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Understanding financial agricultural risk for smallholder farmers in developing countries

what do we know and not know?

June 2017

Evidence Gap Map Report 9

Agriculture

International Initiative for Impact Evaluation

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About this evidence gap map report

This report provides the supporting documentation for the 3ie evidence gap map on financial risk in agricultural production for smallholder farmers in developing countries, developed as part of a project funded by UK aid through Department for International Development. All of the content of this report is the sole responsibility of the authors and does not represent the opinions of 3ie, its donors or its Board of Commissioners. Any errors and omissions are also the sole responsibility of the authors. Any comments or queries should be directed to the corresponding author Bidisha Barooah at bbarooah@3ieimpact.org.

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Summary

Risks in agricultural production pose a major threat to the economic well-being and development of households in rural areas of developing countries. Indeed, 98 per cent of the world's food-insecure people live in developing countries, and four in five of them are involved in small-scale food production (Food and Agriculture Organisation et al. 2015). A key reason for this is the inability of the smallholder farmer to mitigate, diversify and transfer risks.

To deal with shocks and risks that lead to crop and livestock loss, many organisations around the world have proposed, piloted and implemented financial agricultural risk mitigation (FARM) programmes. In this paper, we identify such programmes and strategies and assess the evidence on their effectiveness. Despite the increasing popularity of these programmes, it is unclear whether FARM instruments improve farmer welfare, provide reasonable social protection or offer a good way to manage on-farm risks.

Using a systematic search and screening tool, we found 57 impact evaluations and two systematic reviews that met our criteria for inclusion in this evidence map. We concentrated on financial instruments for risk management in agriculture that aim to reduce vulnerability and increase resilience before, during and/or after an adverse event by transferring, mitigating and diversifying risk to cope with agricultural losses and reduce the magnitude of negative shocks. We restricted agricultural risks to production and on-farm risks.

We included conventional risk pooling and transfer mechanisms (e.g. 'pure' insurance products). We examined both the demand for FARM instruments – i.e. the farmer operating at the micro level – and the supply of FARM instruments (e.g. banks, insurance providers, agribusinesses, input providers and self-help groups). We included savings and credit products that are bundled with risk management products, since they are designed to reduce vulnerability. We investigated a variety of risks faced by smallholder farmers, including financial risks, climate risks and disaster risks. We did not include risks further along the value chain, such as price and market risks.

Main findings

Our map has important findings for implementers, researchers and decision makers. While the stock of evidence is undoubtedly large, it s clustered, with some interventions and outcomes being studied more than others. Among risk-mitigating products, index insurance was the most studied intervention. This is not surprising, given policymakers' and insurers' interest in this product. The majority of studies focused on examining the impact of FARM interventions on take-up – a first-level outcome identified in our theory of change – and short-term outcomes such as productive investment and yield. The evidence base was also restricted geographically, with India and Ethiopia the most represented countries in South Asia and Africa respectively.

However, certain evidence gaps remain. With overwhelming focus on some short-term outcomes, longer-term outcomes that are farther down the causal chain, such as human development and vulnerability indicators, have not been studied much. Most FARM products and insurance in particular have low take-up. Hence, an important question that needs to be answered is: what can be done to increase uptake? Research on the role of product quality, financial and product knowledge and trust building is warranted. Very few studies have examined the impacts of technological innovations (e.g. mobile phones and digital education). Bundled products that combine several risk-mitigating products and the interaction of FARM instruments with social security programmes and nonformal insurance mechanisms require further exploration. With a large number of private players in the field of insurance, analysis on cost-effectiveness and loss ratio will be able to inform implementing agencies. Further, we need more research on the effects of FARM on intrahousehold allocation, women and vulnerable populations.

Contents

List of figures and tables

Abbreviations and acronyms

EGM	Evidence gap map
FARM	Financial agricultural risk management
L&MICs	Low- and middle-income countries

1. Introduction

Risks in agricultural production pose a major threat to the economic well-being and development of households in rural areas of developing countries. Indeed, 98 per cent of the world's food insecure people live in developing countries, and four in five of them are involved in small-scale food production (WFP 2015). A key reason for this is the inability of the smallholder farmer to mitigate, diversify and transfer risks.

To deal with shocks and risks that lead to crop and livestock loss, many organisations around the world have proposed, piloted and implemented financial agricultural risk mitigation (FARM) programmes. In this paper, we identify such programmes and strategies and assess the evidence on their effectiveness. Despite the increasing popularity of these programmes, it is unclear whether FARM instruments improve farmer welfare, provide reasonable social protection or offer a good way to manage on-farm risks.

This evidence gap map (EGM) takes stock of the quantitative evidence on FARM instruments in low- and middle-income countries (L&MIC) that may help to inform decision-making and guide future research. The map identifies studies relevant to the overall theory of change and organises them according to intervention type and outcomes.

We had two specific objectives. First, we identified areas where there is (or is not) high-quality evidence on the impacts of FARM instruments, including whether they help smallholder farmers mitigate, diversify and transfer agricultural risk. Second, we assessed what additional evidence may be useful for policymakers and practitioners and what questions researchers could usefully pursue to support evidence-informed policymaking and programming.

There is a lot of literature examining the performance of FARM programmes (Cole et al. 2012). Studies show that these programmes often encounter implementation challenges that make it methodologically difficult to determine if agriculture risk mitigation has been successful in affecting positive outcomes – for the farmer or the insurer – in the longer run. Furthermore, the lack of long-term data, pre- and postintervention, limits the ability of studies to capture impacts adequately.

1.1 Methods

Relying on 3ie's approach to developing EGMs (Snilstveit et al. 2017), we first developed a theory of change based on a thorough review of existing theoretical and empirical literature and inputs from sectoral experts. This helped us identify key underlying theories and assumptions that inform the causal pathways that link FARM instruments to improved smallholder farmer welfare. Second, we used a prespecified screening protocol to search 15 databases systematically for literature between 1995 and 2015. We identified 57 impact evaluations and two systematic reviews. More details about the methods can be found in Appendixes A and B. We mapped each of these studies onto a matrix of intervention and outcomes, identified from the theory of change, which created a visual representation of the stock of evidence (Figure 11).

1.2 Limitations

An EGM only shows available evidence that satisfies our inclusion and exclusion criteria. Publication bias means that studies that show significant effects tend to be published in journals, and there is a research bias toward outcomes and interventions that are easily measured and studied. EGMs do not mitigate these biases. 3ie EGMs include only impact evaluations that use a counterfactual and systematic reviews (Snilstveit et al. 2017).

Therefore, gaps can indicate where there may be evidence, but not of the type we think is most useful to inform decision-making. 3ie EGMs do not appraise the quality of included impact evaluation evidence. We do use the 3ie confidence rating tool to appraise systematic reviews. Thus, although an EGM may display the stock of evidence on a particular FARM instrument and outcome, it does not comment on the reliability of the impact evaluation evidence.

1.3 Overview

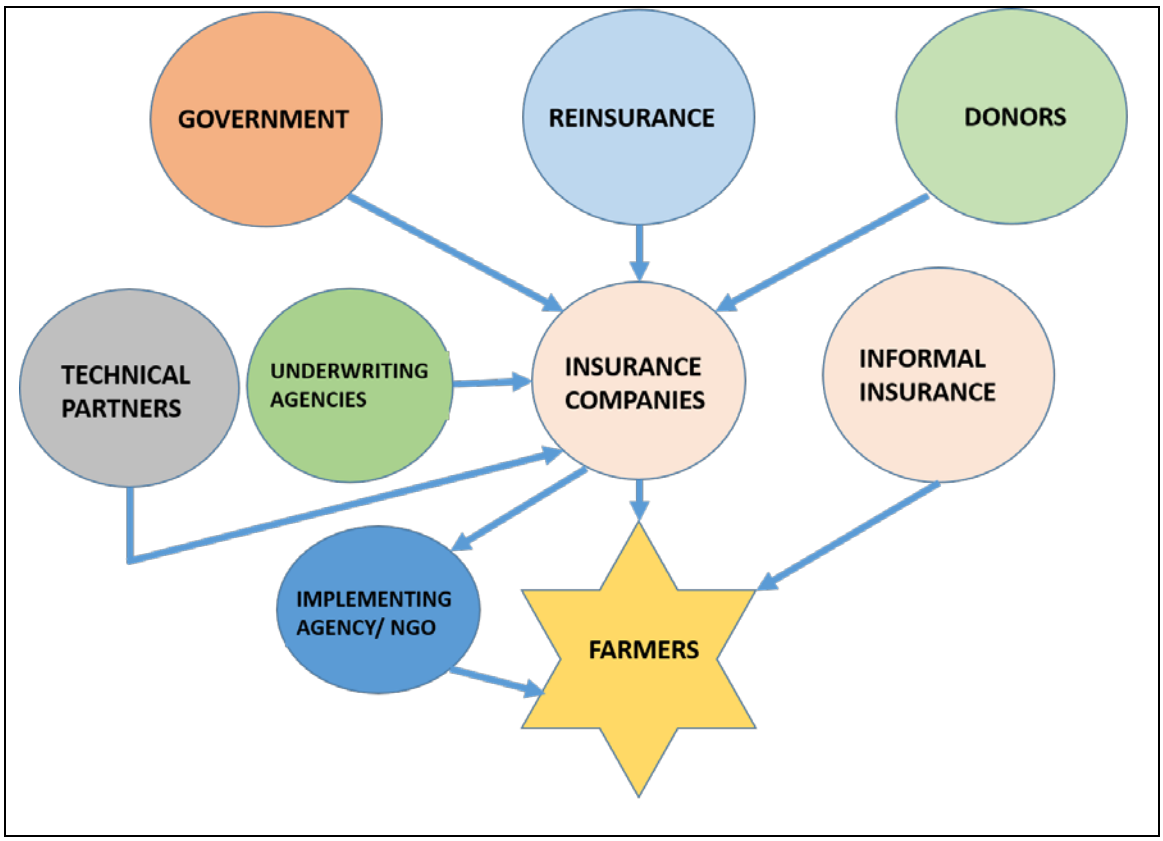
The remainder of this paper follows this structure: Section 2 describes the scope and the methods that we used in this study. Section 3 describes the main findings, and Section 4 presents the conclusion.

2. Scope of the EGM

2.1 Framework

In this evidence mapping, we concentrated on financial instruments for risk management in agriculture that aim to reduce vulnerability and increase resilience before, during and/or after an adverse event by transferring, mitigating and diversifying risk to cope with agricultural losses and reduce the magnitude of negative shocks. The agricultural risks we considered in this paper were restricted to production and on-farm risks. We included conventional risk pooling and transfer mechanisms such as ‘pure’ insurance products. We examined both the demand for FARM instruments – i.e. the farmer operating at the micro level – and the supply of FARM instruments (e.g. banks, insurance providers, agribusinesses, input providers and self-help groups) (Figure 1). We included savings and credit products that are bundled with risk management products, since they are designed to reduce vulnerability. We investigated a variety of risks faced by smallholder farmers, including financial risks, climate risks, disaster risks and so on. We did not include risks further along the value chain, such as price and market risks.

Figure 1: Relationships between different actors



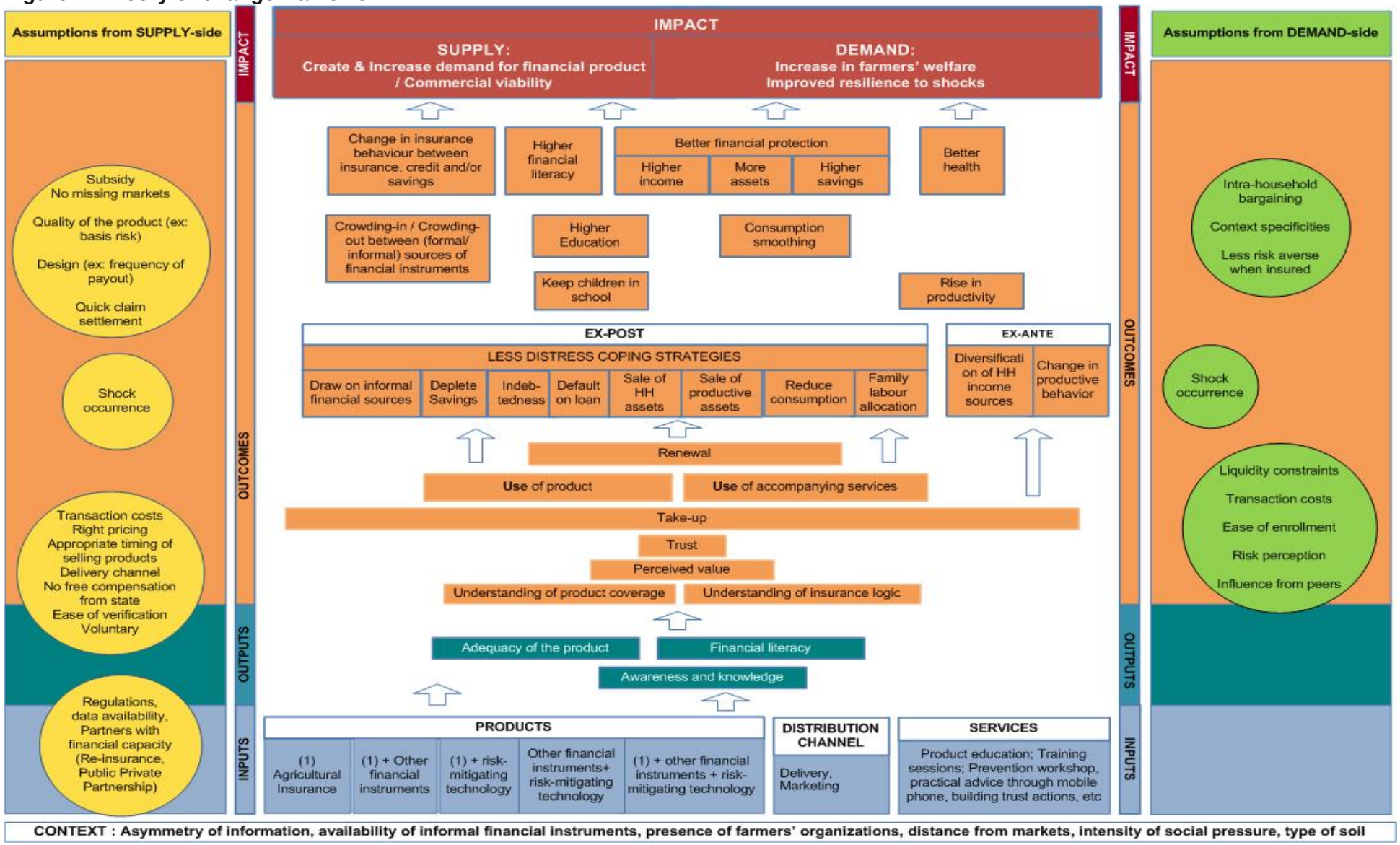
2.2 Theory of change

Pathways that link interventions to impact are complex, and understanding the underlying mechanisms that inform expected intermediate and ultimate effects can be very useful. A theory of change allows us to think sequentially about this causal pathway. The intermediate steps and assumptions behind causal links inform and guide ex ante hypotheses about how, when and why programmes are effective. In this section, we constructed and described an overall theory of change for FARM interventions (Figure 2) using existing literature (De Bock and Ontiveros 2013; De Janvry et al. 2013; Dercon 2008) and insights from practitioners to construct and verify these links.[1]

Figure 2 should be read from the bottom to the top. We used colour to distinguish between input, outputs, outcomes and long-term impacts, and listed assumptions related to the supply and demand of agricultural risk insurance on left- and right-hand sides of the diagram, respectively. We discuss this chart briefly below.

[1] We also considered advice provided by interviewees and stakeholders and feedback from a stakeholder workshop we held to explain, understand and verify these links.

Figure 2: Theory of change framework



2.2.1 Context of the smallholder farmer in L&MICs

We distinguished between two types of contextual variables in FARM programmes. The first, proximate contextual variables, included levels of poverty, education, soil quality, climate, remoteness, social structures and peer group effects. They are important because they affect how effective most programmes and linkages are, and they also affect most other relationships and programmes.

The second set, immediate contextual variables, were specific to FARM programmes and affect the 'state' of their effectiveness. These included asymmetry of information (Besley 1995) and available (and alternative) informal financial instruments, e.g. remittances (Manje and Churchill 2002). The presence of an informal insurance mechanism is very likely to influence the uptake and impact of formal insurance, with the direction of impact defined by whether the formal insurance substitutes for or complements informal insurance and the extent to which one crowds out or crowds in the other. Evidence suggests that these risk-sharing mechanisms are far from perfect (Townsend 1994; Murdoch 1999) and that households can only cover part of their shock informally. Mobarak and Rosenzweig (2013) provide evidence that the presence of informal risk insurance may lead to an increase in formal insurance, particularly in cases where formal insurance carries basis risk.

2.2.2 Types of input

We accounted for inputs that influence, inform or determine how FARM instruments are designed and supplied. Inputs in this space include products, goods and services. We grouped them into three categories: inputs that influence the types of FARM products, programmes and policies; those that influence, inform and determine what type of value-added services are supplied; and those that affect the delivery of FARM products and processes (Dalal et al. 2014). These included agricultural insurance and bundled products; inputs into building and strengthening delivery and marketing channels; and services to increase awareness among farmers.

In the supply column on the left side of Figure 2, we listed prior conditions for providing these inputs. These included regulations that facilitate microfinance institutions operating and offering products: e.g. in India, regulations do not allow for differentiated premiums, which makes it difficult to offer appropriate products to farmers.

Prior conditions also included data availability: typically, a long period is required to design an appropriate product (e.g. average yields index insurance) because these products require multiyear data on yields and other variables. Finally, yet importantly, the possibility of building partnerships with government and/or of reinsuring were also important considerations, because they help determine what sorts of inputs are provided.

2.2.3 Immediate outputs2

We distinguished between three types of outputs that FARM programme implementers may aim to deliver with products and services:

- awareness and knowledge: e.g. familiarity with the concepts of risk reduction and risk pooling (Panda et al. 2015);

[2] Outputs are direct results of using the products and services. They are directly under the control of the programme implementers.

- specific financial literacy: e.g. the ability to understand how financial instruments work and to choose the best option (Gaurav et al. 2011); and
- adequately designed products: a result of increased interaction with farmers, piloting products and services and bundling financial risk mitigation instruments to adequately cover production and on-farm risks for farmers in the context of farmers' risks. Indeed, the product should be tailored to the local context to offer sufficient client value (Hill and Robles 2011; Jensen, Barrett and Mude 2014).

FARM programmes and policies typically target a variety of outcomes. We distinguished between first- and second-level outcomes. First-level outcomes are those that lead to increased uptake and use of FARM products and services. Second-level outcomes are changes that occur as a result of increased take-up and use of FARM products and services.

2.2.4 First-level outcomes

It is critical that potential policyholders understand the insurance product and coverage, and more broadly, that they understand insurance as a concept. These seem like preconditions for beneficiaries to participate actively. We hypothesised that, since the concept of insurance is not easy to grasp (Cai et al. 2013), it is only once people understand it that they adopt it. The value that farmer-clients see in a product is critical in determining both the type of instrument and its quantity. Additionally, field studies have shown that trust in both the product and the provider are crucial in determining enrolment in insurance programmes (Cole et al. 2013; Dong et al. 2009; Giné et al. 2008; Basaza et al. 2008; Matul et al. 2013) Indeed, increased understanding of the product, recognising value and trusting the insurance agent and agency are all important in determining the uptake of FARM products and services. All these outcomes (understanding the importance of insurance; perceived value; and trust) affect the uptake of FARM products (Miranda and Farrin 2012; Binswanger-Mkhize 2011).

Once acquired, the use of the product (e.g. buying improved seeds or filling in a claim) and the use of services (e.g. attending the information campaign or following the advice broadcasted) are expected to lead to another range of outcomes further up the causal chain, depending on assumptions being met. We argue that renewal is one indicator that shows the success of uptake and successful use. While renewal comes later in the process, it is a first-level outcome as defined here, meaning uptake.

We needed to make assumptions for impacts on first-level outcomes. On the demand side, liquidity constraints impede farmers from paying the premium and/or buying the product. Personal profile and perception of risk (level of risk aversion) also play a role in the choice to enrol in agricultural insurance. This may differ between men and women. Awareness of weather vagaries and expectations of unanticipated variability are also likely to influence uptake decisions. Peers also influence these decisions (Giné et al. 2008). Furthermore, transaction costs play a role in affecting both demand and supply, since they increase the product cost, both explicitly and implicitly.

On the supply side, ease of verifying insurance claims affects the purchase of indemnity insurance. The time and channels of delivery of insurance products are also crucial for

product take-up.[3] Indeed, there is usually a complex set of actors who interact on the ground to advise, sell and service insurance holders. These include: government staff, who usually also subsidise agricultural insurance; the underwriting agency; a bank; the on-the-ground agency that has field and community agents, who facilitate interactions; and finally, the farmer. All these actors influence the adoption of insurance services and products.

Farmer expectations about other sources of relief and compensation are also important to consider: for most weather and large-scale crop disasters, the state sets up compensation and relief mechanisms that help farmers. Indeed, a positive expectation of a state-sponsored indemnity after an adverse event is likely to perversely affect the likelihood that farmers see value in purchasing an insurance policy. All of this assumes that purchasing FARM products is voluntary. Indeed, if insurance schemes are compulsory or bundled with other necessary products, the uptake of the FARM product is likely to be independent of several of the variables we discuss here (e.g. some insurance is mandatory while subscribing to a loan in India).

2.2.5 Second-level outcomes

We classified farmer response to uptake of risk-mitigating products into ex post and ex ante strategies. Ex post strategies are risk-coping actions that occur at the household and farm level after a production shock: e.g. FARM products and services may lead to a reduced need to draw on informal financial sources, lower debt levels, fewer defaults on loans and fewer distress sales of household assets. We also expected changed patterns of allocation of family labour (see Cohen 1992 for a thorough discussion on risk-coping strategies).[4]

On the other hand, ex ante risk-mitigating actions are those that are adopted irrespective of whether a shock has occurred. Risk-mitigating strategies include decisions to diversify household income sources – e.g. multicropping instead of specialisation – even when the adverse event does not occur. We hypothesise, therefore, that farmers who adopt FARM instruments are less likely to opt for low-risk, low-yielding crops and likely to change their seasonal migration behaviour. Another risk-mitigating outcome is the increase in productive investment, e.g. buying pesticides or better seeds.

If the insurance mechanism allows farmers to switch to higher-risk, higher-yielding crops, we would expect a positive effect on productivity. It is also likely that this increased uptake allows smallholders to smooth consumption and avoid distress-coping strategies such as drawing on informal financial sources after a shock. This is also likely to change the distribution among insurance, credit and savings instruments held by a smallholder household. Overall, we expect that most of these actions will lead to better financial protection of rural households, through higher income levels and/or through more assets or higher levels of savings. It also potentially leads to better health conditions as a result of changes in behaviour such as consumption smoothing and risk mitigation. Higher

[3] One should also bear in mind that the best-suited sign-up period in rural areas is often restricted to a small post-harvest window.

[4] In response to negative shocks, beneficiaries who buy or use FARM products and services are less likely to deplete their savings and therefore more likely to need lower levels and amounts of formal or informal loans and less likely to be unable to repay loans or sell assets (in distress sales), reduce daily consumption or mobilise family – and in particular, child – labour.

productivity and incomes would free up resources for children's education, and we may expect less use of child labour and higher levels of education.

Again, several assumptions were important for each hypothesised outcome. On the supply side, our main assumptions were related to expected outcomes and the commercial viability or quality of the product offered. So, in an index-based insurance scheme, quality will be ensured through a strong correlation between actual loss and the index triggering the payout – i.e. by low levels of basis risk. Similarly, in product design, the frequency of payouts plays a key role in influencing uptake. Quick claim settlement is also a crucial factor in inspiring trust and take-up (Karlan and Murdoch 2009). Indeed, attributes of FARM processes or products such as delays or defaults of payments may hinder the sequence in the causal chain. In many countries, non-missing markets and subsidies are often required for FARM products to be adopted. Finally, from both the supply- and demand-side perspectives, the actual occurrence of the shock is necessary to trigger the payouts for insurance. So the expected frequency of shocks and adverse events is critical in determining uptake.

Intrahousehold bargaining power also influences outcomes. Greater bargaining power of the wife in the household may influence the choice to send children to school (Quisumbing and Maluccio 2000). We also assume that farmers' own expectations of the impact of losses following an adverse event become smaller if FARM technologies and services are adopted.

2.2.6 Impacts

We argue that the ultimate impacts of increased uptake of FARM products and services are a reduction in vulnerability, improved resilience to shocks and an increase in farmer families' welfare. We also posit that all of these changes increase the commercial viability and sustainability of FARM products and contribute to creating and strengthening markets for these products.

2.3 Description of interventions included

We used the theory of change to construct the EGM framework. One of the strengths of the EGM is to visually display the density of existing evidence sorted by type of intervention and outcomes that are measured along the causal chain (Snilstveit et al. 2017). In particular, this tool takes stock of and maps the evidence in a matrix with intervention categories displayed in rows and outcome indicators displayed in columns. Another key feature of the EGM is that it also provides links to studies in the map. Table 1 lists and describes the categories of eligible interventions.

We excluded studies that assessed agricultural risks but were not directly related to dealing with production risk. These included studies that considered ways to mitigate price risks; assessed contract farming and reduced market-related risks, including those related to transportation, logistics and general infrastructure; and dealt with political and institutional risks. We also excluded studies of technical attributes of products (e.g. testing different insurance indices) that did not look at outcomes of the intervention in terms of their impact on beneficiaries (Table 3).

Table 1: Categories of FARM interventions included

Categories of FARM interventions	Brief description/examples
1. Formal financial risk-management products	Finance from banks and other formal sources
Formal yield/indemnity insurance	The indemnity is based on the actual average yield of an area, and payout occurs when the average yield for the area is less than the insured yield
Index insurance	Benefits paid out on the basis of a predetermined index (e.g. rainfall level)
Formal agricultural risk-related credit	Loans, microfinance
Formal agricultural risk-related savings	Deposits
Direct subsidy/grant/transfer	e.g. cash transfers
2. Informal risk-management financial products	Finance from nonbanks. Includes gifts, rotating savings and credit associations
3. Agricultural technology/inputs	e.g. irrigation technology
4. Social protection schemes	e.g. India's national rural employment guarantee scheme
5. Bundled insurance	Combination of FARM insurance products with other products, e.g. health insurance
6. Innovative/improved product	e.g. M-PESA, mobile money
7. Other products	Self-help group savings
8. Services	
Financial literacy/product training	Includes awareness/marketing campaigns
Financial advice	Advice on financial related matters
Other services	

2.4 Description of outcomes of interest

Table 2 shows the outcomes we included in the map. A first group of outcomes of the effects of FARM products and services relates to variables that inform demand and supply for FARM products. Included in this category are studies investigating uptake and renewal rates, the use of product and extension services, trust, cost-benefit, cost-effectiveness and loss ratios. These variables affect the demand and the commercial viability of FARM products and services and therefore their supply.

Second-order outcomes (Table 2), which are short- and medium-term outcomes, are split into different categories. These include outcomes that measure:

- how farmers change their ex post risk-coping strategies, e.g. levels of indebtedness, assets, consumption levels, (adoption of) low-risk-low-yield strategies, default levels (on loans) and changes in levels of savings;
- changes in access and use of financial instruments, e.g. loans, savings and informal financing; and
- changes related to ex ante risk-reducing household production decisions, e.g. decisions related to farm-level investments, household assets, input decisions, cropping patterns and changes in productivity, yields and consumption levels.

Table 2: Outputs and outcomes

Output, outcome or effect	Definition
Outputs	
Product adequacy	Whether the product actually works or adequately addresses risks
Financial literacy	Beneficiary understanding of the product's financial component
Awareness and understanding	Basic awareness and understanding of risk mitigation
First-order outcomes	
Trust	Changes in level of trust in the product, service and provider
Take-up/demand	Changes in level of take-up of the product – e.g. percentage of farmers buying insurance; number of units of insurance bought
Use of product and services	Whether the service or product is actually used – e.g. did farmers who bought insurance claim payouts?
Renewal	Whether the target population renews the product or service
Other outcomes*	
Costs and benefits	The monetary worth of the intervention, total project costs versus project benefits in monetary terms
Cost-effectiveness	Comparison of the relative costs or monetary inputs of two or more interventions and the (desired) outcome/impact effects
Loss ratio	Total losses paid by an insurance company in the form of claims
Second-order outcomes (short-/medium-term outcomes)	
Change in risk-coping (ex post) strategies	Informal financial sources, (levels of) indebtedness, (levels of) productive assets, changes in consumption level, low-risk-low-yield strategies, default levels (on loans), savings levels changes, cropping patterns, mobilisation of family labour
Changes in access to and use of financial instruments	Loans, savings, informal financing
Changes related to ex ante household production decisions	Decisions regarding investments, assets, inputs, cropping patterns, productivity and consumption
Impacts (long-term outcomes) and heterogeneous effects	
Welfare-level outcomes	Food consumption, income, nonproductive assets, family labour (including child labour and migration), changes in health and/or education
Minority groups	Smallholder farmers, female farmers

*Note: We do not discuss these factors separately, but we recognise that studies examine these outcomes, and these studies contribute in important ways to understanding the uptake, use and effects of FARM products and services.

To understand long-term impact, we examined whether studies investigated household welfare and study variables, such as levels and changes in food consumption, food consumption patterns, nonproductive assets (productive assets are included in outcomes), levels and changes in family labour (including child labour and migration). Last but not least, we examined whether and how studies investigated indicators that are proxies for welfare, including health, education and income. We also examined whether studies looked at heterogeneous effects separately across different and important subgroups, including, but not restricted to, smallholder and women farmers.

2.5 Studies of interest

We included robust impact evaluations using a rigorous identification strategy and valid counterfactuals in the map, defining these as experimental and quasiexperimental studies (Table 3). We also included systematic reviews. But we excluded studies that used bivariate correlation analysis or cross-sectional data with endogenous programme placement and no control for confounding. We also excluded lab experiments, lab-in-the-field, behavioural experiments that used games and simulations to test hypotheses constructed by researchers.

Table 3: Summary of inclusion and exclusion criteria for studies

	Included	Excluded
Target population	Smallholder farmers in L&MICs	Studies focusing on nonrural population
Intervention type (short-term/long-term)	Financial instruments for risk reduction in agriculture (e.g. crop, livestock and disaster insurance and financial instruments bundled with risk mitigation technologies) FARM instruments bundled with other types of insurance, e.g. health insurance	Nonfinancial risk mitigation; nonagricultural risk (e.g. health and life insurance); macro-level interventions; studies focusing only on price risk; contract farming and market-related risk; political and institutional risk; lab experiments, lab-in-the-field behavioural experiments
Outcomes	Behaviour (e.g. savings, investment) and welfare outcomes (e.g. consumption or education); productivity and cropping patterns; evidence on demand (take-up and renewal rates) and supply	Evidence on (hypothetical) willingness to pay for insurance and laboratory experiments; papers that only examine technical attributes of the product
Data	Quantitative survey data or secondary data	Studies that only use qualitative data
Study design	Robust impact evaluations using a rigorous identification strategy and valid counterfactuals (e.g. experimental, quasiexperimental, difference in difference, regression discontinuity designs, propensity score matching, instrumental variables, multivariate regressions with fixed effects); systematic reviews	Correlational analyses; cross-sectional evidence with endogenous programme placement and no control for confounding Literature reviews not done systematically
Timing of the study	Peer-reviewed papers; published papers; working papers. Studies published in a peer-reviewed journal published in or after 1995. Ongoing studies not published in a peer-reviewed journal written and made available after 2011. To inform insights around the theory of change, we also included a select set of policy briefs and monitoring and evaluation reports of FARM programmes (see bibliography).	Studies published in peer-reviewed journals before 1995; personal drafts or memos or conference presentations

3. Findings

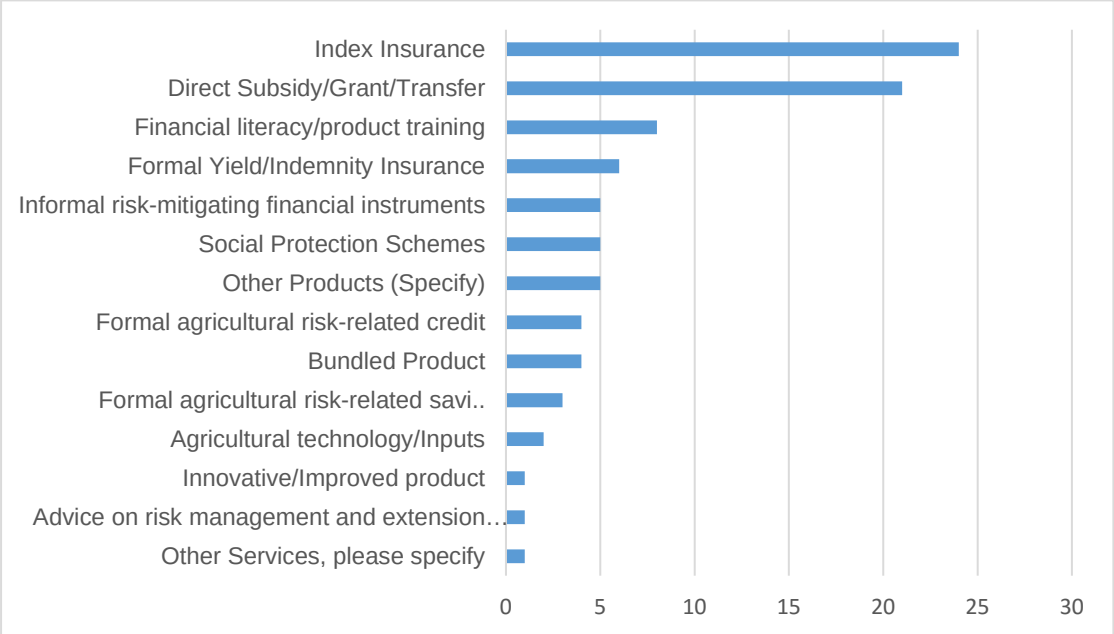
In this section, we present the main findings and highlight the evidence gaps.

3.1 Evidence base

Fifty-nine studies met our inclusion and exclusion criteria.[5] Of these, two were systematic reviews and the rest were primary impact evaluations. Figure 11 reports the number of papers that appear in each cell of the EGM. The study search flow diagram in Appendix A shows that the initial search resulted in 10,203 references. We screened these titles and abstracts for relevance (based on the scope) and then screened the remaining references on full text based on the inclusion criteria. The interactive EGM is available online on our website.

Figure 3 indicates that formal risk management products are the dominant studied intervention type. We found that index insurance has received much attention (in 24 studies, or 40%),[6] followed by studies that examined the effect of direct subsidies, grants and cash transfers (21 studies or 35%). The EGM shows that their role in helping farmers managing risk is being actively explored. Almost 13 per cent of studies included in the EGM examined other types of intervention, e.g. financial literacy and product training. Indeed, many of these interventions are often employed to support index insurance products. Only a few studies examined the impact of informal risk-mitigating financial products such as informal savings groups or informal credit.

Figure 3: Number of studies by intervention type (including systematic reviews)



Note: The total number of studies is 59. The studies are not mutually exclusive across intervention type.

[5] We could not obtain 10 reports among the 241 reports for which the full text was screened; 231 full texts were screened.

[6] Note that the numbers in the rows and columns are not mutually exclusive. This is because one study is likely to examine more than one type of intervention and more than one type of outcome. The percentages presented are a percentage of the total number of studies (59).

Studies were conducted in 21 L&MICs, but the distribution of studies is extremely uneven. The map in Figure 4 shows that interventions were highly concentrated in Sub-Saharan Africa and South Asia. FARM programmes in Ethiopia (10), Kenya (5) and India (11) are the most studied. While index insurance is examined a lot in South Asia, in Sub-Saharan Africa, direct subsidies, grants and transfers are studied most. Additional analyses show that social protection schemes often employ FARM interventions. Indeed, agricultural risk mitigation instruments such as insurance and credit for savings and loans are seen as instruments for social protection in countries such as India and Ethiopia.

Figure 4: Number of studies by country

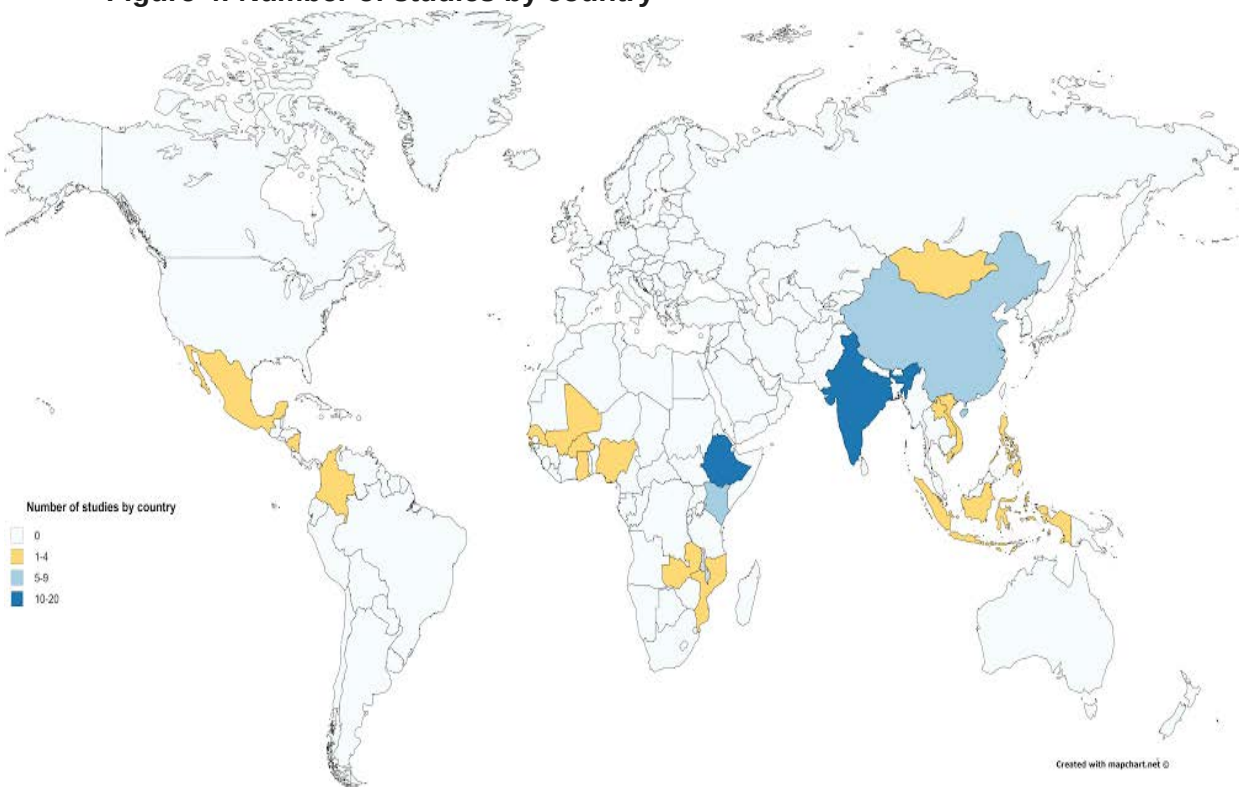


Figure 5 shows that 15 included studies focused on the effects of grants, subsidies and transfers in Sub-Saharan Africa, whereas this was much less the case in South Asia (only three studies). Similarly, a higher number of studies in Sub-Saharan Africa looked at index insurance, although the proportion of studies (as a ratio of total studies in the region) was the same across both regions. Studies in Sub-Saharan Africa focused more on the enabling environment around agricultural risk mitigation instruments, such as financial literacy training, social protection schemes and bundled products. The proportion of studies investigating the impact of informal risk management financial instruments was much higher in South Asia than in Sub-Saharan Africa.

Figure 5: Number of studies by intervention type and region

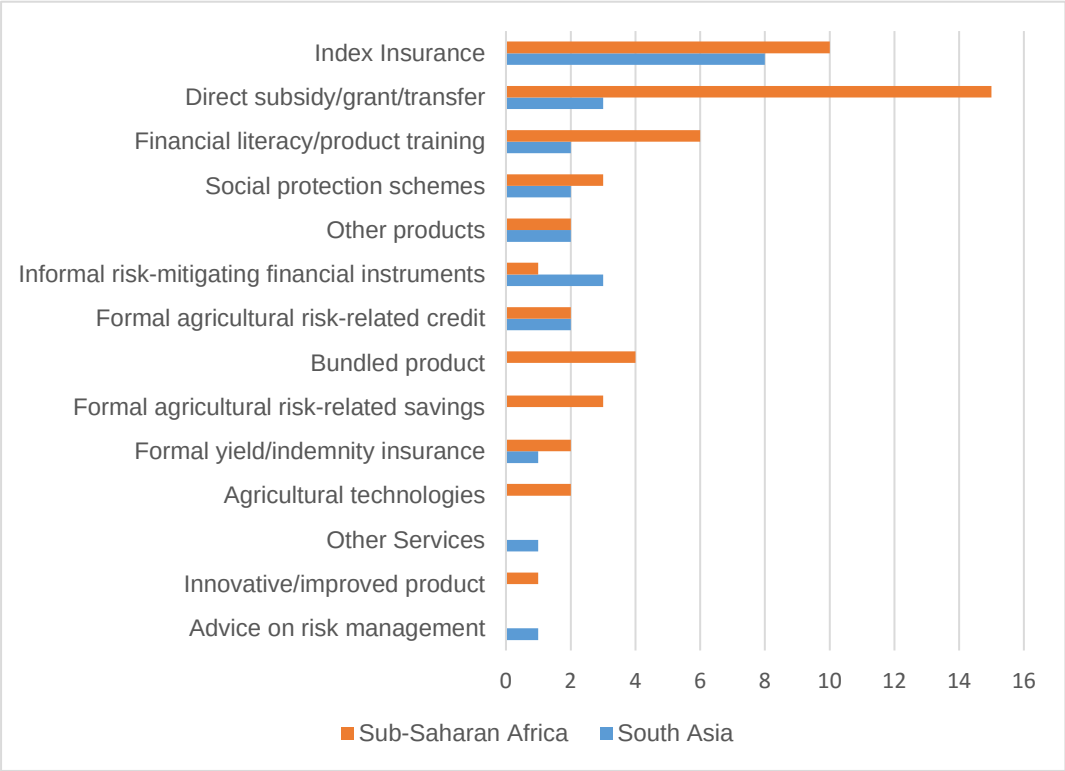


Figure 6 displays, in descending order, the number of studies by type of outcome examined. We found that evidence was skewed towards some outcomes. Among first-level outcomes, 25 of the 59 studies examined uptake and demand for FARM instruments. Other first-level outcomes (e.g. trust, renewal and use of products or services) received less attention. Fourteen studies examined whether FARM products led to changes in financial literacy and product understanding. Very few studies looked at insurance renewal (two studies), the effect of FARM programmes on the use of insurance and extension services (one study) or the repayment of loans (three studies). None of the studies included in our EGM examined loss ratio, which is an important statistic for most insurance agencies.

A large percentage of studies examined outcomes that are likely to manifest over the course of one year, including change in productive assets (25 studies), productivity as measured by yield and revenues (22 studies), and farm investments (19 studies). This is not surprising, as many of these products try to decrease barriers to investments in productive activities. It is also easy to study access – which changes in the short term – compared to welfare and income, which may only change over longer periods.

Less than a quarter of the studies (12) looked at the impact of FARM on access to and use of formal loans. Even fewer (nine) examined how savings and informal financing respond to FARM. This is a non-negligible gap, as one of the important theorised functions of FARM instruments is to increase access to formal finance and reduce reliance on nonformal networks. The effect of these instruments on crop diversification, cropping patterns and changes in the adoption and use of other formal risk-mitigating instruments was less studied.

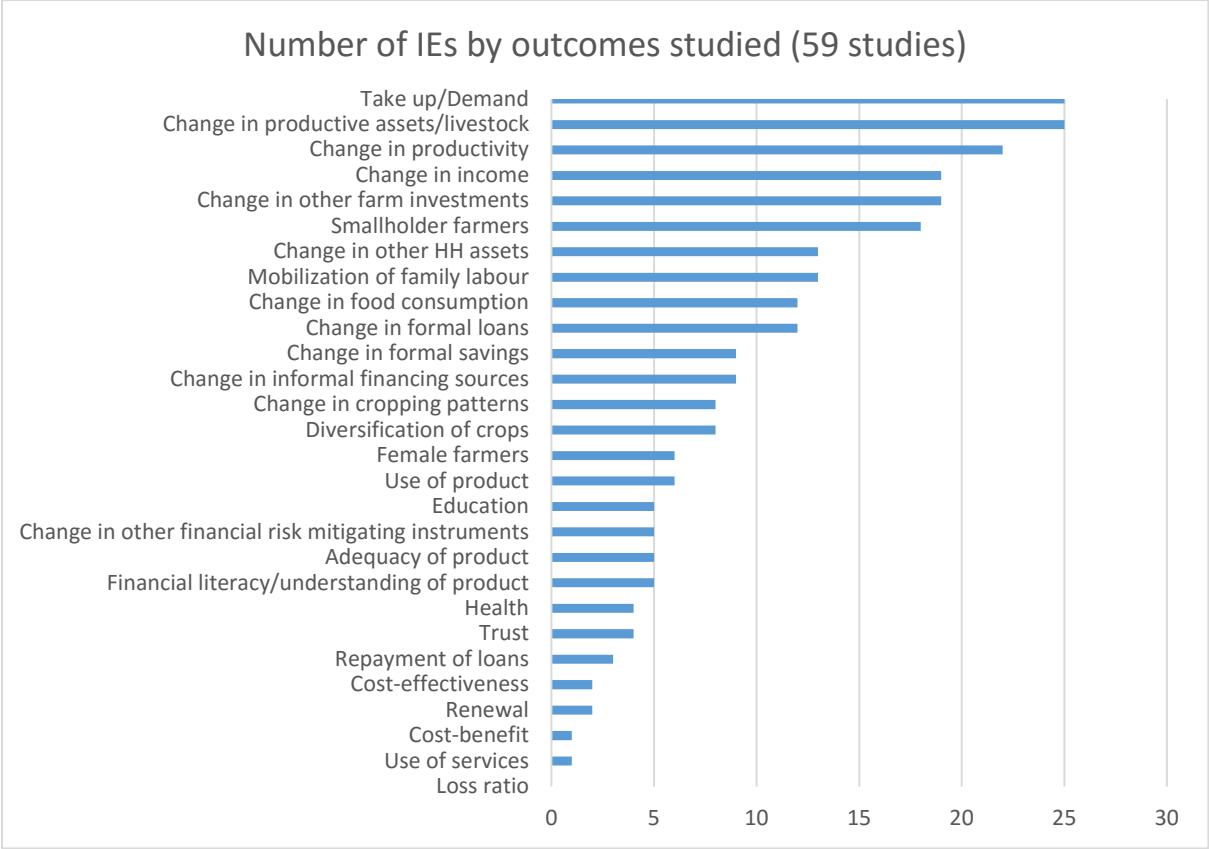
Indicators of economic well-being received less attention. While a third (19) of the studies focused on yearly changes in income, less than a quarter (12) focused on food security. Other welfare-related indicators – such as health outcomes (four studies) and education outcomes (five studies) – were even less studied. Perhaps one of the reasons for this skewed interest in some outcomes is the length of the studies available: the average study length of 32 months may be too short a time period for human development indicators to change in response to reduced risks.

There was limited evidence on whether the design of FARM products is adequate for smallholder farmers. Only 14 studies examined whether products are appropriate to the specific (biophysical) context and farmers' socioeconomic characteristics.

Figure 6 also shows the lack of evidence on supply-side outcome variables such as loss ratios, cost-benefit ratios and cost-effectiveness. Although fewer than half the studies (18) examined impacts on smallholder farmers, female farmers received even less attention (six studies).

There are two possible explanations for why so few available studies examine outcomes further along the causal chain (e.g. impacts on health and farm management strategies). First, it is possible that most studies are not concerned with longer-term outcomes and are more concerned with uptake and demand. Second – and this is more likely – low uptake may constrain researchers from examining outcomes further along the causal chain. Low uptake makes it difficult for researchers to have adequately powered samples that can help them examine outcomes and impact variables further along the causal chain. Unfortunately, it was difficult to determine the actual reason from studies included in this map, since none of them had links to their pre-analysis plans.

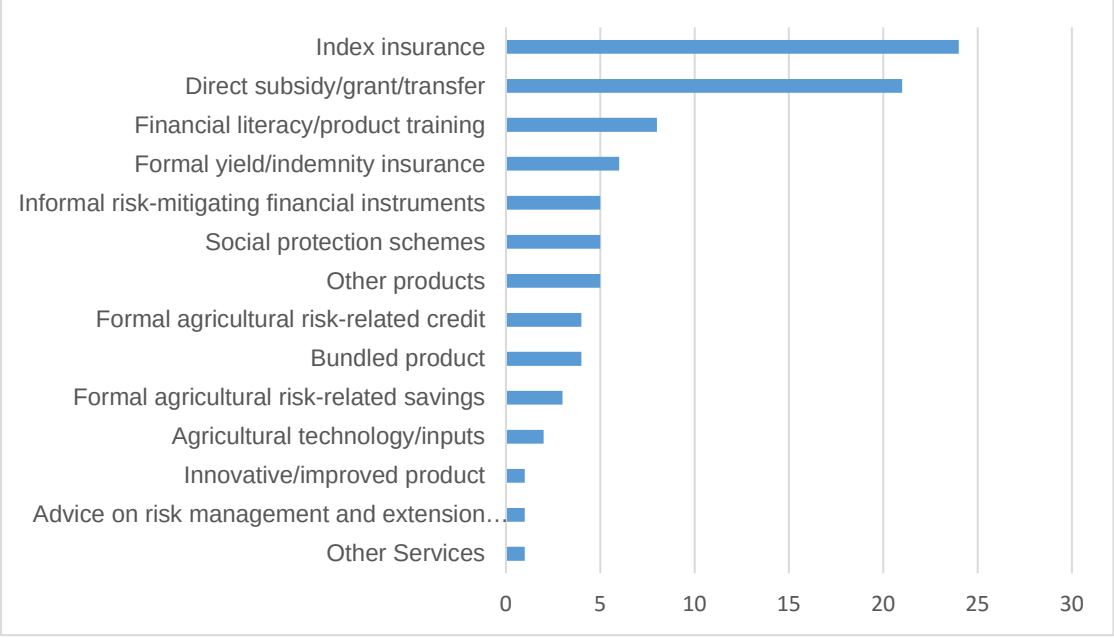
Figure 6: Number of unique studies by outcome type



Note: N = 59 studies

Figure 7 shows that 18 of the 45 occurrences of demand for interventions (40%) were related to index insurance products.

Figure 7: Number of studies analysing demand/take-up rates, by intervention type



Note: One study may examine multiple interventions. Total observations (number of studies*interventions) is 45. Figures correspond to number of studies.

More detailed analysis suggested that the representation of interventions by outcomes studied varied. Index insurance accounted for the highest proportion of studies that examined changes in food consumption and productive assets. However, when we looked at outcomes that may take time to manifest, we found that direct subsidy and grants formed the majority of studies.

Figure 8 shows a clear increase in the number of studies over time. This reflects an increased attention to risk-coping technologies (e.g. index insurance) over time.

Figure 8: Total number of studies per year

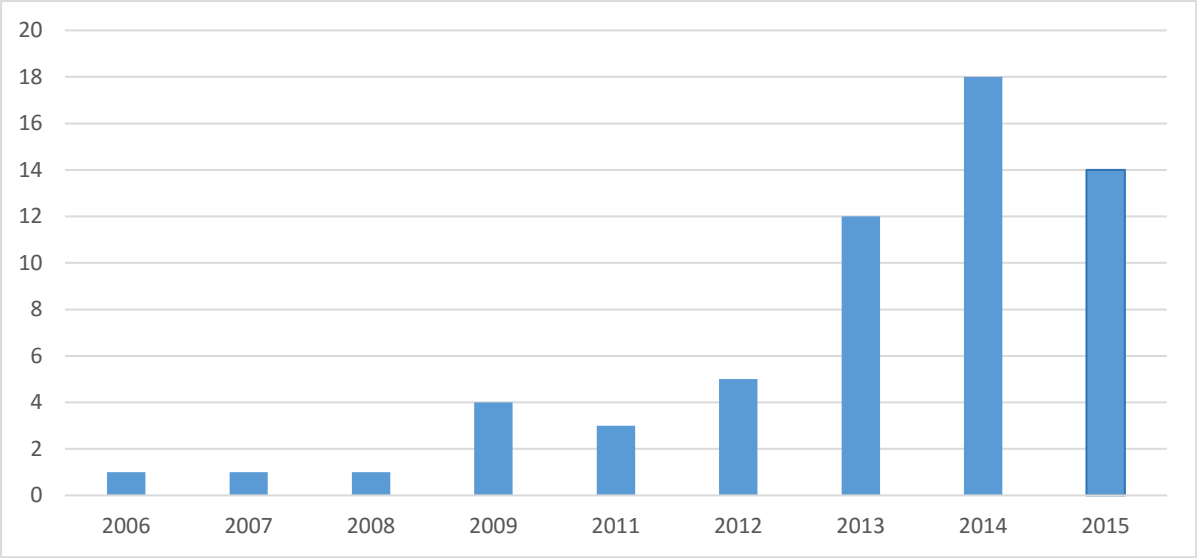
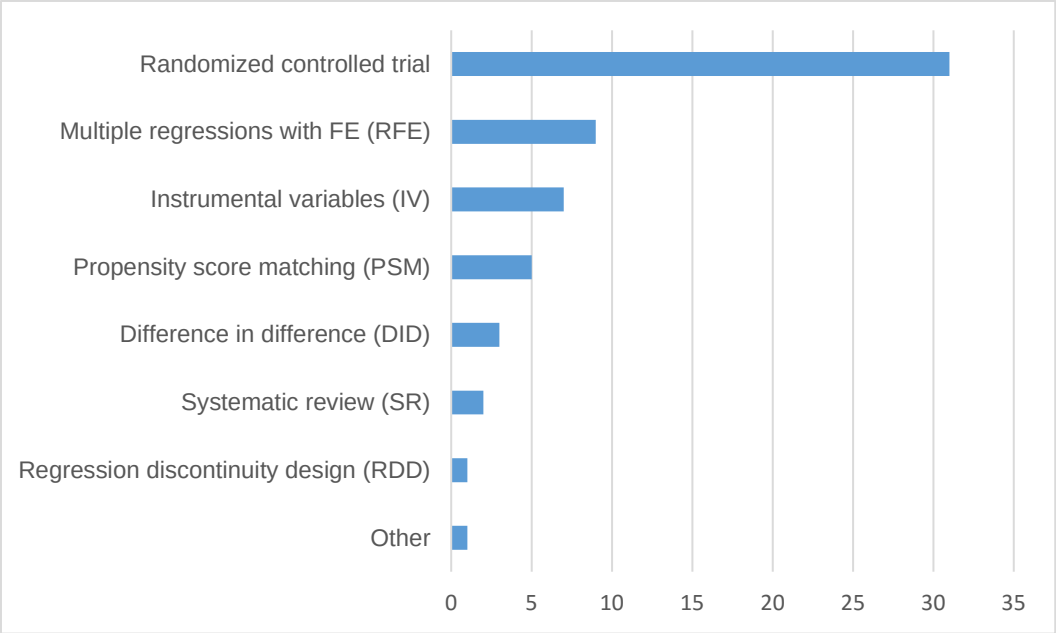


Figure 9 shows that randomised controlled trials were the most prominent study design. More than half the studies employed randomised assignment to understand the effect of FARM instruments on various outcomes. Figure 9 distinguishes the types of design used to examine FARM programmes.

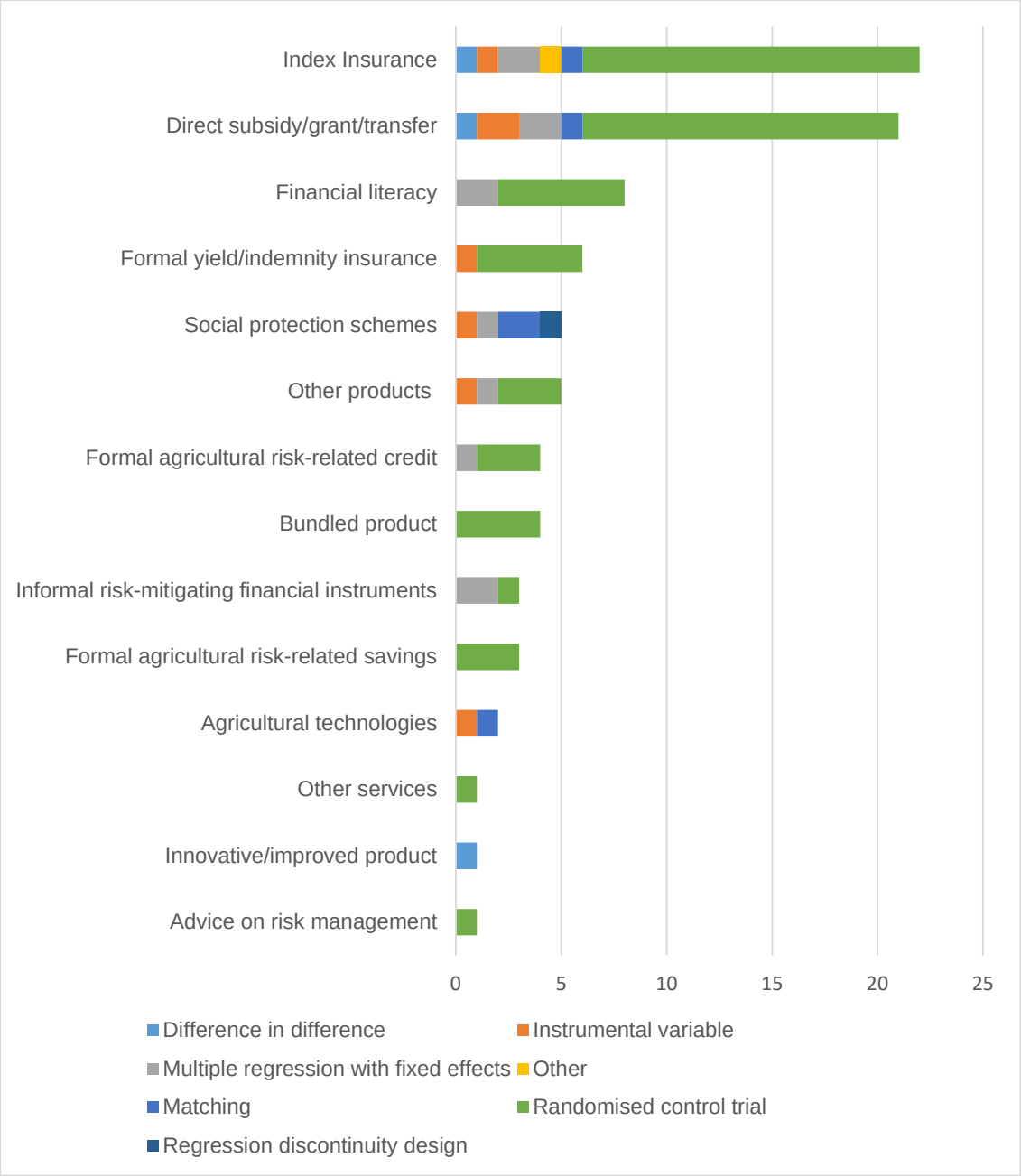
Figure 9: Number of studies per study design



Note: 'Other' includes one paper that uses a Heckman selection model.

Figure 10 shows the distribution of study design by intervention type. It shows that randomised controlled trials are mostly used to measure the effect of FARM products (including index insurance products), bundled insurance products, financial literacy and product training interventions. Randomised assignment has hardly been used to measure the effect of either agricultural technology and inputs or social protection schemes.

Figure 10: Distribution of study design by intervention type



3.2 Findings from systematic reviews

Two systematic reviews were included in this study, both of which we critically assessed for quality using 3ie's critical appraisal tool.[7]

The first one (Cole et al. 2012) included 13 studies produced since 1990 in L&MICs and focused specifically on studies that assessed the effects of index-based insurance on low-income households – particularly weather insurance and area yield-indexed crop

[7] Available at: www.3ieimpact.org/sites/default/files/2019-01/quality_appraisal_checklist_srdatabase.pdf

insurance – and their impact on household investment decisions, household well-being and take-up of consumption smoothing.

Cole and colleagues' main finding is that adoption of formal agricultural insurance is low, despite insurance mostly being provided at subsidised rates. Their other findings suggest that higher liquidity and income levels are positively associated with take-up of insurance, a lower level of income diversification is positively associated with demand for insurance and financial literacy is positively correlated with interest in weather insurance. Surprisingly, higher levels of risk aversion are associated with lower demand for index-based microinsurance. There is some, albeit mixed, evidence that access to index-based insurance increases the use of agricultural inputs (e.g. fertiliser). The review highlighted substantial gaps in the literature on the take-up and impact of index-based microinsurance.

The second systematic review (Apostolakis et al. 2014) is a systematic narrative literature review of microinsurance. It included 64 studies that examined the financial performance and social impact of microinsurance on the well-being of the poor. It included peer-reviewed articles from 1990 to 2014 and excluded studies that did not include a direct reference to the search term 'microinsurance'. It also excluded studies discussion, conceptual or review papers and/or those that used nonexperimental methods. They found that microinsurance reduces the vulnerability of the poor and helps them overcome poverty. The main pathways of these effects are through increased access to healthcare services and an indirect effect on the household's economic status.

3.2 Summary of findings for research

Our study has important findings for researchers and research funders. While the stock of evidence is undoubtedly large, it is clustered, with some interventions and outcomes more studied than others. Among risk-mitigating products, index insurance is the most studied intervention. This is not surprising, given the interest of policymakers and insurers in this product. The majority of studies focused on examining the impact of FARM interventions on take-up – a first-level outcome identified in our theory of change – and short-term outcomes such as productive investment and yield. The evidence base is also restricted geographically, with India and Ethiopia the most represented countries in South Asia and Africa respectively.

However, certain evidence gaps remain. With overwhelming focus on some short-term outcomes, longer-term outcomes that are further down the causal chain (e.g. human development and vulnerability indicators) have not been studied much. Most FARM products and insurance in particular have low take-up. Hence, an important question that needs to be answered is: what can be done to increase uptake? Answering this will require research on the role of product quality, financial and product knowledge and trust building.

Very few studies have examined the impacts of technological innovations such as mobile phones and digital education. Bundled products that combine several risk-mitigating products and the interaction of FARM instruments with social security programmes and nonformal insurance mechanisms also require further exploration. With a large number

of private players in the field of insurance, analysis on cost-effectiveness and loss ratio will be able to inform implementing agencies. There is also a need for research on the effects of FARM on intrahousehold allocation, women and vulnerable populations.

Figure 11: Evidence gap map summary

4. Conclusion: what impact and synthesised evidence is needed?

The systematic reviews did not present sufficiently strong evidence for policy. Therefore, in this section, we summarise the implications of the evidence and gaps research.

Adoption of formal agricultural insurance is low, and the evidence on renewals is limited (Cole et al. 2012), despite insurance being mostly provided at subsidised rates. This poses a challenge for rigorous impact evaluation. Low take-up makes impact evaluations inadequately powered and too biased to be able to draw credible conclusions.

In order to study impacts of agricultural insurance, the main first-order question we need to answer is: what can be done to increase take-up and renewals? In our theory of change, we discussed a number of linkages in the causal chain that lead to take-up, such as trust building, financial literacy, product awareness and perceived and actual adequacy of product. Yet our EGM shows that there is insufficient evidence on these important linkages.

The need for evidence on improving take-up has been highlighted in the systematic review by Cole et al. (2012). Although limited to index insurance, this review discusses the requirement of research to address issues such as basis risk, financial literacy and product knowledge to improve take-up. The problem of low take-up is not limited to the adoption of other FARM products. Take-up also varies with and is influenced by a number of contextual factors, including the presence of informal risk-mitigating strategies, trust and the regulatory environment. These require better understanding.

Most existing impact evaluations study outcome variables that can be measured on a short-time horizon, such as productive investments, farm investments and productivity. These are no doubt important, but at the same time, investigating the welfare impacts of FARM products (e.g. health and education) would be valuable. Doing this would require impact evaluations with a longer time window and therefore a higher cost. This is especially true for insurance contracts that have a low probability of paying out and in cases where welfare impacts are mainly expected through changes in behaviour (e.g. increased investment).

On the demand side, some other outcomes would require long-term evaluations. Few papers study renewal rates. Given the generally low renewal rates and the threat this represents for the sustainability of these products, this is an area where more research would be useful. In the case of voluntary subscriptions, renewal rates can be seen as a form of appraisal of the products by the clients after having experienced them. A second outcome that has been understudied in-depth is behaviour under risk, or more specifically, risk perceptions and financial literacy and the way in which perceived ex post impacts drive ex ante changes in behaviour. Similarly, on the supply side, almost none of the long-term evaluations investigated the cost efficiency of FARM products or loss ratio.

The majority of studies focused on index insurance. The strength of index insurance products is to overcome the supply-side difficulties of moral hazard and adverse selection, as well as the high transaction and verification costs that are otherwise included in indemnity insurance products. Being promising, it appears to be increasingly studied. However, a number of innovative risk-mitigating products and strategies that are being fielded or piloted have not received enough attention in the literature: e.g. very few empirical and theoretical studies focus on the impacts of offering bundled products (either bundling several risk classes or products with value-added services). Similarly, technological innovations – e.g. using digital education in the sale of insurance products, and mobile money – require more examination. Little evidence exists on the interactions between FARM tools and public policy instruments: e.g. using insurance as part of a social safety net scheme. The role played by public policies is central to reach impact, whether that be through the signals given to farmers when big disasters occur – e.g. free compensation systems – through the prevailing regulatory environment or by reliance on public subsidies.

The evidence is also skewed geographically. Only seven countries in Sub-Saharan Africa and South Asia hosted almost 73 per cent of the interventions studied in the 59 selected papers. Except for India, the focus is not always on countries where there have been large programmes, e.g. Turkey or Mexico.

Furthermore, the existing literature lacks an explicit focus on gender. Indeed, it is very likely that women have a different risk perception from men and also face and respond differently to risk. However, only eight of the included studies (less than nine per cent) look at differential effects on women.

This report highlights the increasing interest in FARM tools among researchers and practitioners. We found that the number of studies on this topic has increased recently and that they are increasingly using experimental methods for impact evaluation. Nevertheless, a wide scope for research remains open. The main priorities in terms of research are below:

- What can be done to address low take-up of FARM products? In this context, areas that require further examination are the product features, particularly improving quality and adequacy of the product; tailoring product design to local risks; using innovations; and exploring new types of bundled products.
- Investigating the role of public policy, thinking through whether FARM products – and in particular, crop insurance programmes – provide better value for money for governments than post-disaster compensation schemes.
- Adopting a long-term perspective will add value to the current state of knowledge. It will also allow researchers to analyse the long-term welfare impacts of FARM technologies (e.g. impact on education or health).
- Differential effects of FARM financial interventions on women deserve more attention from the research community. Women have different agricultural risk exposure and risk perceptions than men.

However, some important challenges will need to be solved in order to conduct high-quality impact evaluations. Low uptake and related power issues are important. Some countries solve the problem of uptake by making subscription mandatory (e.g. by

compulsorily bundling loans with insurance). In addition, regulatory constraints, reliance on heavy subsidies and free compensation (farmers who think that the government should solve such problems) are some other challenges to conducting impact evaluations on this topic.

Appendix A: Methods

1. Process

We used a deliberative process to build the EGM for this scoping study. This was based on existing literature, our theory of change, the results of our online survey and feedback from the Nairobi workshop. All team members participated in building and populating the EGM.

2. Inclusion criteria

To identify papers to be included in the EGM, we defined specific inclusion and exclusion criteria, shown in Figure A1.

3. Search strategy

Mapping the existing evidence implies conducting a systematic search for studies falling within the scope of this study on financial instruments to manage agricultural risks. To do this, we systematically and manually searched a range of academic databases. These searches were supplemented by a manual search of policy-oriented websites active in the field and a snowball search through seminal studies in this field (see Table A1).

Table A1: Overview of sources and portals consulted during the literature search

Source	Portals	URL
Scientific journals	Cab abstracts	www.cabdirect.org
	Econlit	https://www.aeaweb.org/econlit/
	Scopus	www.scopus.com
	Campbell Library	www.campbellcollaboration.org/lib/
	Jstor	www.jstor.org
	Science Direct	www.sciencedirect.com
	Agricola	http://agricola.nal.usda.gov/
	Picarta	www.picarta.com
Development institutions	Eldis	www.eldis.org
	International Research Institute for Climate and Society	http://iri.columbia.edu/our-expertise/agriculture/
	Global Index Insurance Facility (World Bank)	www.indexinsuranceforum.org
	Impact Insurance (International Labor Organization)	www.impactinsurance.org
	International Fund for Agricultural Development	http://ifad.org
	International Food Policy Research Institute	www.ifpri.org
	Agricultural Technology Adoption Initiative Center for Effective Global Action Berkeley	www.atai-research.org http://cega.berkeley.edu

Bilateral donors	Department for International Development UK Deutsche Gesellschaft für Internationale Zusammenarbeit, and so on	
Snowballing	Google Scholar	https://scholar.google.co.uk/

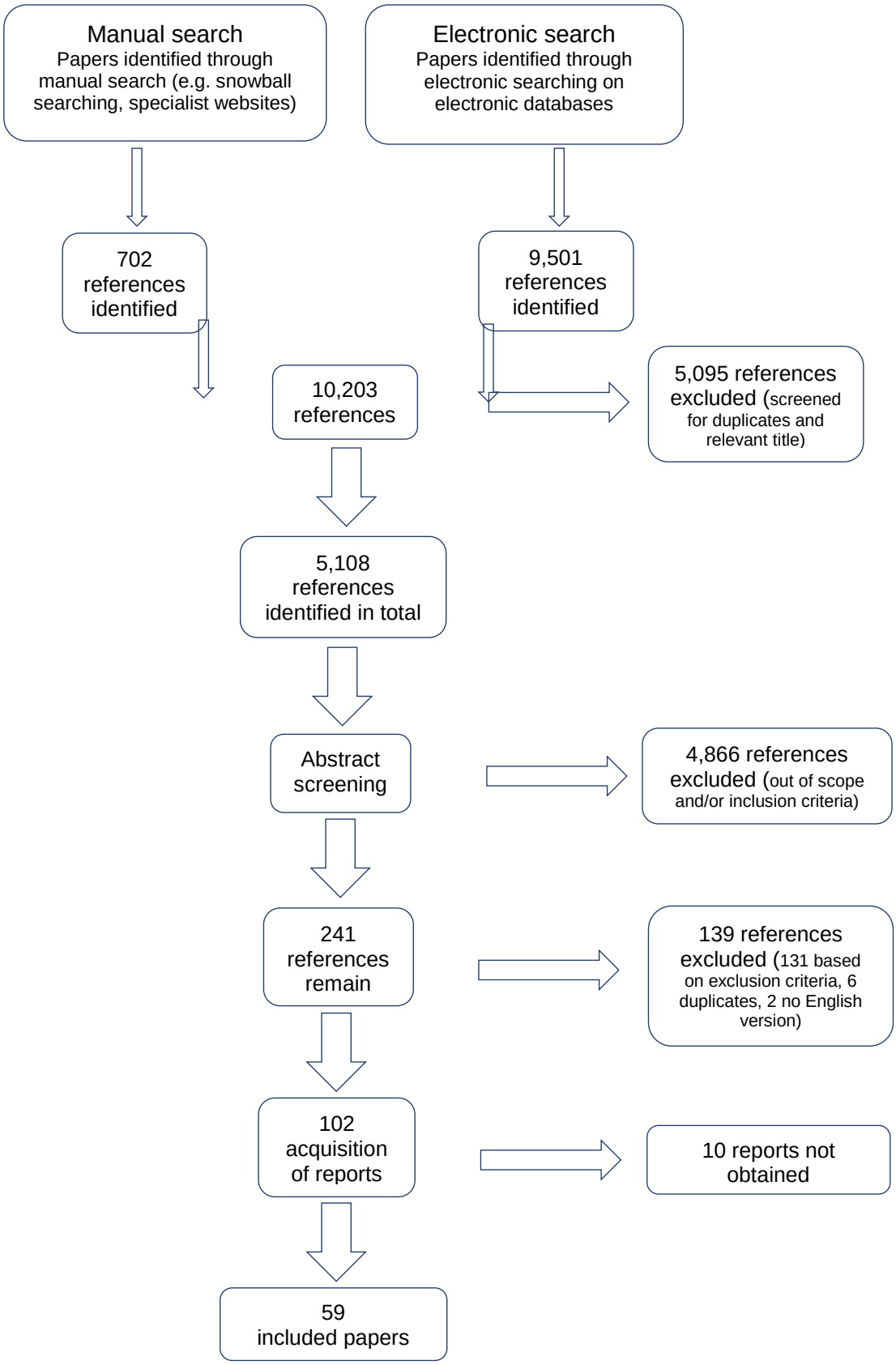
We screened the results using several steps, as displayed in the study decision flow diagram (Figure A1). Combining the results of the systematic search (9,501 references) with the results of the manual search and snowball search (702 references), we identified a total of 10,203 records. After the first screening phase (based on the titles) and the removal of duplicates, 5,108 records remained to be screened. The third phase of the search strategy – screening records based on their abstract – resulted in a total of 241 records remaining. To carefully assess these records further, we collected PDFs of these 241 records. Based on the full texts, we identified 92 records to be incorporated into the EGM. At every stage, several people checked and cross-checked the records, discussing all papers for which doubts remained.

3.1 The map framework

The first step in developing an EGM is to identify the headings of the rows and columns. In our EGM, the rows are the interventions, listed by articles. Since one article – especially the literature and systematic reviews – can deal with multiple interventions, there are frequently multiple rows for the same article. Consequently, even though we list 92 articles, 146 rows appear in the table. The columns are the outputs and outcomes indicators that were tested in the studies.

This was followed by the systematic coding of eligible studies (Appendix B). We used Endnote© software to manage the references we obtained through the search strategy. We screened study titles for relevance and full text papers for inclusion, collecting information on study design, study population and location, and interventions and outcomes. We encoded data using Microsoft Excel©. We included 92 studies and displayed these in the map. Finally, we used Stata© software to perform the analysis of trends.

Figure A1: Study search and screening flow diagram



Appendix B: Coding guide for eligible studies

	ID	Question	Description/codes
Publication details	ID	Unique identifier	Unique ID number generated
	Year	Publication date	Year
Intervention details	Region	Region where the programme was implemented	East Asia and Pacific Latin America and the Caribbean Middle East and North Africa South Asia Sub-Saharan Africa Europe
	Country	Country where the programme was implemented	Write down the country/ies
Study design	Study design	The design or method used to establish causality in the study	Randomised controlled trial Difference in difference Instrumental variables Regression discontinuity design Multiple regressions with fixed effect Propensity score matching Other quasiexperimental design/method Other (e.g. systematic review)
Interventions	Intervention	The product or service on which the study provides evidence	Formal agricultural risk-related credit Formal agricultural risk-related savings Formal yield/indemnity insurance Index insurance Informal risk-managing financial instruments Agricultural technology/inputs Social protection schemes Direct subsidy/grant/transfer Other products Bundled products Financial literacy/product training Advice on risk management Agricultural extension services/product utilisation Other services
	Intervention subtype	Anything specific about the intervention	
	Length of study	Length of panel data/ exposure to programme	Number of years or months N/A when not applicable

1. Outcome guide

Please note that if one paper consists of several interventions looking at different outcomes, we should **use one row per intervention** (but keep the same unique ID identifier).

2. Variables and their definitions

1. Unique study ID: This will be a unique ID generated for each study. An Excel© sheet with the study names and their IDs will be provided to you. Please ensure that this is correctly entered.
2. Year of publication: The year in which this was published or became a working paper.
3. Region: The region where the intervention/programme was started. See drop-down list.
4. Country: The country/countries where the intervention/programme was started. If more than two countries, use || as a separator.
5. Study design: The design used to establish causality in the study (?). If multiple designs are used, select the most robust. See drop-down menu.
6. Intervention: This is the product/service(s) on which the study provides evidence (not necessarily always impact). Not difficult when there is a control group that does not get anything. Then report what the treatment groups got. It is more complicated when multiple arms are involved or every group gets at least something. In this case, choose what each group got: e.g. if one group got the product and the other the product and training, choose both the product and training as intervention, because one cannot assume that the impact of training and product is necessarily independent or additive. See table at the end for definition of each intervention type.
7. Intervention subtype: Anything specific about the intervention you would like to highlight.
8. Length of the study: If the data structure is a panel, the length between baseline and endline. If the data structure is not a panel, or this is an ex post study, the length of the exposure to the programme.
   (For Columns I to AK, enter 1 if Yes, 0 if No. OUTPUT/OUTCOMES are what are reported as the dependant variables. Remember that the EGM does not report what works or what the evidence is but whether there is evidence in that field. Do not worry about the coefficients.)
9. Take-up/demand: Buying of the product; value of the product.
10. Trust: Mutual trust; trust providers.
11. Financial literacy/understanding of product training: Understanding of the product (e.g. understanding of basis risk, bookkeeping, financial management; being aware that the product exists and knowing where to go to get information about it). Note that these should be outputs (e.g. an increase in profit could be due to better financial literacy, but this is the outcome and not output). Explicit indicators.
12. Adequacy of the product: The product was relevant, trustworthy and met the needs of the target group; quality of the product (the percentage of risk it takes away, reduces basis risk).
13. Use of product: Use of the product after a shock (e.g. how many people filed claims, how many reported receiving the product).

14. Use of services: Same as above, with respect to services.
15. Renewal: How many people bought the product or service again?
    Remember that we only look at the dependent variable (left-hand side of the regression).
16. Change informal financing: By informal financing activities, we mean borrowing, lending and gifts to persons in their social group. Group lending/savings/insurance activities (e.g. rotating savings and credit associations or remittances) are included in this. If there is a switch from formal to informal sources, this will be included here (crowding in/out).
17. Change in formal loans: The number and value of loans from formal sources. Indebtedness. Do people mortgage their property or assets (e.g. land)?
18. Repayment of loans: Mean amount, frequency and timing (delays/on time) of loan payments.
19. Change in food consumption: Hunger, skipping meals, food security, how many members ate.
20. Mobilisation of family labour: Child labour, migration.
21. Change in productive assets: Productive farming assets (e.g. livestock, tractors, tools for agriculture, water pumps).
22. Change in other household assets: All other household assets. This should not overlap with productive assets.
23. Diversification of crops: Change in the number of crops or land cultivated under each crop.
24. Cropping patterns: Change in the type of crop, switching from one crop to another. Possible to have both 23 and 24.
25. Change in productivity: Farm or agricultural productivity (e.g. yield, harvest output, farm animal outputs, such as milk from cows).
26. Change in other farm investment: Inputs – adoption of technology, irrigation, pesticide, fertiliser, inputs. Can overlap with 22.
27. Change in income: Household or individual income. Expenditure can be proxy for income.
28. Change in formal savings: Bank deposits, saving in bank accounts.
29. Change in other formal risk-mitigating financial instruments
30. Health: e.g. Z-scores, cognitive abilities, physical capacity, days lost in illness y=1, n=0.
31. Education: e.g. enrolment, attendance, test scores, grade progression.
32. Heterogeneous effects: Were there heterogeneous effects for smallholder farmers, female farmers and other groups?
33. Cost-benefit analysis: Did the study contain a cost-benefit analysis?
34. Cost-effectiveness: Did the study show the cost-effectiveness of the intervention?
35. Loss ratio: Does the study mention the loss ratio?

Reviewer, write your initials.

Appendix C: List of studies and reviews included in the EGM

Apostolakis, G, van Dijk, G and Drakos, P, 2015. Microinsurance performance – a systematic narrative literature review. *Corporate Governance*, 15(1), pp.146-170.

Basu, K and Wong, M, 2015. Evaluating seasonal food storage and credit programs in east Indonesia. *Journal of Development Economics*, 115, pp.200–216.

Beaman, L, Karlan, D and Thuysbaert, B, 2014. Saving for a (not so) rainy day: a randomized evaluation of savings groups in Mali (No. w20600). National Bureau of Economic Research.

Beaman, L, Karlan, D, Thuysbaert, B and Udry, C, 2014. Self-selection into credit markets: evidence from agriculture in Mali (No. w20387). National Bureau of Economic Research.

Benin, S, 2015. Impact of Ghana's agricultural mechanization services center program. *Agricultural Economics*, 46(S1).

Bertram-Huemmer, V and Kraehnert, K, 2015. Does index insurance help households recover from disaster? Evidence from IBLI Mongolia.

Bhargava, AK, 2014. The impact of India's rural employment guarantee on demand for agricultural technology. IFPRI Discussion Paper 01381, Washington: IFPRI. Available at: <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/128468>.

Cai, H, Chen, Y, Fang, H and Zhou, LA, 2009. Microinsurance, trust and economic development: Evidence from a randomized natural field experiment (No. w15396). National Bureau of Economic Research.

Cai, H, Chen, Y, Fang, H and Zhou, LA, 2015. The effect of microinsurance on economic activities: evidence from a randomized field experiment. *Review of Economics and Statistics*, *97*(2), pp.287–300.

Cai, J, 2013. The impact of insurance provision on households' production and financial decisions, Policy Brief 73, Clermont-Ferrand: Fondation pour les études et recherches sur le développement international. Available at: <http://www.ferdi.fr/sites/www.ferdi.fr/files/publication/fichiers/Br73-J.Cai3_.pdf>

Cai, J, De Janvry, A and Sadoulet, E, 2013. Social networks and the development of insurance markets: evidence from randomized experiments in China. *University of Michigan*.

Carter, MR, Laajaj, R and Yang, D, 2013. The impact of voucher coupons on the uptake of fertilizer and improved seeds: evidence from a randomized trial in Mozambique. *American Journal of Agricultural Economics*, 95(5), pp.1345–1351.

Carter, MR, Laajaj, R and Yang, D, 2014. Subsidies and the persistence of technology adoption: Field experimental evidence from Mozambique (No. w20465). National Bureau of Economic Research.

Carter, MR, Laajaj, R and Yang, D, 2015. Savings and subsidies, separately and together: decomposing effects of a bundled anti-poverty program. *Cambridge, M.A.: Abdul Latif Jameel Poverty Action Lab.* Available at: https://www.povertyactionlab.org/sites/default/files/publications/283_324%20Savings%20Subsidies%20Jun2015.pdf [Accessed 29 June 2017].

Channgakham, P, 2006. The effects of a fertilizer loan on dry-season rice cultivated areas in Laos. *Economics Bulletin*, 15(12), pp.1–8.

Chibwana, C, Fisher, M, Jumbe, C, Masters, WA and Shively, G, 2010. Measuring the impacts of Malawi's farm input subsidy program. Available at: https://ssrn.com/abstract=1860867 or http://dx.doi.org/10.2139/ssrn.1860867 [Accessed 29 June 2017].

Cole, S, Giné, X, Tobacman, J, Topalova, P, Townsend, R and Vickery, J, 2013. Barriers to household risk management: Evidence from India. *American Economic Journal: Applied Economics*, *5*(1), pp.104-135.

Cole, S, Giné, X and Vickery, J, 2017. How does risk management influence production decisions? Evidence from a field experiment. *The Review of Financial Studies*, 30(6), pp.1935–1970.

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Evidence for peacebuilding: evidence gap map, 3ie evidence gap report 1. Cameron, DB, Brown, AN, Mishra, A, Picon, M, Esper, H, Calvo, F and Peterson, K (2015)

This evidence gap map report by Barooah and colleagues examines the evidence on financial agricultural risk management instruments for smallholder farmers. The authors identified areas where there are (or are not) impact evaluations and systematic reviews on these instruments. Among risk-mitigating products, index insurance is the most studied intervention. Research on the role of product quality, financial and product knowledge is lacking. With overwhelming focus on some short-term outcomes, longer-term outcomes that are farther down the causal chain, such as human development and vulnerability indicators, have not been studied much. Most instruments, and insurance in particular, have low take-up, hence an important question is what can be done to increase uptake.

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