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### The size and nature of the evidence-base for smallholder farming in Africa: a systematic map

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## The size and nature of the evidence-base for smallholder farming in Africa: a systematic map

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Relevant systematic reviews and impact evaluations were systematically sought and described in order to assess the size and nature of the evidence-base about the effectiveness of interventions for smallholder farmers in Africa. A total of 21 relevant systematic reviews and 415 reports of impact evaluations were identified. This paper describes this African evidence-base in terms of the interventions and outcomes assessed, and the geographical spread of the primary research across the continent. Gaps in the evidence-base are identified and recommendations made for future research.

**Keywords:** smallholder farming; Africa; training; innovation; food security; yield; income; evidence

### 1. Introduction

Smallholder farming has long been credited with the potential to end food insecurity (Sen 1981; Reutlinger and Pellekaan 1986). The argument is that it is both an effective subsistence strategy and a potential income-generating activity enabling poor farmers to purchase additional food (IFAD 2012). Furthermore it is thought to benefit those segments of the population that are most vulnerable to the effects of poverty, namely women, children and youth (World Bank 2007).

Whilst definitions of smallholder farming vary, the concept usually incorporates the following key elements (Morton 2007): farms on which labour is predominantly family ('family farms') (IFAD 2009); farmers and farms that are resource poor (Dixon, Taniguchi, and Wattenbach 2003; Nagayets 2005); farms of a particular size, most commonly two hectares (World Bank 2003; Nagayets 2005; Hazell et al. 2010; Wiggins, Kirsten, and Llambí 2010; IFAD 2011); and farms which are predominantly subsistence, but might also include a mix of commercial and subsistence activities (Narayanan and Gulati 2002).

Smallholder farming has particular significance to Africa. Africa's economy is dominated by agriculture (Masset et al. 2011), the vast majority of farmers in Africa are smallholders, and they produce a large percentage of Africa's food – such farms contribute to 80 per cent of the food supply in sub-Saharan Africa (IFAD 2011). Given both the importance of smallholder farming in Africa and its potential to contribute to the food security of so many, it is not surprising that considerable efforts are invested in its success.

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Both national and international agencies are investing in improving the productivity of smallholder farming. These include the International Fund for Agricultural Development (IFAD) and the Canadian Foreign Affairs, Trade and Development agency (DFATD). Additionally, in 2009, the G8's L'Aquila initiative pledged \$22 billion USD for agriculture in developing countries (G8 2009). On a national level, heads of state in Africa are increasingly stressing the need for support for smallholder farmers. For instance, South African President Jacob Zuma emphasised the need for support of smallholder farmers in his 2013 State of the Nation Address (RSA 2013). Parallel efforts are being invested in agricultural research, such as impact evaluations and systematic reviews, to assess the effectiveness of these agricultural programmes.

When addressing questions of effectiveness, there are increasing drives for evidence that is both reliable and accessible (Gough, Oliver, and Thomas 2012). Good quality research is needed to inform policy-decisions and support the effective investment of increasingly limited resources (Gough, Oliver, and Thomas 2012). The best design and conduct of impact evaluations has been much debated over the last 10 years with increasing recognition that not all research is equal (Lipsey and Noonan 2009; Banerjee and Duflo 2011; Karlan and Appel 2011). Furthermore, high quality systematic reviews of impact evaluations are increasingly recognised within international development as the best way of providing a bias-free overview of the best available effectiveness evidence (The Campbell Collaboration 2013). These reviews employ structured and transparent methods to ensure that all of the relevant evidence is considered. Before findings of individual studies are amalgamated, their quality is assessed using the same appraisal criteria.

Given the importance of smallholder farming in Africa, and the efforts to both implement and research interventions to increase the effectiveness of smallholder farming in tackling food security across the continent, we set out to explore the size and scope of the evidence-base. In doing so, we considered both impact evaluations and systematic reviews with relevance to smallholder farming in Africa.

## 2. Methods

We employed a two-step process, beginning initially with a review of systematic reviews and then a wider assessment of individual impact evaluations. For the review of reviews, our goal was to review relevant systematic reviews in a structured and unbiased way. First, we prepared a theoretical framework of interventions for smallholder farmers and key outcomes of importance that was peer reviewed by topic and methods experts. We then searched key sources of existing reviews (in December 2012 and January 2013). Seven databases and six systematic review libraries were searched, including the International Information System for the Agricultural Science and Technology (AGRIS) Database, the database of applied sciences (CAB abstracts), the largest economics research database (IDEAS), the database of the Abdul Latif Jameel Poverty Action Lab (JPAL), the British Library for Development Studies (BLDS) and the database of the International Food Policy Research Institute (IFPRI), the libraries of the Collaboration for Environmental Evidence, the Cochrane Collaboration, the Campbell Collaboration, the EPPI-Centre, and 3ie's database of systematic reviews in development. Criteria were applied to all search hits to help us judge whether or not the review was relevant. These criteria included:

*Study design* – the review needed to have a structured methodology for identifying and assessing relevant literature.

*Population* – the review had to include interventions for smallholder farmers.

*Region* – reviews were limited to those that included all or some of Africa in their geographical scope.

*Interventions* – reviews had to consider interventions that fell into one of our broad categories of: training for farmers, agricultural finance, agricultural innovation and new technology and infrastructure for farmers.

*Outcomes* – reviews had to consider at least one of the following within their outcomes of interest: agricultural investment, innovation, yield, productivity, income and other household economic impacts, food security and/or nutrition.

*Date* – reviews had to be published since 1980.

Having identified relevant systematic reviews from our searches, we retrieved the full texts of these reviews. Any reviews that were relevant but not yet completed were noted and follow-up searches were conducted in July 2013 to ensure that we had the most up-to-date report. All relevant reviews were then described using a structured coding sheet, which had first been developed and piloted by the team. After coding all the reviews, we analysed our data using structured matrices that allowed us to identify which aspects of smallholder farming have already been thoroughly reviewed providing structured summaries for decision-makers.

Once we had established the coverage of systematic reviews of relevance to smallholder farms in Africa, we moved on to review the evidence-base in terms of impact evaluations. Our methodology for reviewing impact evaluations was first developed in detail and peer reviewed by both topic and methods experts. Following the peer review process we embarked on detailed and thorough searches for research assessing the impact of interventions for smallholder farmers in Africa. Agricultural databases, including AGRIS, IDEAS and CAB Abstracts were searched as well as specialist websites such as IFAD, IFPRI and the 3ie impact evaluations database. In addition, we also searched general databases, such as Web of Science (specifically the Social Science Citation Index and Science Citation Index), Africa bibliographical databases (specifically African periodical literature/African Women's Bibliographic database), BLDS and JPAL evaluations. We also contacted our advisory group of experts requesting relevant impact evaluations. The individual studies included in the relevant systematic reviews were also considered. As with our review of systematic reviews, all search hits were judged against our inclusion criteria (the same criteria used in the review of systematic reviews) to ensure all reports in our map were relevant. Those reports that met our criteria were then described using a structured coding framework. This was done using titles and abstracts rather than full texts due to limited time and resources.

Given the large number of reports and high volume of data, we used specialist systematic review software for managing our data – EPPI-Reviewer version 4 (Thomas, Brunton, and Graziosi 2010). Data were analysed using structured matrices to map out the available evidence-base and integrated with the findings of our review of systematic reviews (see Table 1). Our analysis was discussed with our advisory group and our findings refined in light of their feedback.

### 3. Findings: the size and nature of the evidence-base

#### 3.1. The systematic review evidence-base

We found 21 systematic reviews of relevance to smallholder farming in Africa, what many would consider a large evidence-base. Of the 21, 18 reviews have been completed, 2

Table 1. Summary of the evidence-base.

OUTCOMES	INTERVENTIONS							
	Training/Knowledge transfer		Innovation and new technology		Agricultural infrastructure		Agricultural finance	
Investment	GAP IN SR EVIDENCE	2 impact studies	GAP IN SR EVIDENCE	3 impact studies	GAP IN SR EVIDENCE	5 impact studies	GAP IN SR EVIDENCE	10 impact studies
Innovation	GAP IN SR EVIDENCE	27 impact studies	GAP IN SR EVIDENCE	8 impact studies	GAP IN SR EVIDENCE	4 impact studies	1 systematic review	3 impact studies
Yield/ Productivity	1 systematic review	27 impact studies (yield)	5 systematic reviews	186 impact studies (yield)	3 systematic reviews	13 impact studies (yield)	2 systematic reviews	15 impact studies (yield)
Income/ household economics	1 systematic review	18 impact studies (productivity)	1 systematic review	45 impact studies (productivity)	reviews	12 impact studies (productivity)	7 impact studies (productivity)	28 impact studies
Food security/ nutrition	GAP IN SR EVIDENCE	29 impact studies	1 systematic review	80 impact studies	GAP IN SR EVIDENCE	20 impact studies	5 systematic reviews	8 impact studies
		13 impact studies	5 systematic reviews	37 impact studies	GAP IN SR EVIDENCE	8 impact studies	1 systematic review	8 impact studies

protocols have been published (Loevinsohn and Sumbug 2012; Knox, Daccache, and Hess 2013) and a third protocol is currently under peer review (Dorward et al. 2013).

The protocols both focus on agricultural infrastructure (Loevinsohn and Sumbug 2012; Knox, Daccache, and Hess 2013), whilst Dorward and colleagues' review will focus on agricultural finance.

The scopes of the 18 completed reviews were categorised into 4 broad intervention categories: training, innovation and new technology, infrastructure and finance. Only 1 of the 18 focussed on training, specifically farmer field schools (Waddington et al. 2012).

Reflecting the search for new and better ways of farming, we found nine systematic reviews that evaluated the impacts of innovation and new technology (Berti, Krasevec, and FitzGerald 2004; Bennet and Franzel 2009; IOB 2011; Bayala et al. 2012; Hall et al. 2012; Girard et al. 2012; Gunaratna et al. 2010; Masset et al. 2011; Rusinamhodzi et al. 2011). These included evaluations of the effectiveness of conservation agriculture in general (Bennet and Franzel 2009; Rusinamhodzi et al. 2011; Bayala et al. 2012), as well as specific conservation agriculture interventions, including: parkland trees associated with crops (Bayala et al. 2012), coppicing trees (Bayala et al. 2012), green manure (Bayala et al. 2012), mulching (Bayala et al. 2012), crop rotation and intercropping (Rusinamhodzi et al. 2011; Bayala et al. 2012), traditional soil and water conservation (Bayala et al. 2012), tillage management (Rusinamhodzi et al. 2011) and residue retention (Rusinamhodzi et al. 2011). These systematic reviews also considered the impacts of organic agriculture (Bennet and Franzel 2009) and genetically modified crops (Hall et al. 2012), as well as assessing specific interventions aimed at increasing nutritional status of households, such as home gardening (Berti, Krasevec, and FitzGerald 2004; Masset et al. 2011; Girard et al. 2012), cash cropping (Berti, Krasevec, and FitzGerald 2004), irrigation (Berti, Krasevec, and FitzGerald 2004) and biofortification (Gunaratna et al. 2010; Masset et al. 2011). The impact of interventions to increase food production has been reviewed (IOB 2011), including particular forms of agriculture, specifically livestock (Berti, Krasevec, and FitzGerald 2004), in particular poultry development (Masset et al. 2011), animal husbandry (Masset et al. 2011) and dairy development (Masset et al. 2011), fish ponds (Masset et al. 2011), aqua culture (Masset et al. 2011) and mixed garden and livestock (Berti, Krasevec, and FitzGerald 2004).

Five completed reviews have considered finance for farmers, in particular: index insurance (Cole et al. 2012), micro-credit (Stewart et al. 2010, 2012; Duvendack et al. 2011), micro-savings (Stewart et al. 2010, 2012), micro-leasing (Stewart et al. 2012) and agricultural investment grants (Ton et al. 2013).

Lastly, three systematic reviews focus on the impact of agricultural infrastructure interventions, specifically agricultural interventions and food security (IOB 2011); infrastructural investments in roads, electricity and irrigation (Knox, Daccache, and Hess 2013); and land property rights (Hall et al. 2012).

Having explored which systematic reviews have been, or are being, conducted of relevance to smallholder farming in Africa, we turn our attention to the individual impact evaluations that have been undertaken.

### 3.2. *The impact evaluation evidence: interventions evaluated in impact studies*

A total of 415 papers reporting impact evaluations of relevance to smallholder farmers in Africa were identified.<sup>1</sup> An overview of this literature is provided and summarised in Table 1. Many of these reports considered more than one intervention as summarised in Table 2.

Table 2. An overview of interventions evaluated in the impact evaluation literature.

Intervention	Number of studies
Training and knowledge transfer	78
Innovation and new technology	268
Finance	50
Infrastructure	46

Of the 415 impact evaluations, there were 78 intervention papers that focused on training and knowledge transfer. These included: four reports that focussed on the impacts of research, three reports focused on market access information and business skills, five reports of nutrition education, four reports looked at the impact of crop variety and technology adoption, and seven focussed on pest management training. By far, the two largest types of training/knowledge transfer mechanisms evaluated were *extensions services* (21) and *farmer field schools* (24).

Of the 415 reports of impact evaluations, the vast majority focused on the impact of innovation and new technology (268). These fall into two different categories, namely land use and crop management and livestock management. Reports that addressed land use and crop management included those focussing on biofortification, GM crops and the adoption of hybrid varieties, which together constituted 36 of the total number of innovation and new technology intervention studies. Soil conservation interventions made up 22 of the 268 innovations and new technology reports. Innovative approaches to cropping (which included rotation, inter, alley, cover and strip cropping) were evaluated in 29 of the identified papers. We found 14 reports of pest and disease management control interventions and 4 evaluations of tillage practices. There were five reports that looked at weed control interventions. Five evaluations examined various water harvesting techniques, with a further 29 papers focusing on water management and irrigation systems. The impact evaluations that dealt with livestock management focused on the following: there were 20 reports of impact evaluations that dealt with livestock feeding supplementation and techniques; 11 reports within this intervention category addressed management and technologies for dairy farming specifically. Reports focusing on disease control and treatment practices constituted 11 of the total number of studies and of these 11, there were 5 papers that addressed vaccination programmes specifically.

A total of 50 reports addressed the impact of finances for smallholder farmers. The largest proportion of reports addressed the impact of microcredit (24), three examined micro-savings, one of which included consideration of commitment savings in which savers are asked to lock a specified amount of their savings in until a pre-agreed date. There were five reports that looked at the impact of insurance or micro-insurance, whilst seven examined the effects of grants and subsidies, and four evaluated the impact of cash transfers. Five further reports examined the effect of microfinance in general. There was one report that looked at the impact of seed aid, and one explores the effect of debt relief.

We identified 46 reports that addressed the impact of agricultural infrastructure on smallholder farmers. These included 14 reports which addressed the effect of market reforms and market access, and 9 looked at the impact of asset ownership, which included land ownership, land tenure, land certification, land reform and dairy ownership. Two impact evaluations examined the impact of road and transport infrastructure and two reports looked at the effect of access to water, which included evaluations of water

Table 3. An overview of outcomes assessed in the impact evaluation literature.

Outcomes	Number of studies
Agricultural investment	18
Innovation or new technology	40
Yield	227
Productivity	75
Income and other economic impacts	147
Food security or nutrition	55

commercialisation and irrigation schemes. Two further reports explored the impact of farmers' cooperatives.

### 3.3. *The impact evaluation evidence: outcomes evaluated in impact studies*

We assessed whether the 415 identified impact evaluations considered intervention impacts on: investment, innovation, yield, productivity, income and household economics and food security and nutrition (see Table 3).

There were 18 reports of evaluations that measured the impact on investment by farmers, for example investments in new technology, conservation practices and farm inputs. A total of 40 reports examined the impact of various interventions on the adoption of new technology and innovations. These included impacts on farmer knowledge of new technologies, actual adoption of a new technology and development of new farming systems.

Large numbers of reports assessed the impacts of interventions on yield (227) and productivity (75). These included reports focussing on improvement and conservation of soil fertility, the quality of output, and interventions' impact on crop and livestock disease resistance, as well as technical efficiency, better resource management, reduced input costs, impacts on labour requirements, stronger systems and better utilisation of available resources.

A total of 147 reports of impact evaluations focused on measuring income and other household economic impacts. These included assessments of general financial wealth, numbers of livestock, levels of indebtedness, repayment rates, return on investments and rate of return, higher gross margins, accumulation of specific assets, farm gate prices and producer prices. Lastly, we identified 55 reports assessing outcomes related to food security, specifically measuring outcomes such as nutritional knowledge, the nutritional value of farmers' food and levels of food consumption.

### 3.4. *The impact evaluation evidence: which populations have been evaluated and where*

Two potentially vulnerable populations have been highlighted as particularly important with regards smallholder farming in Africa – young farmers and women. Despite this, we found no impact studies of interventions that target young farmers. There were some reports in which women were specifically considered, however, on closer examination it became clear that these were assessing impacts of interventions on men and women separately, rather than evaluating programmes which specifically target women.

The geographic spread of the evidence extends throughout Africa (see Figure 1). It is striking that by far the majority of studies identified had been conducted in Kenya (76) – nearly a sixth of all studies included in this map. Nine countries (Kenya, Ethiopia, South Africa, Zimbabwe, Malawi, Nigeria, Tanzania, Ghana and Uganda) have 20 or more



Before considering the gaps in the systematic review evidence-base, it is important to note three key weaknesses in our methodology relating to our searches, our reliance on abstracts and limited reporting of impact methodologies within those abstracts. Our searches were detailed but not comprehensive. For many, the searches may appear very thorough and they were. However, systematic review search specialists may recommend additional sources and techniques for searching. This is still, however, the most comprehensive map of the African evidence available. We coded the impact evaluations that we identified using only their abstracts, due to resource pressures. In most cases, the abstracts included sufficient details for us to map out their scope. It does mean that we may have missed some details and the accuracy of our judgments has relied on authors' reporting within their abstracts. There was a considerable pool of search hits (80) that had to be excluded because there were no abstracts or full texts available.<sup>2</sup> We have employed a broad definition of what constituted an impact evaluation. Where possible we sought assurance within the abstract that the evaluation had included a counterfactual based on a comparison group. However, we included studies where limited details were available on methodology, so long as they declared that they were evaluating impact.

Of the 21 systematic reviews identified, none of the reviews of training, infrastructure or finance interventions considered outcomes related to food security and no reviews considered in detail outcomes about investment or innovation. Of the 415 reports of impact studies identified, there are few on training interventions, innovation and new technology, agriculture infrastructure or finance interventions which considered their impacts on agricultural investment and adoption of innovation. The number of evaluations that consider impacts of interventions on yield and productivity is in contrast large, and has been well covered in systematic reviews. There are also large numbers of studies that examine impacts on income and other related measures of household wealth, and on food security and nutrition. There are several areas where there are considerable numbers of impact evaluations being conducted, but there is a lack of systematic reviews of these impact evaluations. Income and household wealth has only really been evaluated in systematic reviews of microfinance. Food security has also not been thoroughly reviewed as an outcome within systematic reviews, with the exception of evaluations of innovation and new technology interventions. These reviews, however, are quite specific in their scope and a broader assessment would be valuable.

In conclusion, there are three key gaps in the evidence-base which need addressing: (1) the number of impact evaluations of training interventions, innovation and new technology interventions, agriculture infrastructure or finance interventions which considered impacts on agricultural investment and adoption of innovation is very small; (2) there is a gap in the body of systematic reviews assessing impacts on smallholder financial wealth; and (3) there is a need for future systematic reviews which assess the impacts of interventions on food security.

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### **Notes**

1. Full citation details of identified studies are available on request.
2. We will be collecting the full texts in a more focused and detailed follow-up to this project.

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