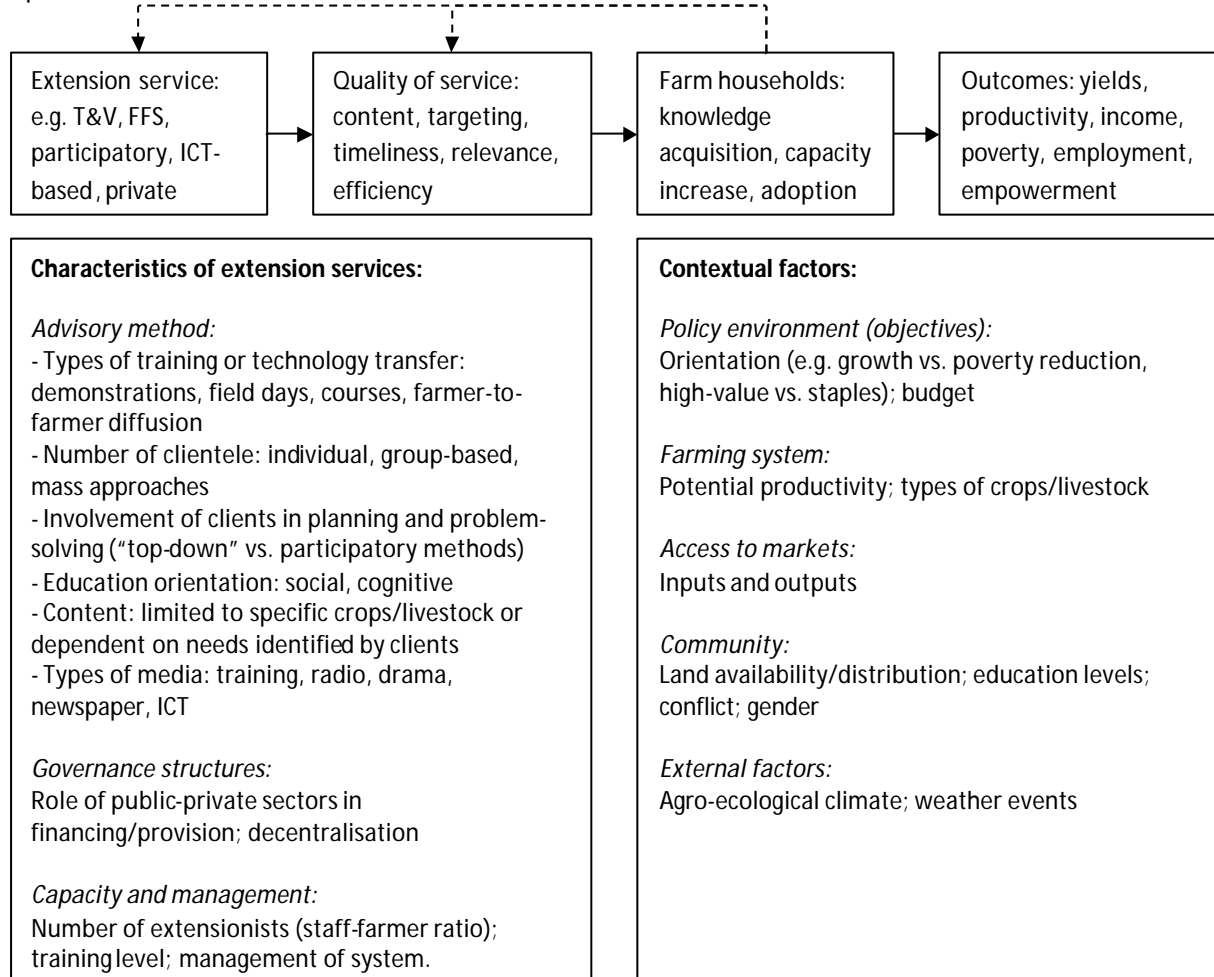
However, discussing the fiscal sustainability of the FFS approach to extension, focusing on Indonesia and the Philippines, Quizon et al. (2001) reached a different conclusion. Noting that lack of fiscal sustainability has been described as a generic problem affecting many large-scale public extension services, the authors conclude that FFSs face the same issues

³ There are four main phases in the operationalisation of participatory extension: social mobilisation, in which communities are assisted in identifying and prioritising needs and problems; community-level action planning, in which actionable solutions are identified; implementation and farmer experimentation; and monitoring and sharing of experiences (Hagmann et al., 1999). Participatory approaches also need to focus on supporting representation in development fora to foster community links with service providers and political structures (Birner et al., 2006).

as other approaches. The cost per farmer is high and the evidence from Indonesia suggests there is a low rate of informal diffusion. They suggest that as the situation for farmers, in terms of political power, governance systems and day-to-day interactions among farmers, is quite similar in many other developing countries in Asia and Africa, the results are relevant for discussions of similar extension activities in these areas. They warn that while pilot projects might indicate the viability of the FFS approach in certain circumstances, the issue of fiscal sustainability may be particularly relevant when scaling up.

A wide range of factors are likely to influence effectiveness of agricultural extension services. Figure 1 presents the basic elements of the causal chain from extension service delivery inputs through indicators of service quality, farmer uptake and agricultural outcomes, together with the underlying characteristics of extension services and contextual factors influencing knowledge acquisition, uptake and effectiveness.

Figure 1 Causal model and characteristics of services and underlying conditions influencing uptake and effectiveness



Source: Birner et al. (2006).

The effectiveness of the extension system in fostering capacity building, technological adoption and ultimately improved agricultural outcomes depends on key factors relating to the advisory methods used, the governance, capacity and management structures of the

extension system, as well as underlying contextual factors such as the policy environment, market access, characteristics of beneficiary communities and weather conditions. As noted in Birner et al. (2006), the reasons for effective service delivery will be diverse, including the appropriateness of the advisory methods, the capacity and numbers of extensionists, and the management and governance structures of the organisations delivering the services. And as highlighted by participatory models in particular, effectiveness may be also influenced by the degree of feedback (indicated by the dashed arrows in Figure 1) and the mechanisms of delivery of information from farmers to the research and extension system, and thus the role of farmers in formulating demand and their ability to exercise voice. This may depend in turn on the degree of decentralisation, the ratio of extensionists to farmers, a responsive management approach, and indeed the use of participatory advisory methods (ibid.). The policy environment determines the overall orientation of the advisory service, the degree of resources devoted to it and the types of farmers targeted. Characteristics of local communities, such as heterogeneity in terms of land- and asset-holdings, ethnicity, education, gender roles and the degree of social exclusion, will determine the ability of the extension services to penetrate communities and reach the disadvantaged, and the degree of farmer-to-farmer diffusion. Finally, all of these factors, together with market access and weather conditions will determine the degree of adoption of techniques and final outcomes such as yields (for example, production per unit of land), income and empowerment.

2. Objectives

The objective is to provide a synthetic review of literature examining the effectiveness of interventions in agricultural extension and advisory services in fostering improved outcomes for farmers, and the reasons for differing levels of effectiveness in different contexts.

3ie synthetic reviews are conducted to Campbell/Cochrane Collaboration standards of systematic review (Higgins and Green, 2009), while also emphasising variation in programme outcomes arising from the context in which the intervention is carried out, as well as the behavioural mechanisms which underlie social change (Pawson, 2006). Van der Knapp et al. (2006) provide an example of a review following this approach, and in a recently completed synthetic review of the impact of water, sanitation and hygiene interventions on childhood diarrhoea (Waddington et al., 2009) we synthesise information along the causal chain from outputs through to outcomes.

The review will aim to synthesise quantitative estimates of effectiveness of extension interventions relating to intermediate outcomes such as knowledge acquisition, adoption and diffusion of technology, and final outcomes such as agricultural yields, household income and poverty status. Because of the diversity of local agro-ecological conditions and farming systems across, and even within, developing countries, the specific technology, crops and management techniques recommended by extension programmes will be different depending on the local context and needs of the farmers. Therefore, the focus of the Review will be on extension as a *mechanism or tool* for improving farmers' knowledge and management practices in a way that leads to improved agricultural productivity, incomes and welfare for farm households.

The review will also provide special focus on farmer field schools (FFSs), the extension modality which has received much attention from policy makers in recent years. In addition to information collected from IEs, the synthetic review will conduct a systematic search and synthesis of quantitative and qualitative literature examining the facilitators or determinants of, and barriers to, effectiveness of FFS interventions using a thematic approach. The

qualitative evidence will not be used in the effectiveness synthesis, but the findings from these two arms of the study will be brought together in an attempt to understand why, how and in which contexts agricultural extension interventions are effective (Noyes et al., 2008). Development programmes implement complex interventions in a range of different contexts, making the limitations of a systematic review focusing solely on effectiveness particularly apparent. For the review to be more useful for policy-makers and practitioners it is essential that syntheses also provide insights into why and how interventions are successful or not in achieving their intended outcomes. Context-mechanism-outcomes configurations will guide our overarching framework, and will use more established approaches to qualitative evidence synthesis, particularly meta-ethnography and/or thematic synthesis (Mays et al., 2005; Noblit and Hare, 1988; Thomas and Harden, 2008), in an attempt to operationalise the approach while remaining true to the standards of systematic review set out by the Campbell/Cochrane Collaborations.

3. Study team

Hugh Waddington (literature search, literature review, study coding, data analysis, write-up) manages the 3ie Synthetic Reviews Programme, was principal investigator of a synthetic review of water and sanitation evaluations (Waddington et al., 2009) and has previous experience in impact evaluation and meta-analysis in the areas of health and nutrition at the World Bank (Charmarbagwala et al., 2004; OED, 2005).

Birte Snilstveit (literature search, literature review, study coding, write-up) is the 3ie Synthetic Review Programme's Research Assistant, with previous experience in synthetic review (Waddington et al., 2009). She holds an MA in Political Economy of Development, training in research methods and an interest in social analysis of poverty and development.

Dr Howard White (technical advisor) is the Executive Director of 3ie, previously at the Independent Evaluation Group of the World Bank and Fellow of the Institute of Development Studies, University of Sussex. He is a proponent of theory-based impact evaluation design and has led a number of impact evaluations in the areas of education, health, rural development and rural electrification. He also has experience of meta-evaluation and meta-analysis (for example, Charmarbagwala et al., 2004; IEG, 2008; Waddington et al., 2009).

Dr Jock Anderson (technical advisor) has over 40 years' experience in agricultural development research and policy, including positions as Professor of Agricultural Economics at the University of New England, Armidale, Australia and Evaluation Adviser at the World Bank. He has written extensively on agricultural extension, including a number of recent review articles (see, for example, Anderson, 2007).

4. Methods

The Review aims to synthesise both quantitative and qualitative information relating to effectiveness of agricultural extension interventions and the reasons underlying this. The Review will aim to synthesise data from studies providing quantitative estimates of effectiveness of agricultural extension and advisory service interventions and studies examining reasons for implementation success or failure. The study will therefore aim to synthesise both quantitative estimates of impact - measured by effectiveness in fostering farmers' knowledge acquisition, adoption of technological improvements or enhanced productivity - and quantitative and qualitative information following a programme theory

approach, focusing on factors underlying the extent of service delivery quality, technological adoption and diffusion, and sustainability.

4.1 Study selection criteria

Quantitative effectiveness studies

Studies eligible for inclusion in quantitative synthesis are rigorous impact evaluations (IEs), based on experimental design (randomised assignment to the intervention) or quasi-experimental design, including those based on statistical matching methods such as propensity score matching (PSM) or studies based on survey data that use multivariate techniques with adequate control for confounding variables and statistical methods to account for sample selection bias, such as instrumental variables and difference-in-difference estimation. Conversely, studies that do not attempt to control for these factors will be excluded from quantitative synthesis. Articles will be selected that:

- report specific interventions providing agricultural extension and advisory services;
- are conducted in developing (low- or middle-income) countries;
- are based on data collected at the farm or household level;
- estimate impact on farmers' knowledge, including farmer-to-farmer diffusion, adoption of improved technology, and/or outcomes such as agricultural yields, incomes and poverty status.

This review limits the definition of extension and advisory services to those modalities focusing on providing information or education on improved techniques, inputs or produce, as opposed to those addressing issues related to marketing of produce, such as provision of information on prices (for example, Jensen, 2007). The study will include those interventions which provide extension as defined here in combination with additional interventions, such as credit and market linkages, as in Ashraf et al. (2008).

Initial searches returned 14 quantitative IEs which are likely to meet the inclusion criteria, 8 of which examine farmer field schools: Ashraf et al. (2008); Cerdan-Infantes et al. (2008); Feder et al. (2004); Godtland et al. (2004); Khan et al. (2005); Khan and Iqbal (2005); Mancini (2006); Nkonya et al. (2008); Owens et al. (2001); Reddy and Suryamani (2005); Romani (2003); Wu et al. (2005); Yamazaki and Resosudarmo (2008); Yang et al. (2008). Information on these studies is summarised in Appendix 1. The searches also returned a number of additional evaluations suffering from methodological weaknesses, such as lack of control for endogenous programme placement and selection bias (Bindlish et al., 1993; De Jager et al., 2006; Huan et al., 1999; Rola et al., 2002; Tripp et al., 2005). The nature of agricultural extension interventions is seen to make randomisation difficult and most evaluations therefore tend to use quasi-experimental methods including designs using regression analysis and survey data. Only one evaluation involving randomised assignment of an intervention aiming to assist farmers in adopting and marketing export crops by providing advisory services, credit and marketing assistance has been identified (Ashraf et al., 2008).⁴ A common weakness with the identified IEs is that they mostly rely on relatively small samples and often provide little information on the control group apart from that there is no intervention in the village. Moreover, the inclusion of details of the intervention itself is varied and often limited. We therefore envisage contacting study authors to elicit further details and conduct additional searches for programme/project documentation.

⁴ This is common across agricultural interventions. Duflo et al. (2006), Duflo et al. (2009) and Gine and Yang (2009) appear to be the only other impact evaluations in the field of agriculture that use randomised assignment.

Non- IE studies

The in-depth analysis of farmer field school (FFS) interventions will draw on the quantitative IEs, including any background programme/project documentation which we are able to obtain on the interventions related to the IEs. Furthermore, additional non-IE studies will be drawn on which report results of primary data analysis. Methods for assessing inclusion status and study quality in qualitative synthesis are still under development, and there is no universally-agreed methodology for doing so. We will adopt a two-stage approach to inclusion of non-IE evidence, which, in addition to removing studies based on the usual relevance criteria (intervention, population, relevance to research question, study type and location), removes studies of particularly low quality in the first round (Thomas et al., 2003; Spencer et al., 2003). Assessments of quality are then made in the second round, which can then be used in sensitivity analysis of findings. The two-stage approach with minimum quality criteria is useful in that studies suffering from clear methodological flaws are excluded at an early stage and one avoids having to go through full data extraction and quality appraisal, which can be laborious for an unnecessarily large number of studies. Drawing on Thomas et al. (2003), and having reviewed CASP and Spencer et al. (2003), we have developed a similar two-stage approach to quality appraisal for the review of qualitative studies on farmer field schools (see Appendix 2).

Studies eligible for inclusion are based on quantitative, qualitative or mixed methods of analysis that:

- report specific interventions providing agricultural extension and advisory services;
- are conducted in developing (low- or middle-income) countries;
- are based on primary data collected from clients, extension agents or experts;
- assess determinants/facilitators of, or barriers to, at least one of the following: service delivery quality; knowledge acquisition and/or diffusion; adoption of technological improvements; sustainability;
- report at least some information on all of the following: the research question, procedures for collecting data, sampling and recruitment, at least two sample characteristics.

A number of studies have been identified examining factors underlying effectiveness of FFSs using mixed methods of research. Drawing on Rogers' (2005) theory of the diffusion of innovations, Feder and Savastano (2006) assess the characteristics and influence of opinion leaders on the diffusion of new knowledge in the context of the FFS programme in Indonesia. They find excessive socio-economic distance between opinion leaders and followers reduces the effectiveness of diffusion. Johnson et al. (2003) assess the technological, economic, human and social impacts of involving participatory methods in extension service delivery, including FFSs in Indonesia, suggesting participation resulted in more relevant technologies and higher economic impact. Similarly, Simpson and Owens (2002) report on the findings of qualitative research conducted on FFSs in Ghana and Mali, including group and individual interviews with stakeholders, and finding that programmes paying more attention to consultations with farmers to identify local needs tended to result in greater adoption and impact.

4.2 Search Methods for Identification of Studies

Electronic Searches

Because of the relatively specific nature of the interventions, combined with the limited numbers of hits in preliminary searches, we will search using the following broad terms: 'farmer field school*' OR 'agricultural advisory service*' OR 'training and visit' OR 'integrated pest management' OR 'agricultural extension' OR 'rural extension' OR 'participatory extension'. The following databases will be searched: AgEcon, CAB Abstracts, Social Science Citation Index, International Bibliography of Social Science, EconLit, US National Agricultural Library, JOLIS, BLDS, IDEAS. Google, Google Scholar, Networked Digital Library of Theses and Dissertations Index to Theses and the ProQuest dissertation database will also be searched to ensure maximal coverage of unpublished literature.

To identify quantitative impact evaluations, we will combine the following terms using Google and Google Scholar (in other words, 7 separate searches): ('farmer field school*' OR 'agricultural advisory service*' OR 'training and visit' OR 'integrated pest management' OR 'integrated nutrient management' OR 'integrated production and pest management' OR 'integrated crop management' OR 'agricultural extension' OR 'rural extension' OR 'participatory extension') AND (evaluation OR impact OR effectiveness). For the detailed examination of farmer field schools, we will use the following broad terms using Google and Google Scholar: 'farmer field school*' OR 'Integrated pest management' OR 'integrated nutrient management' OR 'integrated production and pest management' OR 'integrated crop management'. Searches of Google and Google Scholar will be limited to the first 1,000 hits sorted by relevance.

For all other databases, we will use the general search terms ('farmer field school*' OR 'agricultural advisory service*' OR 'training and visit' OR 'integrated pest management' OR 'agricultural extension' OR 'rural extension' OR 'participatory extension').⁵

Although we have pre-selected a number of 'themes' relating to the causal chain (knowledge, adoption, diffusion), which we were originally going to pair with these broader terms, we decided we would allow for broader searches which may subsequently determine the themes iteratively through the papers identified.

The initial search will be limited to titles and abstracts, and references for papers on which full text copies are sought will be entered into reference management software Refworks.

Hand search and reference snowballing

We will conduct bibliographic back-referencing and citation tracking of included studies and conduct a hand-search of relevant journals and shelves at the library of the University of Birmingham, UK. Finally, we will identify and contact key researchers and organisations working in the field of agricultural extension, including IFAD, IFOAM, ICARDA, Agricultural program IFAP, Environment and Society (Essex University), ODI (Agricultural research and extension network), IEG, IDRC, CGIAR research centres (including IFPRI), FAO, Inmasp, Global IPM Facility, Poverty Action Lab, World Bank, Environment for Development, Practical Action, Oxfam, FarmAfrica, and key bilateral donors.

⁵ Many of these search terms have been taken from the keywords of identified articles.

4.3 Data Collection and Analysis

The following data, where available, will be extracted for each included study:

General information	Author, publication date, publication type, funding agency, author affiliation.
Intervention design	Intervention type, methods of service delivery, time period and frequency of intervention, governance structures, capacity and management, additional interventions provided.
Study design	Study type, description of treatment and comparison group, method, frequency and period of data collection, allocation method, sample size, sample attrition, spillovers, contamination.
Study quality	IEs: high quality/low quality assessment (see below). Non-IEs: see Appendix 2.
Context	Country, location, confounding variables, community characteristics, agro-ecological climate and weather, baseline input use, market access.
Intermediate outcomes	Knowledge acquisition by farmers, farmer-to-farmer diffusion of knowledge, technological adoption.
Final outcomes	Yields, income, poverty status.
Qualitative/quantitative information	Information relating to thematic synthesis: including determinants of, and barriers to service delivery quality, diffusion of information, adoption of technological improvements, sustainability.

Impact data will be collected from each reference selected for review including on computation procedure of the outcome variable, and the estimated effect and 95 per cent confidence interval. The review will stratify extension and advisory services into groups of related interventions, including those examining FFSs, T&V, decentralised service delivery and privatised or fee-for-service delivery (following Anderson and Feder, 2003). Information will also be collected on additional agricultural interventions (for example, access to inputs such as credit) carried out simultaneously, in an attempt to assess whether, or under which circumstances, additional complementary interventions are necessary.

Studies will also be classified as of high or low quality. 'High quality' IEs are those based on experimental or quasi-experimental data, in which comparison groups are described adequately (in particular in respect of the nature of the interventions being received) and in which clear measurement of and control for confounding variables is made. 'Low quality' IEs are those with inadequate or inadequately described comparison groups, no control for sample selection bias, or no clear measurement or control for confounding variables. For the in-depth analysis of FFSs, we will use a check-list to assess quality of non-IE studies,

making judgements on the adequacy of the data collection, presentation, analysis and conclusions drawn, as shown in Appendix 2 (and drawing on CASP, 2006).

4.4 Data Synthesis

Synthesis of quantitative effectiveness estimates

Quantitative evidence from impact evaluations will be synthesised by random effects meta-analysis, using STATA software (STATA Corporation, College Station, TX, USA). The meta-analysis estimates and 95% confidence intervals will be presented for each category and sub-category of study, together with forest plots. Where appropriate, sub-group analysis will be performed to examine heterogeneity among study results arising from differences in study design and quality, effects of location and baseline conditions, and characteristics of the population being treated. Statistical tests for publication bias and heterogeneity will be carried out as appropriate.

Synthesis of non-IE evidence on FFSs

Systematic reviews have largely focused on synthesising evidence on effectiveness from quantitative research. However, the contribution of different types of evidence, including qualitative research evidence, is increasingly recognised in methodological discussions on systematic reviews. Pope et al. (2007) suggest that “for the more complex questions facing policy- and decision-makers a myriad of other forms of evidence in the widest sense – including qualitative research, non-trial based quantitative research, views of stakeholders and expert panels – will potentially be relevant” (p. 12). In addition to the synthesis of quantitative data on effectiveness, the review will also provide a synthesis of quantitative and qualitative evidence relating to the underlying factors that determine or hinder the effectiveness of FFSs. As yet there is no agreed framework for the synthesis of diverse forms of evidence, such as quantitative and qualitative research findings. Thus, we will draw on a number of methods for qualitative synthesis suggested in the literature, such as realist synthesis, thematic synthesis and meta-ethnography (Noblit and Hare, 1988; Pawson 2006; Pope et al., 2007; Thomas et al., 2008).

A matrix will be constructed identifying determinants or facilitators of, and barriers to, effectiveness, organised under the preliminary themes of service delivery quality, knowledge acquisition, farmer-to-farmer diffusion, adoption of technology and sustainability. Other themes emerging from the primary studies will also be included. We will then attempt to draw on the idea of a ‘lines of argument’ synthesis suggested by Noblit and Hare (1988) by comparing and contrasting findings from different study contexts, with the aim of discovering “a ‘whole’ among a set of parts” (Noblit and Hare, 1988, p. 63). The implications of these findings for programme planning will then be discussed.

5. Plans for Updating the Review

The review will be updated after a period of 36 months, or once a significant amount of new primary study evidence is available.

6. Timeframe

Searches for studies: January-March 2010.

Assessment of relevance of studies: February-April 2010.

Extraction of data: March-May 2010.

Quantitative and qualitative synthesis: June-July 2010.

Preparation of draft report: August 2010.

Dissemination: September-November 2010.

Revision of draft report: December 2010.

7. Statement Concerning Conflict of Interest

There are no conflicts of interest to declare arising from researcher interest or financial sources.

8. Appendix 1 Impact evaluations identified in preliminary searches

Study	Location	Description of intervention	Study arms	IE methods	Outcomes measured
Ashraf et al (2008)	Kenya	Scheme encouraging small-holder farmers to produce horticultural export crops, providing training as well as links to exporters, commercial banks, retail providers of farm inputs and transportation services. Implementing NGO initially provides orientation course to farmers on the process of producing for export, where farmers learn about the need to employ good agricultural practices on their farms to ensure the quality and safety of their produce. In the credit-treatment group, the NGO also helps coordinate in-kind loans from agricultural retailers.	(1) Extension (incl market linkages) (2) Extension (incl market linkages) + credit (3) Control	Cluster-RCT, difference-in-difference estimator	Adoption of inputs and export crop production, value of harvest, household income, follow-up
Cerdan-Infantes et al (2008)	Argentina	Extension programme providing advice on grape production, such as irrigation, fertilisers and pruning	(1) Extension (2) Control; programme offered to all grape producers, farmers participated on voluntary basis.	PSM, panel data fixed effects regression	Yield, quality of produce
Feder et al. (2004a, b)	Indonesia	Farmer field schools (FFS) providing training on integrated pest and crop management to rice farmers, typically involving 8-12 weeks of non-formal training focusing on problem solving approaches and knowledge transfer	(1) FFS (2) Control receiving traditional extension services; FFS location based on village accessibility and presence of active farmer groups	Panel data difference-in-difference estimator	Adoption (pesticide use), farmer-to-farmer diffusion, yields
Godtland et al. (2004)	Peru	FFS providing training on IPM to potato farmers	(1) FFS (2) traditional extension (3) synthetic control	PSM, Heckman	Knowledge of IPM practices
Khan and Iqbal (2005)	India	FFS providing training on IPM to cotton farmers (group activities carried out over 22 training sessions during crop production season)	(1) FFS attendees (2) non-FFS exposed farmers (3) control	Matching, panel data difference-in-difference estimator	Knowledge and beliefs, decision-making capacity, adoption (pesticide use), productivity, income

Study	Location	Description of intervention	Study arms	IE methods	Outcomes measured
Khan et al (2005)	Pakistan	FFS providing training on IPM to cotton farmers	(1) FFS attendees (2) non-FFS exposed farmers (3) control	Matching, panel data difference -in- difference estimator	Farmers' knowledge, decision-making capacity, knowledge retention, adoption, income
Mancini 2006, Mancini et al 2008	India	FFS providing training on IPM to cotton farmers	(1) FFS attendees (2) non-FFS exposed farmers (3) control	Matching, panel data difference -in- difference estimator	Farmers' knowledge, adoption (pesticide use), yield, health, gender and social implications, labour allocation, environmental impacts.
Nkonya et al, 2008	Nigeria	Community driven development agricultural project in Nigeria. Interventions include demand-responsive advisory services (support for services that will enable beneficiaries to adopt output enhancing techniques and more profitable marketing practices), as well as rural infrastructure investment, productive asset acquisition support, capacity building and conflict resolution	(1) Programme beneficiaries (2) control	PSM, difference -in- difference estimator	Provision and use of demand driven services, income poverty, access to infrastructure and productive assets, capacity building, conflict resolution.
Owens et al, 2001	Zimbabwe	Extension to resettlement areas; activities undertaken through group meetings and individual farm visits, typically focusing on crop spacing, fertiliser application, but also fallowing, field contouring and crop rotation.	(1) Beneficiaries (2) control (no access to extension)	Panel data difference -in- difference estimator	Yield, value of production
Reddy and Suryamani (2005)	India	IPM FFS to cotton farmers	(1) Beneficiaries (2) control (unclear extension access)	Matching, panel data difference -in- difference estimator	Farmers' knowledge, skills, adoption of IPM practices, diffusion
Romani, 2003	Cote d'Ivoire	Extension services provided through network of agents and agronomists residing in villages who are in charge of creating and running contact groups and of diffusion of innovation themes and techniques, providing advice on	(1) Beneficiaries (2) Control (not registered in prog)	Panel data fixed effects estimator	Cocoa, coffee and food crop yields, revenue

Study	Location	Description of intervention	Study arms	IE methods	Outcomes measured
		fertilisation and pesticide treatments, creation of plant nurseries.			
Wu et al (2005)	China	FFS	(1) FFS graduates (2) non-FFS exposed farmers (3) control	Matching, panel data difference-in-difference estimator	Adoption (pesticide use), yield, profit
Yamazaki and Resosudarmo, 2008	Indonesia	IPM FFS	(1) FFS attendees (2) non-FFS exposed farmers (3) control receiving traditional extension services	Single difference estimator	Diffusion, adoption, yield
Yang et al., 2008	China	FFS and conventional extension to provide training on pest management techniques to vegetable farmers	(1) FFS attendees (2) control (receiving conventional extension)	Panel data difference-in-difference estimator	Knowledge acquisition and decision-making ability

9. Appendix 2 Non-IE study inclusion and quality assessment criteria

Stage 1 (study inclusion)

Is the paper related to some form of agricultural extension?

Does the paper report on primary research, collected from clients, extensionists or experts?

Is the research undertaken in a developing country?

Does the study assess determinants/facilitators of, or barriers to:

- service delivery quality?
- knowledge acquisition and/or diffusion?
- adoption of technological improvements? and/or
- sustainability?

Does the study report at least some information on all of the following:

- research question;
- procedures for collecting data;
- sampling and recruitment; and
- at least two sample characteristics?

Stage 2 (study quality)

Is the aim of the research clearly stated?

Is there a clear link to relevant literature/theoretical framework?

Does the paper include a clear description of:

- the context?
- the sample selection?
- methods for data collection and recording?
- methods of analysis?

If the findings are based on quantitative analysis of survey data, are multivariate techniques used to control for potential confounding variables?

Are the findings supported by the data?

Are the analysis and conclusions based on the findings from the research?

Does the paper discuss ethical considerations related to the research?

10. References

Akroyd, S. and Smith, L. (2007), 'The decline in public spending to agriculture – does it matter?', Briefing Note, No. 2, Oxford Policy Management Institute, Oxford.

Alston, J.M., Wyatt, T.J., Pardey, P.G., Marra, M.C. and Chan-Kang, C. (2000), 'A Meta-Analysis of Rates of Return to Agricultural R&D – Ex Pede Herculem', IFPRI, Washington D.C.

Anderson, J.R. (2007), 'Agricultural Advisory Services', Background Paper for the World Development Report 2008.
http://siteresources.worldbank.org/INTWDR2008/Resources/2795087-1191427986785/Anderson_AdvisoryServices.pdf

Anderson, J.R. and Feder, G. (2003), 'Rural Extension Services', World Bank Policy Research Working Paper 2976, World Bank, Washington D.C.
http://econ.worldbank.org/files/24374_wps2976.pdf

Anderson, J. R., Feder, G. and Ganguly, S. (2006), 'The Rise and Fall of Training and Visit Extension: An Asian Mini-drama with an African Epilogue', World Bank Policy Research Working Paper 3928, World Bank, Washington D.C.
<http://ideas.repec.org/p/wbk/wbrwps/3928.html>

Asraf, N., Gine, X. and Karland, D. (2008), 'Finding Missing Markets (and a disturbing epilogue): Evidence from and Export Crop Adoption and Marketing Intervention in Kenya', available from: <http://ideas.repec.org/p/wbk/wbrwps/4477.html>

Bindlish, V., Evenson, R. and Gbetibouo, M. (1993), 'Evaluation of the T&V-Based Extension in Burkina Faso', World Bank Technical Paper Number 226, Africa Technical Department Series, World Bank, Washington D.C.
<http://ideas.repec.org/p/fth/wobate/226.html>

Birkhaeuser, D., Evenson, R. E. and Feder, G., (1991), 'The Economic Impact of Agricultural Extension: A Review', *Economic Development and Cultural Change*, 39, pp. 607-650.

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., Mbabu, A., Spielman, D., Horna, D., Benin, S. and Cohen, M. (2006), 'From "Best Practice" to "Best Fit": A Framework for Analyzing Pluralistic Agricultural Advisory Services Worldwide', DSGD Discussion Paper No. 37, IFPRI, Washington D.C.
<http://www.ifpri.org/DIVS/DSGD/dp/dsgdp37.asp>. Published version: *Journal of Agricultural Education and Extension* 15 (4), pp. 341-355, December 2009.

Cerdán-Infantes, P., Maffioli, A. and Ubfal, D. (2008), 'The Impact of Agricultural Extension Services: The Case of Grape Production in Argentina', Office of Evaluation and Oversight Working Paper OVE/WP-0508, Inter-American Development Bank, Washington D.C. <http://ideas.repec.org/p/idb/ovewps/0508.html>

Chambers, R. and B.P. Ghildyal (1984), 'Agricultural Research for Resource-poor Farmers: The "Farmer First and Last" Model', Paper for the National Agricultural Research Project Workshop, Hyderabad, India.

Charmarbagwala, R., Ranger, M., Waddington, H. and White, H. (2004). 'The Determinants of Child Health and Nutrition: A Meta-analysis', OED Working Paper. World

Bank, Washington, D.C.
http://siteresources.worldbank.org/INTEDS14/Resources/child_health_nutrition.pdf

Critical Appraisal Skills Programme (CASP) (2006) '10 questions to help you make sense of qualitative research', Public Health Resource Unit, England 2006.
http://www.phru.nhs.uk/Doc_Links/Qualitative%20Appraisal%20Tool.pdf

De Jager, A., Onduru, D.D., Gachimibi, L.N., Muchena, F., Gachini, G. and Van Beek, C.L. (2006), 'Farmer Field Schools for rural empowerment and life-long learning: Experiences in Central and Eastern Kenya', Paper presented at the Innovation Africa Symposium, 20th-23rd November, Kampala, Uganda.

Duflo, E., Kremer, M. and Robinson, J. (2006), 'Understanding Technology Adoption: Fertilizer in Western Kenya Evidence from Field Experiments', available from:
http://www.econ.berkeley.edu/users/webfac/saez/e231_s06/esther.pdf

Duflo, E., Kremer, M. and Robinson, J. (2009), 'Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya', available from:
http://people.ucsc.edu/~jmrtwo/fertilizer_behavioral.pdf

Evenson, R. (1997), 'The Economic Contributions of Agricultural Extension to Agricultural and Rural Development', in Swanson, B., Bentz, R. and Sofranko, A. (eds), 'Improving Agricultural Extension: A Reference Manual', FAO, Rome, pp. 27-36.

Fan, S. and Rao, N. (2003), 'Public Spending in Developing Countries: Trends, Determination, and Impact', EPTD Discussion Paper, No. 99, IFPRI, Washington D.C.
<http://ideas.repec.org/p/fpr/eptddp/99.html>

FAO (2003), 'Statement at the Ministerial Conference of the WTO - Circulated by H.E. Mr Hartwig de Haen, Assistant Director-General', Fifth Session, Cancun, 10-14 September, Doc No: WT/MIN(03)/ST/61.

Feder, G. and Savastano, S. (2006), 'The Role of Opinion Leaders in the Diffusion of New knowledge: The Case of Integrated Pest Management', World Bank Policy Research Working Paper 3916, World Bank, Washington D.C.
<http://econpapers.repec.org/paper/wbkwbrwps/3916.htm>

Feder, G., Murgai, R. and Quizon, J.B. (2004a), 'Sending Farmers Back to School: The Impact of Farmer Field Schools in Indonesia', *Review of Agricultural Economics* 26 (1), pp. 45-62.

Feder, G., Murgai, R. and Quizon, J.B. (2004b), 'The Acquisition and Diffusion of Knowledge: The Case of Pest Management Training in Farmer Field Schools, Indonesia', *Journal of Agricultural Economics* 55 (2), pp. 221-243.

Gautam, M. (2000), 'Agricultural Extension: The Kenya Experience-An Impact Evaluation', Operations Evaluation Department, World Bank, Washington D.C.
http://www.worldbank.org/oed/ie/kenya_ie.html

Godtland, E.M., Sadoulet, E., de Janvry, A., Murgai, R. and Ortiz, O. (2004), 'The Impact of Farmer-Field Schools on Knowledge and Productivity: A Study of Potato Farmers in the Peruvian Andes', Department of Agricultural & Resource Economics, UC Berkeley, Working Paper Series, No. 963. <http://ideas.repec.org/p/cdl/agrebk/963.html>

Hannover, W. and El Wafa, M.A. (2003), 'Impact Assessment of the Participatory Group Extension Approach Supported by the IPM-Project in the Horticultural Sector in Egypt', Egyptian-German IPM Project, Cairo, Egypt.

Higgins, J. and Green, S., eds. (2009), *Cochrane handbook for systematic reviews of interventions*. Version 5.0.2 [updated September 2009]. The Cochrane Collaboration, 2009. Available from www.cochrane-handbook.org

Huan, N.H., Mai, V., Escalada, M.M. and Heong, K.L. (1999), 'Changes in rice farmers' pest management in the Mekong Delta, Vietnam', *Crop Protection* 18, pp. 557-563.

Independent Evaluation Group (IEG) (2008), 'What Works in Water Supply and Sanitation: Lessons from Impact Evaluation', World Bank, Washington D.C.

Jensen, R. (2007), 'The Digital Divide: Information (technology), market performance and welfare in the South Indian fisheries sector', *Quarterly Journal of Economics* 122 (3), pp. 879-924.

Johnson, N.L., Lilja, N. and Ashby, J.A. (2003), 'Measuring the impact of user participation in agricultural and natural resource management research', *Agricultural Systems* 78 (2), pp. 287-306.

Khan, M.A. and Iqbal, M. (2005), 'Sustainable Cotton Production through Skill Development among Farmers: Evidence from Khaipur District of Sindh, Pakistan', *The Pakistan Development Review*, 44 (4 part II), pp. 695-716.

Khan, M.A., Ahmad, I. and Walter-Echols, G. (2005), 'Impact of an FFS-based IPM Approach on Farmer Capacity, Production Practices and Income: Evidence from Pakistan', in Ooi, P.A.C., Praneetvatakul, S., Waibel, H. and Walter-Echols, G. (eds), 'The Impact of the FAO-EU IPM Programme for Cotton in Asia', Pesticide Policy Project Publication Series, Special Issue No. 9, University of Hannover, Germany. <http://vegetableipmasia.org/Crops/Docs/Cotton/4/PPP%20Cotton%20IPM%20Asia2-CD.pdf>

Mancini, F. (2006), 'Impact of Integrated Pest Management Farmer Field Schools on health, farming systems, the environment, and livelihoods of cotton growers in Southern India', Doctoral thesis, Biological Farming Systems Group, Wageningen University, The Netherlands.

Mancini, F., Termorshuizen, A.J., Jiggins, J.L.S. and van Bruggen, A.H.C. (2008), 'Increasing the environmental and social sustainability of cotton farming through farmer education in Andhra Pradesh, India', *Agricultural Systems* 96, pp. 16-25.

Mauceri, M., Alwang, J., Norton, G. and Barrera, V. (2007), 'Effectiveness of Integrated Pest Management Dissemination Techniques: A Case Study of Potato Farmers in Carchi, Ecuador', *Journal of Agricultural and Applied Economics* 39 (3), pp. 765-780.

Nkonya, E., Philip, D., Mogues, T., Pender, J., Yahaya, M.K., Adebawale, G., Arokoyo, T. and Kato, E. (2008), 'From the Ground Up – Impacts of a Pro-Poor Community-Driven Development Project in Nigeria', IFPRI Discussion Paper 00756, March, IFPRI, Washington, D.C. <http://www.ifpri.org/sites/default/files/publications/ifpridp00756.pdf>

Noblit, G.W. and Hare, R. (1988), *Meta-Ethnography: Synthesizing Qualitative Studies*, *Qualitative Research Methods*, Volume 11, Sage Publications, London.

Noyes, J., Popay, J., Pearson, A., Hannes, K. and Booth, A. (2008), 'Qualitative research and Cochrane reviews', in Higgins, J.P.T. and Green, S., (eds), *Cochrane Handbook for Systematic Reviews of Interventions*, Version 5.0.1 [updated September 2008], The Cochrane Collaboration, available from www.cochrane-handbook.org

Operations Evaluation Department (OED) (2005), 'Maintaining momentum to 2015? An impact evaluation of interventions to improve maternal and child health and nutrition in Bangladesh', World Bank, Washington, D.C. <http://ideas.repec.org/p/wpa/wuwpdc/0510004.html>

Owens, T., Hoddinott, J. and Kinsey, B. (2003), 'The Impact of Agricultural Extension on Farm Production in Resettlement Areas of Zimbabwe', *Economic Development and Cultural Change* 51, pp. 337–357.

Palis, F.G. (1999), 'Changing farmers' perceptions and practices: the case of insect pest control in central Luzon, Philippines', *Crop Protection* 17 (7), pp. 599-607.

Pawson, R. (2006), *Evidence-based policy: A realist perspective*. Sage, London.

Pope, C., Mays, N. and Popay, J. (2007), 'Synthesizing Qualitative and Quantitative Health Evidence: A guide to methods', Open University Press, Blaidenhead.

Praneetvatakul, S. and Waibel, H. (2006), 'Impact Assessment of Farmer Field Schools using A Multi-Period Panel Data Model', Contributed paper prepared for presentation at the International Association of Agricultural Economist Conference, Gold Coast, Australia, August 12-18, 2006. <http://ideas.repec.org/p/ags/iaae06/25499.html>

Purcell, D.L. and Anderson, J.R. (1997), 'Agricultural Extension and Research – Achievements and Problems in National Systems', A World Bank Operations Evaluation Study, World Bank, Washington D.C.

Reddy, S.V. and Suryamani, M. (2005), 'Impact of Farmer Field School Approach on Acquisition of Knowledge and Skills by Farmers about Cotton Pests and Other Crop Management Practices – Evidence from India', in Ooi, P.A.C., Praneetvatakul, S., Waibel, H. and Walter-Echols, G. (eds), 'The Impact of the FAO-EU IPM Programme for Cotton in Asia', Pesticide Policy Project Publication Series, Special Issue No. 9, University of Hannover, Germany. <http://vegetableipmasia.org/Crops/Docs/Cotton/4/PPP%20Cotton%20IPM%20Asia2-CD.pdf>

Ricker-Gilbert, J., Norton, G.W., Alwang, J., Miah, M. and Feder, G. (2008), 'Cost-Effectiveness of Alternative Integrated Pest Management Extension Methods: An Example from Bangladesh', *Review of Agricultural Economics*, Vo. 39, No. 2, pp. 252-269. http://econpapers.repec.org/article/blaragrec/v_3a30_3ay_3a2008_3ai_3a2_3ap_3a252-269.htm

Rola, A.C., Jamias, S.B. and Quizon, J.B. (2002), 'Do Farmer Field School Graduates Retain and Share What They Learn? An Investigation in Iloilo, Philippines', *Journal of International Agricultural and Extension Education* 9 (1), pp. 65-76.

Romani, M. (2003), 'The impact of extension services in times of crisis: Cote d'Ivoire (1997-2000)', CSAE WPS/2003-07, Centre for the Study of African Economies, University of Oxford. <http://ideas.repec.org/p/wpa/wuwpdc/0409053.html>

Simpson, B.M. and Owens, M. (2002), 'Farmer Field Schools and the Future of Agricultural Extension in Africa', AIAEE, Proceedings of the 18th Annual Conference, Durban. <http://www.aiaee.org/2002/simpson405-412.pdf>

Singh, S. and Singh, S. (2007), 'Economic Evaluation of Pest Management Technologies for Sustainable Cotton Production in Punjab', Agricultural Economics Research Review 20, pp.77-86.

Spencer, L., Ritchie, J., Lewis, J. and Dillon, L. (2003), 'Quality in Qualitative Evaluation: A Framework for Assessing Research Evidence', Government Chief Social Researcher's Office, London. http://www.gsr.gov.uk/downloads/evaluating_policy/a_quality_framework.pdf

Thomas, J., Sutcliffe, K., Harden, A., Oakley, A., Oliver, S., Rees, R., Brunton, G and Kavanagh, J. (2003), 'Children and Healthy Eating: A systematic review of barriers and facilitators', EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. http://eppi.ioe.ac.uk/EPPIWebContent/hp/reports/healthy_eating02/Final_Report_web.pdf

Thomas, J. and Harden, A. (2008), 'Methods for the thematic synthesis of qualitative research in systematic reviews', BMC Medical Research Methodology 8 (45), pp. 1-10.

Tripp, R., Wijeratne, M. and Piyadasa, V.H. (2005), 'What Should We Expect from Farmer Field Schools? A Sri Lanka Case Study', World Development 33 (10), pp. 1705-1720.

United Nations (2008), 'Trends in Sustainable Development – Agriculture, rural development, land, desertification and drought', Department of Economic and Social Affairs of the United Nations, New York. <http://www.un.org/esa/sustdev/publications/trends2008/fullreport.pdf>

Van den Berg, H. (2004), 'IPM Farmer Field Schools: A synthesis of 25 impact evaluations', Prepared for the Global IPM Facility, Wageningen University, the Netherlands. <ftp://ftp.fao.org/docrep/fao/006/ad487E/ad487E00.pdf>

Van den Berg, H. and Jiggins, J. (2007), 'Investing in Farmers – The Impacts of Farmer Field Schools in Relation to Integrated Pest Management', World Development 35 (4), pp. 663-686.

Van den Berg, H. and Jiggins, J. (2008), '"Investing in Farmers – The Impacts of Farmer Field Schools in Relation to Integrated Pest Management" – A Reply', World Development 36 (10), pp. 2107-2108.

Van der Knapp, L.M, Nijssen, L.T.J and Bogaerts, S. (2006), 'Violence Defied? A Review of Prevention of Violence in the Public and Semi-public Domain', Research and Documentation Centre, Ministry of Justice, The Hague. <http://www.eucpn.org/pubdocs/Netherlands%20Ministry%20of%20Justice%20Violence%20Defied%20a%20review%20of%20Prevention%20of%20Violence%20in%20the%20Public%20and%20Semi%20public%20domain.pdf>

Van der Knapp, L.M., Leeuw, F.L., Bogaerts, S. and Nijssen, L.T.J. (2008), Combining Campbell Standards and the Realist Evaluation Approach – The Best of Two Worlds?', American Journal of Evaluation OnlineFirst, published January 8, doi:10.1177/1098214007313024.

Waddington, H., Snilstveit, B., White, H. and Fewtrell, L. (2009), 'Water, sanitation and hygiene interventions to combat childhood diarrhoea in developing countries', Synthetic Review 001, International Initiative for Impact Evaluation (3ie), New Delhi. <http://www.3ieimpact.org/admin/pdfs2/17.pdf>

Wandji, N., Binam, N., Mva, J.M. and Gockowski, J. (2007), 'Assessing Potential Impact of a Farmer Field School Training on Perennial Crop in Cameroon', AAAE Conference Proceedings, pp. 253-257. <http://ideas.repec.org/p/ags/aaae07/52103.html>

World Bank (2007) World Development Report 2008: Agriculture for Development, World Bank, Washington, D.C. http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf

Wu, L., Praneetvatakul, S., Waibel, H. and Wang, L. (2005), 'The Impact of FFS on Yield, Pesticide Cost and Gross Margin in Shandong Province, P.R. China: an Econometric Approach', in Ooi, P.A.C., Praneetvatakul, S., Waibel, H. and Walter-Echols, G. (eds), 'The Impact of the FAO-EU IPM Programme for Cotton in Asia', Pesticide Policy Project Publication Series, Special Issue No. 9, University of Hannover, Germany. <http://vegetableipmasia.org/Crops/Docs/Cotton/4/PPP%20Cotton%20IPM%20Asia2-CD.pdf>

Yamazaki, S. and Resosudarmo, B. (2008), 'Does Sending Farmers Back to School Have an Impact? Revisiting the Issue', The Developing Economies, XLVI-2, June, 135-150.

Yang, P., Liu, W., Shan, X., Li, P., Zhou, J., Lu, J. and Li, Y. (2008), 'Effects of Training on Acquisition of pest management knowledge and skills by small vegetable farmers', Crop Protection 27, pp. 1504-1510.