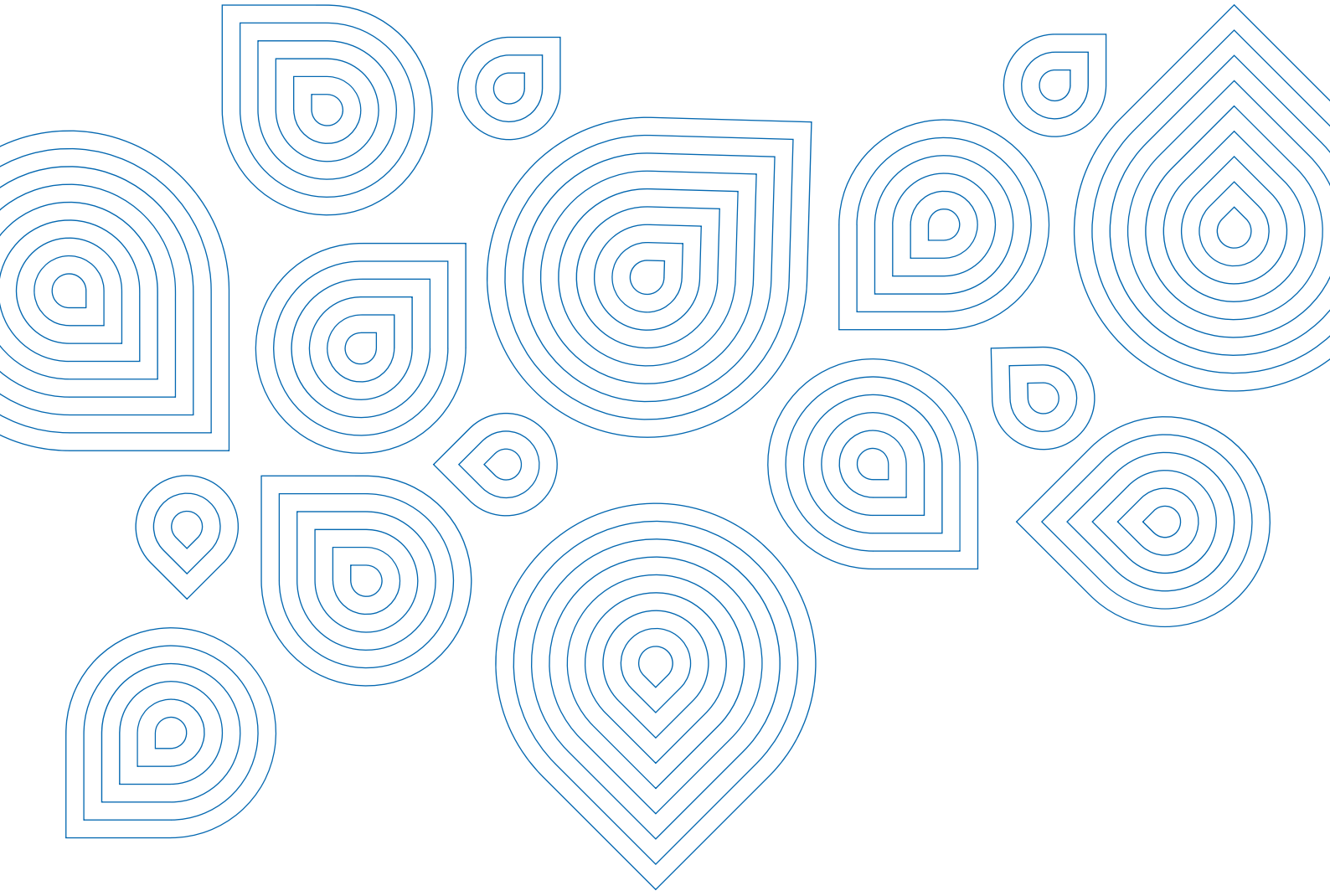
Insurance and Risk Finance Facility

United Nations Development Programme

SUPPLEMENTARY RESEARCH

Government pathways to transform agricultural insurance systems

Annex 2 - Impact evidence on agricultural insurance
A review of recent literature



Government pathways to transform agricultural insurance systems - **Supplementary Research**

Commissioned by the UNDP Insurance and Risk Finance Facility, as part of its Financial Resilience in Agriculture (FRA) initiative funded by the Gates Foundation

Developed by the Wageningen Social & Economic Research (WSER)

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About the research

Annex 2 to the "Government pathways to transform agricultural insurance systems" report, this research examines the scientific evidence on the impact of agricultural insurance. It draws on a selection of robust ex-post impact evaluations, from the period between 2000 and September 2024. Evidence on impacts constitutes a relatively small strand of the agricultural insurance literature; much of the literature instead focuses on index design, basis risk, and the demand for and adoption of insurance. Impact evidence – both positive and negative – focuses predominantly on the farmer level and less so on the aggregators' business models. Studies on the cost-effectiveness of agricultural insurance are very scarce. There is a nuanced evidence base that supports the notion of a positive impact of agricultural insurance. Insurance can have positive impact in numerous manners. But whether this positive impact materialises depends on many factors and circumstances, as well as the specific context. The evidence also shows examples of 'no impact' or even 'negative impact'.

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About Wageningen Social & Economic Research

Wageningen Social & Economic Research (WSER) is a contract research institute of Wageningen University and Research (WUR), which was established in 1876 in the Netherlands. WSER is specialised in policy analysis, impact evaluations, scenario development, market research, value chain research, consumer behaviour and system transformation analysis. These insights support informed decision-making.

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Summary

S.1 Does agricultural insurance produce positive impact among farmers and aggregators?

Agricultural insurance is expected to bring a variety of societal benefits, such as farmers' climate resilience, investment security for agribusinesses, farmers' access to credit, and increased farm investments (Barooah 2017). Against this background, public and private actors have been piloting a wide array of agricultural insurance products in Africa and Asia, for more than twenty years (ISF Advisors 2018 and 2022). But actors face the challenge of building scalable and sustainable models as well as mature agri-insurance markets. Only in a few countries has agricultural insurance reached scale and sustained that scale over time (Binswanger Mkhize 2012, Marr 2016). Developing agricultural insurance requires consideration of multiple elements to ensure its effective implementation and its ability to deliver client-centric solutions that match the need of the farmers. It also requires a coordinated action of national governments, in terms of alignment of cross-sectoral policies and institutional structures (Mahul and Stutley 2010; Hazell et al. 2017).

The main objective of this report is to present globally available evidence about the impact of agricultural insurance. The report focuses on the impact that agricultural insurance can have on a series of developmental outcomes at farmer level, such as farmers' investments and productivity, their climate adaptation and financial resilience, their food security and gender equality. A secondary objective is to present evidence about the impact of agri-insurance for value chain companies and agricultural service companies who distribute the insurances.

The report is based on a study commissioned and financed by UNDP's Insurance and Risk Finance Facility (IRFF), as part of its Financial Resilience in Agriculture (FRA) initiative funded by the Gates Foundation.

After a short note on methodology (S.2), this summary presents the general take-aways for policymakers (S.3), private sector aggregators (S.4) and impact researchers (S.5). It then explains how the evidence can be used in the FRA country programmes around agricultural insurance (S.6). Finally, it presents the specific take-aways for a series of topical domains (S.7).

S.2 Methodology

The review focuses on ex-post impact evidence from 2000 to September 2024. It does not include ex-ante impact evaluations, nor does it cover evidence about the demand and adoption of insurance. Evidence from all continents is taken into account, but the evidence review is written for use in lower- and middle-income countries. A total of 92 articles and reports were found that meet the robustness criteria of this review.

S.3 Messages for policymakers

National governments want to know whether agricultural insurance is an effective instrument for achieving different policy and developmental goals. Depending on the government agency, these goals can relate to the economic impact of agricultural insurance, or rather to social, environmental and climate goals of agricultural insurance.

In this report, we investigated the scientific evidence on the impact of agricultural insurance, for a variety of policy goals. The detailed evidence for each policy domain is presented in Chapters 4, 5 and 6. The general key messages for policymakers are the following:

- There is a *nuanced evidence* base that supports the notion of a positive impact of agricultural insurance. Insurance can have positive impact in numerous manners. But whether this positive impact materialises depends on many factors and circumstances, as well as the specific context. The evidence also shows examples of 'no impact' or even 'negative impact'.

- The *density of evidence* is largest for the impact of agricultural insurance on farmers' economic development (59), followed by financial resilience (32 of the 92 articles). Less evidence is available for the topic of food security (11), climate adaptation (10) and gender equality (6). The effectiveness of premium subsidies is researched in 20 articles, partly focused on adoption effects and partly about developmental outcomes. The evidence on the cost-effectiveness of agricultural insurance as a policy instrument is very scant.
- The evidence base about *positive impact* is relatively strongest at farmer level, especially for the following topics: increased farm investments, increased farm productivity, increased income, stabilised income and food consumption, farmers' own food production, long-term food security, prevention of savings depletion, and use of credit.
- The evidence base is *mixed or relatively weaker* for the following subjects: crop allocation decisions, environmental effects, adoption of climate-smart practices, influence on alternative risk management strategies of farmers, incidence of poverty and reduced inequality. With the exception of crop allocation decisions, these topics align with areas that have received comparatively less research.
- The biggest potential *challenges for positive impact* include low demand and voluntary adoption of agricultural insurance, farmers' limited understanding of agricultural insurance, basis risk in index insurance, limitations in coverage, high premiums—especially when combined with infrequent indemnity payments—accessibility and inclusion challenges for poorer households and women, and the possibility that insurance may substitute other risk management strategies employed by farmers.
- *Premium subsidies* are effective to enhance the adoption of agricultural insurance. But adoption also requires other conditions to be in place. Premium subsidies at scale are a costly budget item for the government and not much is known about their cost-effectiveness compared with other policy instruments. Longer-term subsidies for agricultural insurance need to be clearly targeted to remain cost-effective.
- Good practice lessons on the *regulation* of inclusive and agricultural insurance are available, for example, in publications of the International Association of Insurance Supervisors (IAIS).
- There are important *gaps in the impact evidence* for agricultural insurance. Some topics of interest have hardly been researched, and for others the evidence base is mixed or thin. The most important evidence gaps are listed in the summary section (S.5) and in Chapter 7. More impact research is needed to conclude more decisively on these topics.
- Positive impact of agricultural insurance presupposes a *spotless implementation* of the insurance scheme, with a high-quality insurance product, smooth communication and understanding across the insurance chain, and efficient transactions in premium collection and timely pay-outs.

Details about the takeways for each subtopic can be found in Section S.7.

S.4 Messages for the private sector

Agricultural insurance is often bundled with other services, such as credit and inputs. In these cases, banks, MFIs, input providers and other agricultural service companies operate as aggregators or distribution channels of the insurance product. They can do so as agents, selling voluntary insurance to farmers against a commission or a fee. Or they can decide to package the insurance with their own services, making the insurance a compulsory element of their loan or input provision. The latter will only be done if the company is convinced that the insurance will reinforce its own business model, either by de-risking their operations or by stimulating the sales of their own products.

We searched for scientific evidence that sheds light on the impact of agricultural insurance on the business models of the aggregators. We found that there is some scientific evidence about this impact, but it only covers part of the question:

- For *banks and other financial institutions*, we found clear evidence that insurance can help protect loan portfolios against the risk of loan repayment defaults. Nonetheless, in certain situations an insurance can also lead to higher loan defaults, especially if farmers expect that the insurance will resolve the payment of their loans.
- We did not find any scientific research on the impact of agricultural insurance for *other types of aggregators*, such as value chain companies, digital platforms or international investors.
- *Bundling* of insurance can help to enhance the uptake of insurance. But it only has lasting positive impact on the aggregator's business model if the package of services offers real and additional value, both to the farmers and to the aggregators themselves.
- There is evidence that insurance can lead to *increased use* of inputs and credit. However, we found no direct evidence that this benefits the *own sales* of input providers or the financial service providers acting as aggregators for the insurance. In fact, the increased use of inputs or credit at the farmer level may also translate into higher sales for the aggregator's competitors.

Given the limited scientific evidence, aggregator companies are advised to also draw on expert opinions and peer learning with other aggregators and similar companies when forming their views on agricultural insurance.

Details about the takeaways per subtopic can be found in Section S.7.

S.5 Messages for impact research

Impact research is only a minority stream of the scientific research on agricultural insurance. Much of the literature on agricultural insurance is focused on index design and basis risk, on demand and adoption, on insurance financing and on insurance policy analysis. Earlier impact research relied more heavily on ex-ante impact evaluation methods (e.g. model simulations, choice experiments), whereas ex-post impact research has gained significant momentum in the past decade.

There is more evidence—both positive and negative—of the impact of agricultural insurance at the farmer level than on the business models of aggregators. Similarly, there is more evidence—both positive and negative— on the effectiveness of agricultural insurance than on its cost-effectiveness.

The most important evidence gaps relate to:

- Insight into longer-term impacts of agricultural insurance (longer than 3-4 years), to understand sustained benefits as well as climate adaptation dynamics.
- Gender-specific adoption and impact, also related to the empowerment of marginalised groups.
- Comparative studies on impact across different designs and contexts, using semi-standardised indicators.
- De-risking of aggregators other than financial institutions.
- Cross-selling of aggregators' bundled services (insurance + credit/inputs).
- Cost-effectiveness of agriculture insurance, comparing its societal costs and benefits, and also comparing with other policy interventions.
- Cost-effectiveness of premium subsidies.

Filling these evidence gaps requires long-term funding for fundamental impact research, in combination with robust M&E to accompany shorter-term pilot projects. Also, such impact research should be linked to existing knowledge exchange platforms, such as IRFF/UNDP's Community of Practice, but also others such as the Agricultural Insurance Evidence Programme of 3ie.

S.6 How to use these findings in country programmes for agricultural insurance?

The impact evidence can feed into different phases of (UNDP's) new country programmes for agricultural insurance:

- *Selection of pilot projects*
  The availability of positive impact evidence should be one of the selection criteria of new pilot projects. This does not exclude the possibility to engage in pilots for which the evidence base is still thin, but such pilots should be designed to build evidence in parallel before taking the pilot to scale. For taking pilots to scale, a solid evidence base is a pre-condition.
- *Design of pilots*
  The nuances of the impact evidence should be exploited when designing a pilot project. The evidence that is relevant to the pilot should not be taken for granted, but should be transformed into critical scrutiny of the impact hypotheses of the pilot project, of the assumptions and the pre-conditions for its successful impact and of the M&E/IA protocol to keep the pilot on its impact track.
- *M&E/IA in the pilots*
  The M&E/IA role in the project can facilitate the learning between the implementation of the pilots and the wider learning and evidence platform at global level (IRFF/UNDP's Community of Practice).

In UNDP's design of the FRA pilot projects, a national technical institution will play a special role by taking responsibility for M&E in the pilot projects, working in close collaboration with the implementing agencies. One of the responsibilities of this national technical institution will be to enrich the pilot with insights from the available impact evidence, and inversely, to enrich the global evidence base with M&E/IA data from the pilots.

In UNDP's dialogue with government counterparts, it will be worthwhile to discuss how the attention for impact-evidenced insurance solutions can be institutionalised, e.g. at the insurance regulator's office or the government agency responsible for promoting agricultural insurance.

For those who wish to deepen their understanding of the impact evidence, we made the evidence accessible through different entry points:

- Per topic: in each subchapter of this report, we present the key takeaway messages, as well as the impact evidence on which these key messages are based. The text contains title references of the underlying articles or reports, which can be found back in the list of References at the end of the report.
- Additionally, key data for each of the 92 articles can be found in Appendix Table A1. The appendix—arranged in alphabetic order—also provides weblinks to the original articles for readers who wish to explore them in more detail.
- Finally, an Excel file will be made available, allowing the 92 articles to be filtered by region, insurance product, insured hazard and insured crop.

It is important to realise that the impact evidence needs to be handled with care. For example, much of the impact evidence is generated in very specific contexts: geographies, agroecological and climate conditions, crops and hazards insured, insurance product designs, aggregator models, institutional and regulatory environments. These contexts may also change over time. Therefore, the effects found cannot simply be copied to other contexts; they instead provide insights into the causal mechanisms and drivers that may be at play. This allows us to critically scrutinise new pilots and increase the likelihood of their positive impact.

For pilots with a currently limited scientific evidence base, the implementation should be accompanied by additional impact research. This will ensure that the pilot contributes to a stronger evidence base in the future.

S.7 Recap of takeaways per subtopic

In the text box below, we summarise the takeaways regarding the impact of agricultural insurance for each of the impact pathways analysed in Chapters 4, 5 and 6.

TAKEAWAYS PER SUB-TOPIC

Takeaways for policymakers – farmer level impacts

Adoption of agricultural insurance

- The demand for—and adoption of—agricultural insurance is often limited to a minority of farmers, particularly for index insurance. This limitation is associated with factors related to risk and value, behaviour and understanding, as well as liquidity and credit constraints.
- Bundling insurance with other farmer services or making it compulsory can increase uptake. However, this approach may also reduce the effect of insurance on farmers' behavioural choices.

Impact on farmers' economic development

- The available literature provides evidence that insurance can increase farmers' purchases of inputs, although in some cases no impact on input use is observed.
- Insurance influences crop allocation decisions, leading in some cases to increased acreage, in others to decreased acreage, and affecting patterns such as crop diversification or the substitution of staple crops with cash crops.
- Several studies highlighted a positive relation between risk mitigation through insurance and farm productivity.
- Multiple studies provided evidence that insurance payments have a positive impact on farmers' incomes, though the evidence is mixed.

Impact on climate adaptation

- The first-order effect of agricultural insurance is to stabilise revenues in years of climatic shocks. In that sense, agricultural insurance is an important instrument for farmers' climate adaptation.
- Insurance-related changes in farming practices lead to both positive and negative effects on the environment. Evidence for the hypothesis that insurance increases climate-smart practices is thus mixed.
- Insurance can act as either a complement to or a substitute for other risk management practices. This effect may depend on the type of strategy considered—for example, on-farm versus off-farm diversification—and on the presence of existing strategies prior to the introduction of formal insurance.

Impact on food security

TAKEAWAYS PER SUB-TOPIC

- Insurance helps smooth consumption during adverse weather conditions by providing financial support, allowing farmers to maintain their needs and avoid reducing essential consumption.
- Insurance for food crops boosts food production because the protection against climate-related crop losses encourages investments in better and more productive farming practices.
- Insurance promotes long-term food security by enabling farmers to improve their production methods and increase crop yields.

Impact on Financial resilience

- Insurance stabilises income by providing a safety net against risks such as adverse weather causing crop damage.
- Insurance prevents the depletion of savings by helping farmers avoid selling valuable assets such as livestock, maintaining herd sizes during difficult periods.
- Insurance offers financial protection during crises, enabling farmers to manage climate-related risks and recover from losses. Nonetheless, this financial protection is limited because of the restrictions in insurance coverage.
- Insurance can have negative effects, such as increased financial strain when premiums are paid without corresponding indemnities if losses occur, leading to reduced resources for essential investments.
- While insurance can reduce poverty risk and enhance economic stability, its impact on rural poverty remains limited, particularly for lower-income households.
- Insurance improves access to loans, helping farmers manage financial risks, reduce debt, and use credit for production costs or investment purposes.

Impact on (gender) equality

- Gender-disaggregated data on agricultural insurance are available only in a minority of cases. Where such information was available, women represented 41 percent of the policy holders and 36 percent of the people insured.
- Agricultural insurance adoption among women remains low due to accessibility issues.
- Wealthier households are more likely to adopt insurance. Poorer households face barriers due to high costs and liquidity constraints, preventing them from benefiting, despite potential advantages.
- Cost-effectiveness of agricultural insurance
- Cost-effectiveness of agricultural insurance is not sufficiently investigated. Only in a few cases are the costs of an insurance promotion policy compared with its effects.
- The evidence does not allow concluding that insurance is a cost-effective policy tool for achieving financial resilience among farmers.
- Evidence on the extent to which insurance can serve as a cost-effective tool for promoting farmers' economic development is limited and highly context-dependent.

Takeaways for policymakers – selected policy instruments

Cost-effectiveness of premium subsidies

- In the initial stages of agricultural insurance markets, premium subsidies are often a necessary but seldomly a sufficient condition to enhance adoption of agricultural insurance.
- Generic premium subsidies can become a significant burden to the public budget when agricultural insurance is scaled up nationally.
- To remain cost-effective, longer-term subsidies for agricultural insurance should be targeted towards specific social target groups, climate hazards or objectives. Depending on the objective, alternative subsidy modalities, other than premium subsidies, should be equally considered.
- The impact of premium subsidies on the adoption of insurance should be distinguished from the impact of insurance on developmental outcomes.

Regulatory good practices for agricultural insurance

- Agricultural insurance should be regulated under the general insurance law.
- Agricultural insurance needs specific regulatory provisions, regarding the use of index insurance and consumer protection.
- Pilots and innovations in agricultural insurance require an enabling and knowledgeable role of the regulator.

Takeaways for private sector aggregators

Impact on aggregators' de-risking

- There is evidence that insurance can help protect loan portfolios against the risk of loan repayment defaults. In certain situations, an insurance can also lead to higher loan defaults.
- No research was found on the de-risking effects of insurance for other types of aggregators, such as value chain companies, digital platforms, or international investors.
- Bundling of insurance can help to enhance the uptake of insurance, but the package of services should provide real and additional value, both to the farmers and to the aggregators.

Impact on aggregators' sales of inputs and credit

- Although there is evidence that insurance can lead to increased use of inputs and credit, we found no direct evidence that this can benefit the sales of input providers or financial service providers who serve as aggregator for the insurance.

1 Introduction

1.1 Background

Agricultural insurance is expected to bring a variety of societal benefits, such as farmers' climate resilience, investment security for agribusinesses, farmers' access to credit, and increased farm investments (Barooah 2017). Against this background, public and private actors have been piloting a wide range of agricultural insurance products in Africa and Asia for over twenty years (ISF Advisors 2018 and 2022). However, actors face the challenge of building scalable and sustainable models as well as mature agri-insurance markets. Only in a few countries has agricultural insurance reached scale and sustained that scale over time (Binswanger Mkhize 2012, Marr 2016). Developing agricultural insurance requires consideration of multiple elements to ensure effective implementation and the delivery of client-centric solutions that meet farmers' needs. It also requires coordinated action by national governments, including alignment of cross-sectoral policies and institutional structures (Mahul and Stutley 2010; Hazell et al. 2017).

UNDP's Insurance and Risk Finance Facility (IRFF) has been deploying several programmes to address these topics, in close collaboration with national governments. Among them, the Financial Resilience in Agriculture (FRA) initiative, funded by the Gates Foundation. The objective of the FRA project is to strengthen the resilience of smallholder farmers by enhancing their adaptive capacity and reducing vulnerabilities to climate change through the design and implementation of agricultural insurance programmes in three countries in Eastern Africa (Ethiopia, Tanzania, Uganda) and two South Asian countries (Bangladesh and India). Beyond these countries, evidence and knowledge will be shared through a global Community of Practice.

1.2 Objectives and scope

The main objective of this report is to present globally available evidence about the impact of agricultural insurance. The report focuses on the impact that agricultural insurance can have on a series of developmental outcomes at farmer level, such as farmers' investments and productivity, their climate adaptation and financial resilience, their food security and gender equality. A secondary objective is to present evidence about the impact of agri-insurance for value chain companies and agricultural service companies who distribute the insurances. The specific research questions are presented in Table 1.1.

The report intends to provide an impact evidence base for national governments who partner with IRFF/UNDP. The evidence can enable these governments to make informed decisions about why they would invest in agricultural insurance, taking into account the different policy goals they pursue. The report is not meant to constitute a direct basis for advising governments about how to shape their agricultural insurance policies.

The policy goals pursued may be different for the respective Ministries of Agriculture, Climate Adaptation or Social Affairs, as they may be different for the insurance regulators and Ministries of Finance. This implies also that there are different audiences for this report. In addition to the different ministries and public agencies responsible for agricultural insurance, this report may also be valuable to private sector companies and financial institutions seeking to understand how insurance can affect their business models or investment portfolios.

The report focuses on global evidence from different continents. It will not focus on specific country situations.

The evidence review encompasses a variety of types of agricultural insurance:

- *Indemnity vs index insurance*
  The classical indemnity insurance makes a payment for the actual damage suffered by the client. This actual damage is usually assessed by an expert. In index insurance, the pay-out to the client is based on the occurrence of damage for a certain geographical area, rather than for the individual farm. This damage assessment is often done with secondary data for a larger area (through satellites, rain gauges, etc.), rather than doing individual damage assessments. This makes index insurance cheaper, and suitable for smaller farms, even if indemnity insurance is more accurate.
- *Different types of indemnity insurance*

Some indemnity insurances cover specific risks (e.g. hail), others are multi-peril crop insurances (MPCI) designed to cover a variety of risks such as weather, diseases, insect and bird plagues, animal mortality, fire.

- *Different types of index insurance*
  Index insurance exists in different forms. Weather index insurance (WII) covers weather risks such as drought, excess rainfall, floods, hail, heat waves. Area-yield index insurance (AYII) also covers other risks, such as pests and diseases, and is based on a geographical sampling of harvests.
- *Different risk coverages*
  An insurance usually covers a specific crop or animal sector, and specific risks or hazards. Most of the risks covered by agricultural insurance are systemic rather than idiosyncratic: these systemic risks affect multiple farmers at the same time, as opposed to idiosyncratic risks that usually only affect certain farmers and not others (e.g. illness, death, fire). The predominance of systemic risk also implies a higher need for reinsurance, to spread the risk between affected and non-affected regions and countries.

All these different types of insurance serve different purposes, and have advantages and disadvantages for specific situations. This implies that a choice for a specific type of insurance can only be made upon an assessment of the situation: the policy goals, the context and the demand and preferences of different stakeholders involved.

Our evidence review also covers a variety of scaling levels. Some of the insurances we reviewed are piloted at a small scale, whereas others are operating nation-wide. By the same token, some countries have developed agricultural insurance into a mature market, supported with policies and institutions, whereas other countries are in an experimental phase with agricultural insurance.

1.3 Research questions

The research questions for this study are presented in Table 1.1. In Section 3.2 we will operationalise these sub-questions, by formulating impact hypotheses for each of them.

Table 1.1 *Research questions*[1]

RQ 1 What is the role of agricultural insurance in achieving development outcomes at farmer level?
a) What is the role of agricultural insurance in enhancing economic development of farmer households, particularly through the enhancement of productivity and income?
b) What is the role of agricultural insurance in enhancing climate adaptation efforts, particularly through the adoption of climate-smart technologies?
c) What is the role of agricultural insurance in enhancing financial resilience, especially in terms of providing access to finance for smallholder farmers?
d) What is the role of agricultural insurance in impacting food security?
e) What are the effects of agricultural insurance on gender equality within the agricultural sector?
f) What evidence exists regarding the 'value for money' of agricultural insurance, as a policy instrument to reach the mentioned developmental outcomes?
RQ 2 What is the cost-effectiveness of premium subsidies schemes vis-à-vis other subsidies schemes as for inputs, price, etc.
g) What is known about the cost-effectiveness of premium subsidy schemes for agricultural insurance?
h) How does cost-effectiveness of premium subsidies for agricultural insurance compare to other subsidy schemes, such as those for inputs or prices?
RQ 3 What is known about regulatory good practices that allow innovations around product design, distribution, and delivery, to respond best to smallholder farmer needs.
i) What evidence is known about successful regulatory approaches to promote innovation in agricultural insurance, to the benefit of smallholder farmers?
RQ 4 What is the role of agricultural insurance in supporting the business model of distribution channels like agro value chain players, financial service providers, digital platforms, and investors.
j) What is the role the role of agricultural insurance in reinforcing the business models of aggregators, such as agro value chain players, financial service providers and digital platforms?
k) What are the benefits of agricultural insurance to protect the investment portfolios of private investors?
l) What evidence exists about the potential return on investment for private investors in agricultural insurance?

1.4 Reader's guide

The methodology of this literature study is presented in Chapter 2. Chapter 3 introduces a general theory of change of the impact of agricultural insurance, which serves as a point of departure for the evidence review. In Chapter 4, 5 and 6, the evidence is presented for the different domains. Chapter 4 treats the evidence about impacts at farmer level. Chapter 5 looks into two selected government policies: premium subsidies and regulation. Chapter 6 discusses the evidence about impacts for companies that act as aggregators-distributors for the insurance. Finally, Chapter 7 presents evidence gaps emanating from the preceding three chapters. The conclusions of the study are presented in the Summary chapter.

[1] RQ1 relates to the farmer level impact treated in chapter 4. RQ2 and RQ3 connects to the selected government policies (premium subsidies and regulation) discussed in chapter 5. Finally, RQ4 fits the impact on aggregator companies presented in chapter 6.

2 Methodology

The methodology for this literature review follows a structured, multi-step approach to identify, evaluate, and synthesise relevant studies addressing agricultural insurance and its relationship with climate-smart technologies, financial resilience of smallholder farmers, food security, gender equality in agriculture, and other related concepts.

2.1 Selection criteria

The search strategy was designed to ensure comprehensive coverage of the literature while focusing on the research questions and thematic areas outlined in the study. Our starting point was the systematic literature review conducted by Vyas et al. (2021), which mapped global research on agricultural insurance from 2000 to 2019. The Vyas review identified 796 papers, categorised by country/region, type of insurance product, and thematic focus. Of these, 130 papers were classified as impact evaluations. Building on this foundation, we expanded the search in Scopus for literature with four key additions:

1. *Expanded Search Terms*
   We refined and expanded the search terms to cover the various research questions of the IRFF/UNDP, as outlined in Table 1.1 of this report.
2. *Extended Search Period*
   We broadened the search to include publications from 2020 through September 2024.
3. *Impact-Related Publications*
   We incorporated impact-related publications from another literature review conducted by WUR (Marr et al. 2016).
4. *Manual Search and Grey Literature*
   We included manually searched publications and grey literature, including a systematic review by 3ie (Barooah 2017), a sector overview by ISF Advisors (2018 and 2022), and WUR publications on agricultural insurance.

These additions resulted in a total longlist of 443 publications. From the longlist of 443 publications, we selected 92 studies that evaluate the impact of agricultural insurance on developmental outcomes using a robust counterfactual and rigorous analytical methods. These studies employed credible techniques, such as randomised control trials (RCTs) or matching methods, to establish causal links between agricultural insurance and outcomes like poverty reduction, food security, and income stability.

To maintain a manageable scope, we applied the following limitations:

1. *Exclusion of Demand and Adoption Studies*
   We excluded studies focusing on the demand for or adoption of agricultural insurance, as these do not directly assess the developmental impacts of insurance.
2. *Exclusion of Ex-Ante Evaluations*
   We focused on ex-post impact evaluations, which analyse real-world outcomes. Studies based on model simulations or choice experiments were excluded, as they do not provide empirical evidence of actual impacts.
3. *No distinction between different types of agricultural insurance*
   While agricultural insurance models may vary, in products, crops and hazards covered, and distribution models, we focused on evaluating the impacts of agricultural insurance in general, without analysing impact separately for different insurance models.

These limitations ensured that the review remained focused on the most relevant and methodologically rigorous studies on the impact of agricultural insurance.

A visual depiction of the literature search procedure can be found in **Figure 2.1**.

2.2 Analysis

The analysis primarily focuses on evaluating the impacts of agricultural insurance at farmer level. These impacts were categorised into different categories:

- *Farmers' Economic Development*: 59 articles were selected addressing effects of insurance on the socioeconomic conditions among farmers.
- *Farmers' Financial Resilience*: 32 articles delve into the effect of insurance on farmers' financial resilience.
- *Farmers' Food Security*: 11 articles explore the effects of insurance on food security.
- *Farmers' Climate Adaptation*: 10 articles focus on the effect of insurance on climate adaptation.
- *Farmers' (Gender) Equality*: 6 articles investigate gender-based impacts and broader equity considerations.
- *Cost-effectiveness*: 3 articles focus on the cost effectiveness being insured.

The analysis also examines the effectiveness of a few selected government policies, especially the cost-effectiveness of premium subsidies and an overview of regulatory good practices. Additionally, we assess the impact evidence for agricultural aggregators, focusing on how agricultural insurance helps them to de-risk their business models.

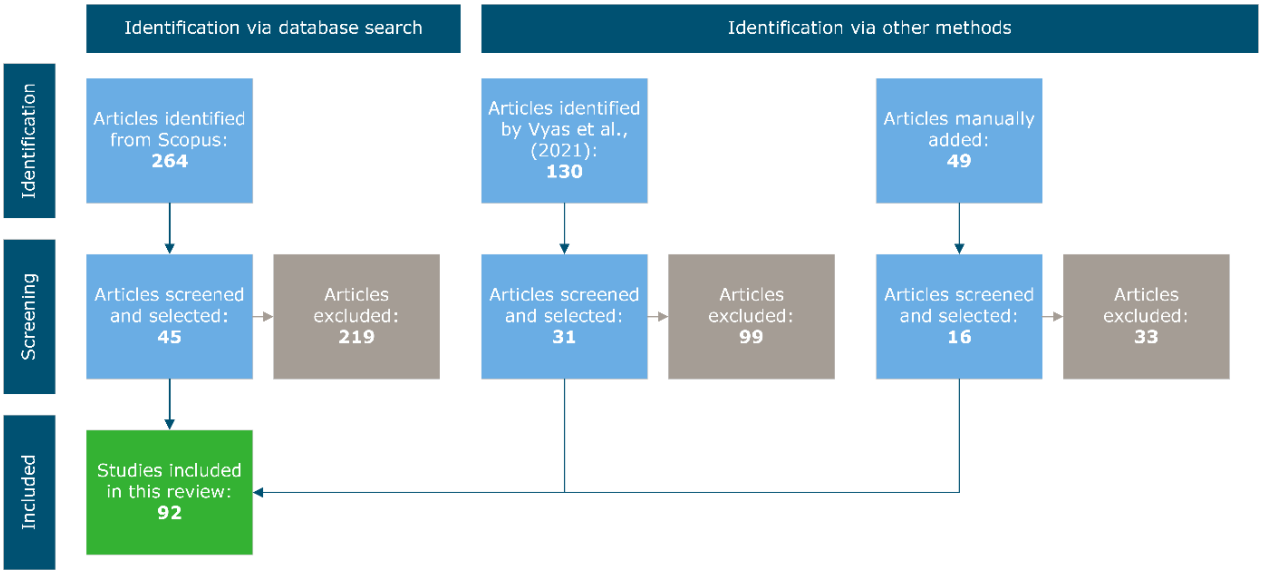

Figure 2.1 *Literature search procedure*

3 Conceptualisation

Our evidence review is built around a general Theory of Change (TOC) about the impact of agricultural insurance.

The TOC is based on the impact domains as they were described in the terms of reference of IRFF/UNDP. It therefore shows how IRFF/UNDP expects that agricultural insurance will lead to ultimate impact. The TOC also shows that there are multiple pathways through which insurance could lead to impact. By making these pathways explicit, we can systematically search for evidence of each pathway.

3.1 A general Theory of Change for agricultural insurance

Figure 3.1 shows the structure of our TOC. It identifies an overarching goal or impact at the farmer-level, which is then broken down into five specific areas where significant changes are expected (long-term impacts in the green boxes). For each of these areas, we propose specific outcomes for which we developed impact hypotheses (Section 3.2). Similarly to the farmer-level impact, the TOC shows an outcome-impact stream for the impact of insurance on the aggregators' business models: the long-term impacts for this stream are represented by the blue boxes. Moreover, we identified key assumptions underlying the TOC, including external factors that could influence the achievement of impacts.

In subsequent stages of our literature search, we look for evidence about each of the impact hypotheses formulated in Section 3.2.

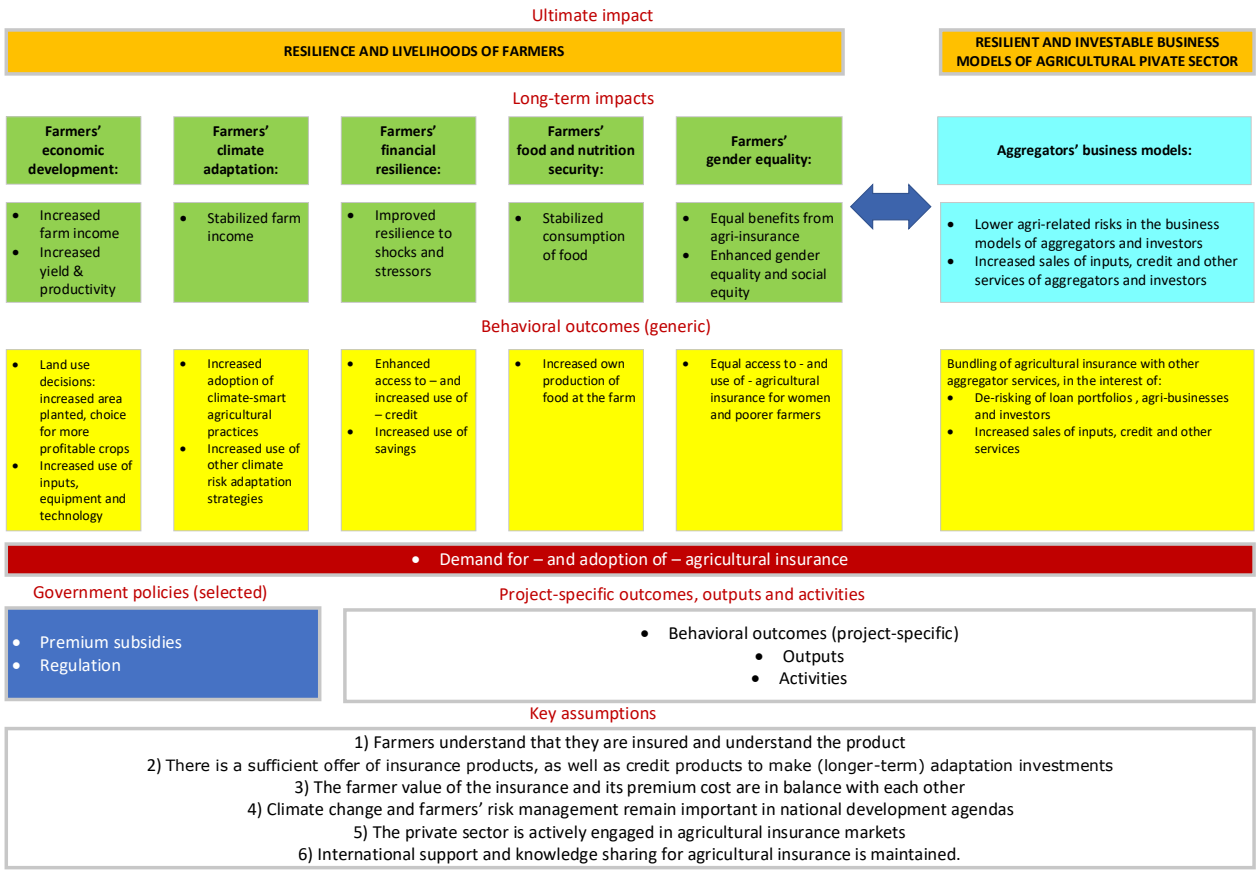

Figure 3.1 *A global Theory of Change for agricultural insurance*

The TOC incorporates common elements found across various national programmes while allowing for flexibility to accommodate country-specific variations. It should be understood that this general TOC should be adapted and customised for each specific agricultural insurance programme. A project-specific TOC should take account of the country and sector context and the specific setup and goals of the project. Such a project-specific TOC should include not only the outcome and impact levels, but also the inputs, activities and outputs that generate the outcomes and impacts. For each level, indicators should be developed to measure progress, as much as possible aligned with international standards and taxonomies. This will be crucial for monitoring and impact evaluation that could influence policy decisions. In Deliverable C/D of this project (see footnote 1 on page 4), we will provide a more detailed discussion of the M&E framework and outcome indicators for agricultural insurance programmes.

3.2 Impact hypotheses of agricultural insurance

Based on the research questions (Table 1.1), we formulated impact hypotheses for each of the impact domains investigated. These impact hypotheses are presented in Table 3.1. For each impact hypothesis, Chapters 4, 5 and 6 present the scientific evidence we found.

Table 3.1 *Impact hypotheses*

Research questions	**Impact hypotheses** ***(to be verified with the evidence in chapters 4/5/6)***
RQ 1 What is the role of agricultural insurance in achieving development outcomes at farmer level?	**Chapter 4**
a) What is the role of agricultural insurance in enhancing **economic development** of farmer households, particularly through the enhancement of productivity and income?	• Insurance increases purchases of farm inputs and investments in equipment, by making farmers feel more comfortable to invest. • Insurance changes total acreage and crop allocation decisions, by making farmers feel more comfortable to invest. • Insurance increases the yields, efficiency and productivity of the insured crops or animals, due to higher investments. • Insurance increases the farmers' income, as a consequence of higher yields and productivity.
b) What is the role of agricultural insurance in enhancing **climate adaptation** efforts, particularly through the adoption of climate-smart technologies?	• Insurance increases the adoption of climate-smart agricultural practices and climate adaptation efforts. • Insurance complements other climate risk adaptation/management strategies of the farmers, instead of substituting them.
c) What is the role of agricultural insurance in impacting **food security**?	• Insurance promotes food security through consumption smoothing. • Insurance promotes food security through boosting farmers' food production for their own consumption.
d) What is the role of agricultural insurance in enhancing **financial resilience**, especially in terms of providing access to finance for smallholder farmers?	• Insurance decreases poverty through stabilising incomes. • Insurance promotes resilience through preventing the depletion of savings. • Insurance enhances farmers' protection against financial risks. • Insurance enhances farmer's access to loans/credit.
e) What are the effects of agricultural insurance on **gender equality** within the agricultural sector?	• Insurance impacts gender equality. • Insurance impacts equality more in general.
f) What evidence exists regarding the **value for money** of agricultural insurance, as a policy instrument to reach the mentioned developmental outcomes?	• Insurance is a cost-effective tool to reach financial resilience. • Insurance is a cost-effective tool to reach farmers' economic development.

Research questions	Impact hypotheses *(to be verified with the evidence in chapters 4/5/6)*
RQ 2 What is the cost-effectiveness of premium subsidies schemes vis-à-vis other subsidies schemes as for inputs, price, etc.	**Chapter 5.1**
g) What is known about the cost-effectiveness of premium subsidy schemes for agricultural insurance?	• Premium subsidies are a cost-effective policy instrument. • Premium subsidies are an effective tool to increase demand for - and adoption of – agricultural insurance. • Premium subsidies are an effective tool to achieve developmental outcomes among farmer households. • Premium subsidies are an effective tool to create commercial agricultural insurance markets.
h) How does cost-effectiveness of premium subsidies for agricultural insurance compare to other subsidy schemes, such as those for inputs or prices?	• Premium subsidies are more cost-effective than other forms of subsidisation.
RQ 3 What is known about regulatory good practices that allow innovations around product design, distribution, and delivery, to respond best to smallholder farmer needs.	**Chapter 5.2**
i) What evidence is known about successful regulatory approaches to promote innovation in agricultural insurance, to the benefit of smallholder farmers?	• There are successful regulatory approaches to promote innovation in agricultural insurance, to the benefit of smallholder farmers.
RQ 4 What is the role of agricultural insurance in supporting the business model of distribution channels like agro value chain players, financial service providers, digital platforms, and investors.	**Chapter 6**
j) What is the role the role of agricultural insurance in reinforcing the business models of aggregators, such as agro value chain players, financial service providers and digital platforms?	• Insurance de-risks the business models of the aggregators. • Insurance reinforces the revenue models of the aggregators, through bundling and cross-selling.
k) What are the benefits of agricultural insurance to protect the investment portfolios of private investors?	• Insurance de-risks the business models of impact investors and commercial investors.
l) What evidence exists about the potential return on investment for private investors in agricultural insurance?	*Note: as no evidence was found on this topic, a specific impact hypothesis was not formulated.*

4 Impact evidence – farmer level impact

In this chapter, we will discuss the evidence about the impact of agricultural insurance on farmers and farm households. Sections 4.2 – 4.6 will examine this evidence for each of the research questions and impact hypotheses presented earlier in Table 3.1.[2] As it turns out, some of the impact hypotheses are strongly supported by evidence, whereas others show a mixed picture. In some cases, there is simply not much scientific research to work with.

Before we look into the impact of agricultural insurance, it is important to briefly touch upon the demand for - and the adoption of – agricultural insurance (Section 4.1).

4.1 A short note on demand and adoption of insurance

Although it is not the subject of the current study, it is important to note that the demand for - and adoption of - agricultural insurance are often problematic, especially for index insurance. In their overview study on this subject, Marr et al. (2016) concluded that the farmers' demand for index insurance has been low. While up to 90 percent of farmers state that they are willing to pay for an insurance, the actual demand is much lower, ranging between 2 and 40 percent and in many cases below one-fourth.

According to Marr et al. (2016,) the literature points at three main reasons for the low demand: risk, behaviour and credit and liquidity constraints:

- *Risk and value*
  Farmers with a stronger risk aversion may be more inclined to take an insurance. But they may also be put off by the uncertainty about the insurance product itself: farmers may experience pay-outs of the insurance as a 'lottery', rather than as a consistent and reliable consequence of hazards taking place. Additionally, resource-poor farmers may already opt for low risk – low return production systems, or for other risk-coping strategies, which can reduce their need for a formal insurance. Moreover, in cases where an index insurance has a high basis risk, this will decrease the value of the insurance for the farmers. Finally, the demand for insurance is sensitive to the price, that is, the premium paid for the insurance.
- *Behaviour and understanding*
  Farmers' understanding of agricultural insurance is often limited. This can be part of a broader issue of limited financial education. Experiments, however, show mixed results when efforts are made towards better understanding: it can increase uptake, but the opposite can also be the case if farmers had too high expectations of insurance. Trust is also an important factor, that is, farmers' trust in the insurance, or in the institutions involved in its implementation. A smooth implementation of the insurance and the pay-outs can increase this trust. Farmers increase uptake of insurance when they see pay-outs taking place, either to themselves or to their neighbours.
- *Credit and liquidity constraints*
  Some studies find that farmers with liquidity constraints – or credit constraints - can have difficulties to pay the insurance premium upfront. Similarly, in some studies, farmers with higher wealth or incomes are more prone to adopt insurance, although the evidence is not straightforward.

If farmers are not (sufficiently) aware of being insured and of the terms and conditions of this insurance, farmers may not actually respond to the insurance with changes in their investment behaviour and decision-making. This may occur when, as a response to the low intrinsic demand, insurance companies bundle the insurance with other farmer services such as credit, inputs or other agricultural services. When the insurance is a compulsory element in this bundled package, and thus the decision to take an insurance is not taken by the farmers themselves, the farmers may not be aware that they are insured. This may dilute the envisaged impacts of the insurance, as the farmers will not change their decisions or behaviour.

[2] For readability, we formulated the impact hypotheses in this chapter as questions, which are then addressed using the evidence we found.

4.2 Impact on farmers' economic development

Key messages:

- Available literature provides evidence that insurance increases farmer purchases of inputs, although there are also cases in which no impact on input use is detected.
- Insurance influences crop allocation decisions, varying between an increase in crop acreage or rather a decrease, and from crop diversification to substitution of e.g. staple crops for cash crops.
- Several studies highlighted a positive relation between risk mitigation through insurance and farm productivity.
- Multiple studies provided evidence that insurance payments have a positive impact on farmers' incomes, though the evidence is not unanimous.

Ample evidence was found that addressed the impact of insurance on the economic development of farmers. In total, 59 articles published between 2001 and 2024 were identified, covering almost the entire period of this review. The majority of the articles cover sub-Saharan Africa, East Asia and North America, making other global regions less represented in the evidence.

Does insurance increase purchases of farm inputs and investments in equipment, by making farmers feel more comfortable to invest?

Available evidence generally suggests that the adoption of insurance enables farmers to spend more on productivity enhancing inputs, such as fertiliser, enhanced seeds or irrigation systems. Vice versa, farmers may reduce investments when they lose their insurance bundle (van Asseldonk et al., 2022). These investments may entail a financial risk, but potentially lead to higher profitability (e.g. Ramirez, 2015). According to Lin et al. (2021), both regular (un-subsidised) and subsidised crop insurance increased the likelihood of investment by reducing risks. Farrin and Miranda (2013) found that poor households may increase their input purchases by 25 percent with formal insurance. Crop insurance in North America increased both farmer investment in fuel-intensive technologies (Chang et al. 2011) as well as fertiliser and chemical inputs (Chang and Mishra, 2012). The provision of free hybrid crop insurance in Kenya lead to a 14.6 percentage point increase in the likelihood of purchasing certified seeds, from 45 percent to almost 60 percent, in a randomised control trial (Bulte 2020). Insurance has also been positively correlated with investment in livestock health services (Jensen et al. 2017).

However, the identified effect size of insurance, as well as the type of investments vary substantially. Impact results range from an increase in investment in maize seeds of 65 percent with weather index insurance (Sibiko and Qaim 2020) to an increase in irrigation of 11 percent, as found by Hill et al. (2019) in South Asia. Weber et al. (2016) found that a 10 percent increase in insurance coverage is associated with only a 4.4 percent increase in fertiliser and chemical expenditures per acre in North America. One study from Ethiopia identified a minimal impact of rainfall index insurance vouchers on fertiliser use, improved seed adoption, and credit usage (Ahmed et al. 2020). Another study in Ethiopia (Wong et al. 2020) did not find an increase in fertiliser purchasing related to insurance-voucher bundles. Farmers in this study reduced their own labour (for sowing) by 0.73 days, but they did not increase hired casual labour.

Does insurance change total acreage and crop allocation decisions, by making farmers feel more comfortable to invest?

Multiple studies also identified that insurance influences area allocations across various crops (e.g. Möhring et al. 2020). Knowing that they have a level of protection, insurance encourages the implementation of different risk management strategies, such as crop diversification (Marr et al. 2016). In other cases, insurance leads to acreage expansion; for example, a 1 percent rise in insured crop acreage led to a 0.624 percent increase in cotton acreage in the USA. In Mexico, insurance payments allow farmers to increase the area of insured crops in subsequent seasons (Ramirez 2015; de Janvry 2016). Another article discusses that insurance increases the production area of tobacco by 23.2 percent and its share of total agricultural land by 10.8 percent among treated households (Cai 2016). However, increases in acreage may be temporary (Wong et al. 2020).

In some cases, staple crops are being replaced by higher-value crops. Cole et al. (2013) indicated that, among Indian farmers, insurance induces greater investment in higher-return but rainfall-sensitive cash crops. This effect is particularly pronounced among educated farmers. Even so, Stoeffler et al. (2022) estimated that crop insurance leads to a reduction in cereal production by 377.7 kg, while increasing the likelihood of cultivating sesame by 8 percent in Burkina Faso.

In yet other cases, the impact of insurance on crop acreage is found to be insignificant or even negative. Insurance may also result in a decrease in the acreage of specific crops. For example, Walter et al. (2012) found, amongst other findings, a 4 percent

decrease in corn acreage in Colorado, USA. Similarly, Burns and Prager (2018) found no impact of crop insurance on total acreage operated in the same country.

Does insurance increase the yields, efficiency and productivity of the insured crops or animals, due to higher investments?
Several studies highlighted a positive relation between risk mitigation through crop insurance and farm productivity (e.g. Mahdid and Boulfoul 2024, van Asseldonk et al. 2022). The thorough literature review study of Barooah (2017) indicated that agricultural insurance increases productivity and efficiency among wheat farmers by reducing income uncertainty, subsequently enabling more optimal resource allocation and adoption of innovative farming methods. In line with this, Agahi et al. (2008) found higher technical efficiency of insured crop farmers in Iran, although results varied per region. For food crops in Ethiopia, the average treatment effect on food crop yield was 0.1554, using the nearest neighbour matching method, whereas the regression matching method revealed a higher effect of 0.1890 (Gebretsadik and Tesfay 2023). However, Boucher et al. (2024) did not find a significant increase in maize yields in a RCT including insurance-voucher bundles.

For animal production, similar positive relationships are identified. In China, Zhang (2016) found that fewer hogs are produced in the absence of insurance. Specifically, farmers who cancelled their insurance produced 22.8 percent (DID method) or 29.6 percent (PSM method) fewer hogs than farmers who remained insured, and 25.1 percent (DID) or 17.6 percent (PSM) fewer than those who were never insured. Moreover, multiple studies highlighted an increase in milk production associated with the purchase of insurance. Kaphle and Bastakoti (2017) reported an average increase in milk production per animal of 42 percent in South Asia, whereas Janzen et al. (2016) found a 10-20 percent increase in milk productivity in Kenya.

Does insurance increase the farmers' income, as a consequence of higher yields and productivity?
Multiple studies provided evidence that insurance payments have a positive impact on farmers' incomes (e.g. Ramirez 2015, Cha et al. 2024, Agbenyo et al. 2022), though the evidence is mixed. De Janvry (2016) found that in Mexico, increases in income because of weather index insurance were around 38 percent. Participation in agricultural insurance led to an estimated increased annual returns of $21 per hectare, in a study conducted in China (Zhang 2011). Another study showed that farmers participating in the crop insurance programme experienced an average income increase of 29.1 percent compared to non-participants (Zhao 2016). Index-based livestock insurance, on the other hand, also led to positive impacts on the income of dairy farmers (Janzen et al. 2016, Matsuda et al. 2019).

However, the evidence is not uniform and also includes cases where insurance negatively affects farmer income. If no losses occur (or insufficient indemnities are paid if losses occur), insurance negatively affects farmer wealth due to premiums paid (Farrin and Murray 2014). Porrini (2019) also found that a 1 percent increase in insurance reimbursement value results in a 0.3 percent decrease in Gross Farm Income, indicating inadequate coverage of total losses.

4.3 Impact on farmers' climate adaptation

Key messages:

- The primary effect of agricultural insurance is to stabilise revenues in years of climatic shocks. In this sense, it is an important instrument for farmers' climate adaptation.
- Insurance-related changes in farming practices lead to both positive and negative effects on the environment. Evidence for the hypothesis that insurance increases climate-smart practices is thus mixed.
- Insurance can either complement or substitute other risk management practices. This effect may depend on the type of risk management strategy considered—for example, on-farm versus off-farm diversification—and on whether other strategies were already in place prior to the introduction of formal insurance.

As climate change increases production risks and therefore income risks for farmers, different types of insurance can (partially) cover climate risks. In this sense, agricultural insurance is an important instrument for farmers' climate adaptation. More details about the impact of insurance on the stabilisation of farmers' incomes is discussed in Section 4.4 on food security and Section 4.5 on financial resilience. In the present section, we will further zoom into the effect of insurance on farmers' decisions related to climate adaptation.

Insurance products could also influence farmers' climate adaptation capacities through the adoption of climate-smart practices. The effects of insurance on farmers' climate adaptation depends also on alternative measures that farmers can take to adapt to climate risks. If farmers use several farming practices and other adaptation strategies (diversification, alternative employment, etc.), they may be less willing to spend money on insurance (Smith 2016). Conversely, having an insurance may lead farmers to invest less in other adaptation measures. This may work out differently in years of 'normal climate risks', as compared to extreme or catastrophic events: in the latter case, farmers' own capability to adapt may be too limited.

Ten of the selected articles provide evidence for the impact of insurance on farmers' climate adaptation capacities. These articles have been published between 2012 and 2024 and cover different geographical areas, including North America, Europe, Central Asia, East Africa and the Middle East. The assessed insurances cover various risks, ranging from livestock mortality due to climatic changes, to hail and multi-peril risks.

Does insurance increase the adoption of climate-smart agricultural practices and climate adaptation efforts?
Evidence related to insurance and adaptation efforts and climate smart agricultural practices is mixed. The review paper of Singh and Agrawal (2019) focuses on the efficacy of weather index insurance for mitigating weather risks through climate-smart agriculture. This efficacy is substantially influenced by the impacts of climate change. Weather index insurance demand is correlated with farmers' concern about impacts of climate change. Farmers' willingness to participate is a prerequisite for sustainable index insurance that leads to climate-smart agriculture and provides social welfare protection to farmers (Singh and Agrawal 2019). Another study in the USA found a statistically significant yet small effect of insurance on planting decisions and acreage, and only in some of the assessed regions. Changes in cropping patterns lead to both positive and negative environmental effects, and impacts are location-specific. For example, crop insurance in the USA was shown to be positively correlated with more environmental damage (Walters et al. 2012). Deryugina and Konar (2017) also show that insurance uptake causally increases the amount of cotton acreage in the USA, which is a water-intensive crop. In this case, a 1 percent increase in insured crop acreage leads to a 0.624 percent increase in cotton acreage and a 0.223 percent increase in irrigation withdrawals, with most coming from groundwater aquifers. Thus, crop insurance may have unintended consequences for the sustainability of water resources. Another study in Ethiopia found that insurance did not result in meaningful increases in input purchases, even after implementing subsidies providing free 'tester' insurance (Ahmed et al. 2020). As such, these studies indicate that changes in farming practices do not necessarily lead to positive environmental effects, and are therefore not inherently 'climate-smart'.

On the contrary, several studies indicated that insurance can support climate adaptation efforts. Jin et al. (2024) found in China that agricultural insurance reduces carbon emissions in the agricultural sector. Emissions are reduced by increasing green technical efficiency (enhancing resource use efficiency and minimise environmental impacts) in the crop sector and improving green technological advances (technologies that address environmental issues, natural resource use and/or pollution, e.g. methane capture devices) in the livestock sector. In their study at a provincial level, a 1 percent increase in insurance development in the province leads to a 0.025 percent overall emission reduction. Moreover, Fu et al. (2024) indicate that agricultural insurance has a positive impact on different aspects of farmer behaviour. The average treatment effects indicate

increases in cultivated land (8.5 percent), capital input per acre (16 percent), mechanisation (24 percent), water conservancy application (49 percent), adoption of agricultural technologies (19.4 percent), and planting structure selection (5.6 percent).

Does insurance complement other climate risk adaptation/management strategies of the farmers, instead of substituting them?

Insurance exists alongside other risk management mechanisms, and can be effective both as a substitute and complementary mechanism. One type of yield risk management strategy is informal risk-sharing within social networks, which is common in developing countries (Hample, 2021). This study provided evidence that formal and informal insurance act as substitutes and, therefore, do not necessarily complement each other. Formal insurance reduced the amount of informal sharing, and increased informal sharing in the past also reduced the adoption of formal insurance. Livestock herders have also been using a wide range of strategies to adapt to climate change impacts for years. Examples include rotational grazing, mixed crop-livestock systems, breeding mixed herds, cultivation of forage crops or indigenous species, and migrating and diversifying income. In line with these strategies, insurance is a complementary risk reduction mechanism. Biglari et al. (2019) identified that livestock insurance is a key mechanism to mitigate the negative impacts of climate change on the livelihoods of livestock herders' households in Iran. The number of insured livestock and perceptions about livestock insurance are important determinants of household resilience to climate change. Knapp et al. (2021) examined hazards in another sector, specifically hail risks for crop production, and found that insurance can act as either a complement to or a substitute for other risk management practices. On-farm diversification (e.g., crop species diversity or processing) was positively correlated with hail insurance uptake, indicating that it serves as a complementary risk management strategy for farmers. Meanwhile, off-farm diversification (e.g., through forestry activities or off-farm labour) has a negative correlation with insurance uptake, and thus represents a substitute in a farmer's risk management portfolio.

4.4 Impact on farmers' food security

Key messages:

- Insurance helps smooth consumption during adverse weather by providing financial support, allowing farmers to maintain their needs and to avoid reducing essential consumption.
- Insurance for food crops boosts food production because the protection against climate-related crop losses encourages investments in better and more productive farming practices.
- Insurance promotes long-term food security by enabling farmers to improve their production methods and increase crop yields.

Out of the 92 studies reviewed, 9 articles highlight the contribution of insurance to food security. The articles encompass multiple countries across five continents. The insurances studied cover both livestock and crops, aiming to mitigate a wide range of climate and production-related risks.

Does insurance promote food security through consumption smoothing?

There is evidence that insurance helps smoothing consumption and maintaining food security of farming households, particularly during adverse weather conditions (Smith 2016). For instance, in Mexico the CADENA programme's weather index insurance (WII) provides direct financial support when droughts or other extreme weather events occur, helping farmers maintain their consumption levels and secure resources for the next planting season (Ramirez Ritchie 2015). This stabilising effect is reflected in the increase in the area of insured crops sown, as farmers receiving insurance payments are more likely to expand cultivation. Moreover, crop insurance in Burkina Faso boosts consumption, evidenced by a 33 percent increase for households in the most productive southern part of the country and a 129 percent increase in households in 'Other' regions (Kazianga and Udry 2004). Further, insurance enables asset-poor households to avoid reducing essential consumption (Janzen and Carter, 2018). Moreover, insurance reimbursement plays a role in consumption smoothing by helping farmers manage fluctuations in their operational costs despite income losses (Porrini et al. 2019).

Does insurance promote food security through boosting farmers' food production for their own consumption?

There is also evidence that agricultural insurance can boost food production, both for the farmers' self-sufficiency as well as food production for the market. Weather Index Insurance (WII) helps strengthen food security by providing financial protection to farmers against climate-induced crop losses, ensuring stable food production and poverty reduction in rural areas (Singh et al. 2019). According to Gebretsadik and Tesfay (2023), insurance improved crop yields, helping households better meet their own

food needs. Additionally, food access was enhanced through increased household food expenditure, allowing families to purchase more nutritious food and ensuring a more reliable food supply throughout the year. In Kenya, livestock insurance enhanced dairy farming, resulting in a 42 percent increase in average milk production per animal and a 67 percent rise in farmers' incomes, which extended food security by up to 11.3 additional months (Kaphle and Bastakoti 2017). Additionally, agricultural insurance subsidies in China have a strong positive effect on a grains-based food security composite index (Kong et al. 2023).

4.5 Impact on farmers' financial resilience

Key messages:

- Insurance stabilises income by providing a safety net against risks such as weather disruptions and crop damage.
- Insurance prevents the depletion of savings by helping farmers avoid selling valuable assets such as livestock, maintaining herd sizes during difficult periods.
- Insurance offers financial protection during crises, enabling farmers to manage climate-related risks and recover from losses. Nonetheless, this financial protection is limited because of the restrictions in insurance coverage.
- Insurance can have negative effects, such as increased financial strain when premiums are paid without corresponding indemnities, leading to reduced resources for essential investments.
- While insurance helps reduce poverty risk and improves economic stability, its impact on rural poverty is limited, particularly for those with lower incomes.
- Insurance improves access to loans, helping farmers manage financial risks, reduce debt, and use credit for production costs or investment purposes.

Financial resilience refers to the degree to which people, organisations, societies are able to bounce back financially from certain shocks and stressors. Among 93 reviewed articles, 32 provide evidence about the effect of insurance on the financial resilience of farmers and herders. These studies span multiple continents and cover a range of insurance models, risk types, and agricultural products. Focus regions include Sub-Saharan Africa, South Asia, North America, and the Middle East and North Africa, highlighting the high exposure of these areas to climate shocks and agricultural risks. Kenya is particularly prominent in the research areas, with several studies analysing index-based livestock insurance designed for pastoralist communities.

Does insurance decrease poverty through stabilising income?

Insurance programmes can play a crucial role in enhancing income stability for farmers by providing a safety net against risks such as weather disruptions and crop contamination (Barooah et al. 2017; Zentner et al. 2011; Kaur et al. 2024b; Singh et al. 2019). For example, the CADENA programme's weather index insurance offers direct payments during adverse conditions, such as droughts, allowing farmers to prevent the depletion of resources and maintain consistency during planting seasons (Ramirez Ritchie 2015). According to Brown et al. (2024), crop insurance provides critical income protection. During the 2017 fumonisin contamination outbreak in the USA, insured farmers received $52 million in claims, helping to offset substantial losses. This finding is consistent with Duchoslav et al. (2018), who found that the adoption of insurance in Mali was associated with a 1.8 percent reduction in the probability of experiencing money shortages.

In addition to insurance, both decoupled and coupled subsidy payments are key mechanisms for stabilising income in the USA (Mishra et al. 2017). Decoupled payments are not linked to current production levels, allowing farmers to save during low-income years and maintain expenditures. With each $1,000 increase in decoupled payments, farmers gain an additional $5 to $14 in spending capacity. In contrast, coupled payments, which are directly tied to production, help support reinvestment by providing approximately $3 per $1,000 increase in payments. This setup smooths income variability, even during fluctuating agricultural cycles.

There is mixed evidence of the impact of insurance on households' poverty and income status. The poverty probability score of insured households in Tanzania and Mozambique also improved by 4.6 percent, suggesting a better economic status among insured households, despite minimal impacts on agricultural productivity. (Boucher et al. 2021). However, Li et al. (2021) found that agricultural insurance in China had a minimal effect on income levels in rural households with a per capita disposable income lower than RMB 4,628.55, showing that it has not been effective in reducing rural poverty.

However, it is important to note that insurance can have a negative impact on wealth, particularly when indemnities are not received. According to Murray and Farrin (2014), premiums paid in Zambia without corresponding indemnities led to financial strain, reducing available resources for purchasing essential agricultural inputs like fertilisers.

Does insurance promote resilience through preventing the depletion of savings?

Available evidence indicates that insurance protects households from depleting their savings and assets during adverse events, promoting financial stability. It may reduce precautionary savings and may enable households to shift resources toward more productive investments. Insurance plays a crucial role in preventing the depletion of savings by offering financial protection during adverse events, enabling recipients to manage expenses without relying on their assets, such as livestock (Kazianga and Udry 2006). Other research indicates that insured households generally exhibit lower precautionary savings, as they no longer need to maintain emergency funds for risks, freeing up resources for productive investments instead (Tadesse et al. 2015, Marr et al. 2016; Jensen et al. 2017). Furthermore, the availability of weather insurance reduces the need for precautionary investment in low-return, risk-free assets, allowing farmers to allocate resources more effectively toward productive activities rather than hoarding savings as a buffer against potential risks (de Nicola 2015).

Similarly, insurance can serve as a vital tool for financial stability, allowing households to avoid distress sales, preserve savings, and invest in productive resources that enhance resilience and long-term income (Janzen and Carter 2018b). According to Gebrekidan and Lyu (2022), insured herders in Ethiopia experience lower livestock distress sales, with insured households reporting an average of 2.63, compared to 2.25 for uninsured households, resulting in a mean difference of -0.384. This suggests that insurance helps preserve livestock during difficult periods. In Kenya, payouts from Index-Based Livestock Insurance (IBLI) enabled pastoralist households to maintain herd sizes during droughts, reducing the need to sell or slaughter livestock by 2 percent compared to uninsured groups (Noritomo et al. 2019). Some studies highlight that insured households may also increase livestock sales during non-shock seasons (that is, seasons with no drought), which indicates a more effective timing of their sales when prices are higher; empirical analysis hints at two possible explanations, either a reduced pressure for precautionary savings or a need to sell animals to pay the insurance premium (Jensen et al. 2017a).

Does insurance enhance farmers' protection against financial risks?

Insurance can enhance farmers' protection against financial risks, although this effect can be limited by the restrictions in the insurance coverage. Insurance helps farmers and herders mitigate financial risks associated with adverse events (Smith, 2016). Insurance, with payout probabilities between 70 percent and 94 percent, enhances income stability and offers a government-backed safety net for catastrophic losses, including those where mortality rates of livestock exceed 25-30 percent. This helps alleviate the financial burden on individuals during crises (Mahul and Skees 2007). Additionally, Ethiopian households with index-based livestock insurance tend to receive higher informal transfers during payout periods, further enhancing their resilience (Matsuda et al., 2019).

For herders, livestock insurance offers essential financial protection, improving their capacity to manage climate risks. Iranian households with more insured livestock and a positive view of insurance services have shown stronger resilience, as insurance acts as a critical safety net against climate-related losses (Biglari et al. 2019b). Furthermore, in China each unit increase in farmers' participation in agricultural insurance correlates with a 10.8 percent increase in household economic resilience,[3] underscoring that insurance not only protects against immediate losses but also fosters long-term financial stability and adaptability to climate challenges (Xie et al. 2023).

For the European context, Capitanio and Adinolfi (2009) highlight the limitations of subsidised insurance in Europe, noting that although it covers only 35 percent of losses despite an average premium of €660 net of aid, it offers limited financial stability. Supplementary policies, which require an additional €355 premium, increase reimbursements beyond the premiums paid; however, farmers still face financial exposure, as evidenced by a net damage index of 0.82, reflecting continued vulnerability to weather-related losses.

Does insurance enhance farmer's access to loans/credit?

Insurance enhances farmers' access to credit by improving creditworthiness and increasing loan repayment rates, while also helping to manage debt and expand access to essential financial and agricultural services. Index-based insurance improves farmers' access to loans by enhancing their creditworthiness (literature review by Marr et al. 2016). Insured farmers in the USA,

[3] The authors define economic resilience in three dimensions: resistance capacity, adaptive capacity, and transformative capacity. They operationalise the concept using a variety of indicators, such as possession of household appliances and agricultural machinery, involvement in food crop production, diversification of livelihood activities, participation in agricultural cooperatives, availability of remittances, and access to agricultural knowledge and price information.

on average, experience an increase of nearly $64,000 in short-term debt; they interpret this finding as consistent with the 'risk balancing theory': the insurance reduces the farmer's business risk, which enables the farmer to increase his financial risk by taking on more debt. They also indicate that the increased use of short-term debt helps the farmers manage the financial burden associated with increased seasonal production costs (Ifft et al. 2015). Additionally, micro-insured loans result in a 15 percentage-point increase in the likelihood that farmers receive a loan by the first survey round. Meso-insured loans, in which the payouts go to the lender, show an even larger increase of 21 percentage points in farmers' likelihood of receiving a loan (Mishra et al., 2020). By the second survey round, meso-insured loans continue to demonstrate a substantial impact, with a 16 percentage point increase in the likelihood of receiving a loan.

Furthermore, there is evidence that insurance can increase access to services, although reduction of business risk may be limited. According to Cariappa et al. (2020b), farmers with insurance did not experience sufficiently reduced business risks to engage in larger loans. In contrast to this finding, Kaphle et al. (2017) report substantial increases in access to services, with agricultural service access increasing from 36.5 percent to 79.3 percent, and financial service access increasing from 38.8 percent to 71.4 percent, highlighting substantial improvements in the resources and support available to farmers.

4.6 Impact on (gender) equality

Key messages:

- Gender-disaggregated data on agricultural insurance are only available in a few cases. Where such information was available, women represented 41 percent of the policy holders and 36 percent of the people insured.
- Agricultural insurance adoption among women remains low due to accessibility issues.
- Wealthier households are more likely to adopt insurance. Poorer households face barriers due to high costs and liquidity constraints, preventing them from benefiting despite potential advantages.

Out of the 92 articles reviewed, 6 studies examine the impact of insurance on equality. These studies focus on regions such as Sub-Saharan Africa, South Asia, and Latin America, where agricultural insurance has been implemented to address issues of inequality. The insurance schemes primarily cover livestock—particularly in Kenya and Sub-Saharan Africa—and crops in other regions, helping to reduce income instability and provide financial protection for marginalised groups, including smallholder farmers and women.

Does insurance impact gender equality?

Evidence on the impact of agricultural insurance on gender is scarce. In the 2022 global review of microinsurance, a large share of agricultural insurance products did not report gender-disaggregated data: 44 percent provided no information on policyholders, and 70 percent had no data on the insured individuals (MIN, 2022). Where insurers did provide gender information, women represented 41 percent of the policy holders and 36 percent of the people covered. Challenges to women's access to insurance include their land tenure and ownership, as well as the fact that the insured crops often do not correspond to those in which women are primarily engaged (MIN, 2022).

We found no articles that refer explicitly to the impact of insurance on women.

Does insurance impact equality more in general?

While insurance has the potential to reduce inequalities, by enhancing economic stability, wealth disparities limit access to insurance for poorer households, thereby widening existing inequalities. Those most in need of insurance are often excluded from its benefits. Insurance can have an impact on reducing inequalities, but its effectiveness in Mexico is limited by wealth disparities and accessibility (Ramirez Ritchie, 2015). Wealthier households in Uganda are more likely to adopt insurance, with a 12 percent increase in adoption probability per standard deviation of wealth, while poorer households are 20 percent less likely to adopt due to high upfront costs and liquidity constraints (Cecchi et al., 2016). This results in a divide where the most vulnerable, including poorer households, are excluded from the benefits of insurance. According to Binswanger-Mkhize (2012), wealthier farmers in LMICs are more likely to adopt insurance as a supplementary tool, benefiting from existing self-insurance mechanisms like diversified investments and social networks. In contrast, poorer farmers in India face liquidity and credit constraints, preventing them from accessing insurance despite the potential benefits (Cariappa et al.,2020b). These results are a paradox where those most in need of protection are often excluded, exacerbating existing inequalities.

Insurance can also affect contributions to social capital. One study found that insured households contribute less to public goods than uninsured households. Poorer households without access contribute even less, reflecting the unequal distribution of benefits. While insurance can increase investments in productive technologies by 25 percent among poor households, the high costs limit overall adoption, with only 30 percent of households showing interest (Farrin and Miranda 2013).

4.7 Value for money - Cost-effectiveness

Key messages:

- Cost-effectiveness of agricultural insurance is not sufficiently investigated. Only in a few cases are the costs of an insurance promotion policy compared with its effects.
- It cannot be concluded from the evidence that insurance provides a cost-effective strategy from a policy perspective, to attain financial resilience among farmers.
- Evidence on the extent to which insurance can be a cost-effective tool for promoting farmers' economic development is limited and highly context-dependent.

To date, only three articles have provided evidence on the cost-effectiveness of insurance products from a policy perspective. These articles have all been published in recent years, between 2020 and 2024, and focus on crop insurance products (e.g. maize or cotton). The different studies cover different geographical areas, including Asia, North America and Europe.

Is insurance a cost-effective tool to reach financial resilience?

The limited available evidence provides little insight into the cost-effectiveness of insurance; however, two studies discuss its broader effectiveness in enhancing financial resilience. One study assessed whether implementing a central insurance scheme could offset losses from crop failure in a cotton-growing region of India. It concluded that net returns would remain negative and that the premium rate and indemnity would need to be adjusted to adequately protect farmers against such losses (Kaur et al., 2024). Meanwhile, another predictive study indicated that crop insurance is the most promising risk management strategy for farmers growing maize that is susceptible to mycotoxins. Crop insurance participation had the most substantial impact on reducing economic losses. During the 2017 fumonisin outbreak in the USA, insured farmers gained a total of $52 million by claiming Zero Market Value (ZMV) for maize with FUM levels exceeding 2.1 mg/kg. In contrast, uninsured farmers faced challenges, with approximately 60 percent of their maize classified as non-salvageable. Moreover, crop coverage levels also had substantial impact on reducing economic losses (Brown et al., 2024).

Is insurance a cost-effective tool to reach farmers' economic development?

Although there may be a positive relation between insurance and farmers' economic development, evidence is too limited to substantiate the cost-effectiveness. One article examined the relationship between insurance and pesticide expenditures, concluding that, without insurance, pesticide expenditures would be 6 to 11 percent lower. This suggests that risk management tools, such as insurance, act as complements to pesticide use; however, the impacts vary across countries. For example, in France, pesticide expenditures are positively associated with insurance, whereas no such correlation was observed in Switzerland. Additionally, insurance was found to be positively related to cropland expansion (Möhring et al. 2020).

5 Impact evidence – selected government policies

5.1 Cost-effectiveness of premium subsidies

Key messages:

- In the initial stages of agricultural insurance markets, premium subsidies are often a necessary but seldomly a sufficient condition to enhance adoption of agricultural insurance.
- Generic premium subsidies can become a substantial burden to the public budget when agricultural insurance is scaled up nationally.
- To remain cost-effective, longer-term subsidies for agricultural insurance should be targeted towards specific social target groups, climate hazards or objectives. Depending on the objective, alternative subsidy modalities, other than premium subsidies, should be equally considered.
- The impact of premium subsidies on the adoption of insurance should be distinguished from the impact of insurance on developmental outcomes.

Premium subsidies are one way—among others—to subsidise the emergence of agricultural insurance markets and to support the provision of agricultural insurance. A premium subsidy usually covers part of the insurance premium, and thus makes the insurance more affordable for the end users. Apart from premium subsidies, there are also alternative methods of subsidisation of agricultural insurance, such as subsidies to the administrative and operational costs of the insurance, subsidies to the pay-outs to the farmers, subsidies for the product development and pilot testing, or subsidies to the awareness raising to farmers (Hazell et al. 2019). At a global scale, premium subsidies represent 44 percent of the total premium revenue collected for agricultural insurance. Other forms of subsidisation are also substantial, but altogether about half the size of the premium subsidies (that is, 22 percent of total premium revenues collected) (Mahul and Stutley 2010, quoted in Hazell et al. 2019).

There are both economic and socio-political motives to subsidise agricultural insurance. First, a classical economic motive can be to build agricultural insurance markets in situations of market failures and externalities. By providing a temporary subsidy, the government can help the incipient insurance market to overcome initial uncertainties, finance bulky initial investments to the benefit of multiple market players, or help certain underprivileged groups to become acquainted with the benefits of insurance. Second, a more social- and/or political motive, potentially justifying a more structural and permanent subsidy for insurance, would be to make insurance more accessible to certain target groups, or to contribute to wider goals of social equity, climate adaptation and food security (Hazell et al. 2019; Mahul and Stutley 2010).

In this section, we explore the evidence about the cost-effectiveness of premium subsidies for agricultural insurance. We found 20 articles that investigate the effects of premium subsidies. We first examine whether premium subsidies improve the demand for and adoption of insurance, and then assess the impact of subsidized insurance on developmental outcomes.

Are premium subsidies a cost-effective policy instrument?

The cost-effectiveness of premium subsidies is under-researched. Most studies on premium subsidies examine their effectiveness, but few address their *cost-effectiveness*. We found only one study about the USA that concludes that insurance subsidies cost about as much as the farmers' loss in net revenue (Maisashvili et al. 2020). This would reflect a relatively low cost-effectiveness.

Are premium subsidies an effective tool to increase demand for - and adoption of – agricultural insurance?

Multiple studies show that there is a low demand among farmers for voluntary insurance, due to high upfront costs and liquidity constraints (e.g. Farrin and Miranda 2013). Several studies also demonstrate that the demand for insurance is highly price-sensitive: high premiums discourage farmers from buying an insurance (e.g. Stoeffler and Opuz 2022). Depending on the economic or sociopolitical motive behind a subsidy, and the underlying market failures or externalities, this could make a case for subsidising the price (premium) of the insurance.

Several authors confirmed the expectation that a substantial premium subsidy would increase the demand for insurance. For example, Ahmed et al. (2020) show that issuing discount vouchers in Ethiopia increases the uptake of the rainfall index insurance. Stoeffler and Opuz (2022) find a similar positive result for area-yield index insurance in Burkina Faso. However, several authors find that only a discount on the upfront premium does not always lead to an increase in take-up. For example, the same study in Burkina Faso found that providing clear explanations and ensuring understanding of the insurance prior to enrolment had an effect equivalent to a 50 percent premium subsidy (Stoeffler and Opuz 2022). Casaburi and Willis (2018) conclude that pricing alone is insufficient to drive adoption of insurance in Kenya. In contrast, in India, subsidies were found to have a significant impact on Weather Index Insurance (WII). While heavily subsidised crop insurance is widely adopted in industrialised countries, scaling up WII in developing nations requires a robust legal and regulatory framework to enhance profitability and scalability, benefiting both farmers and the overall WII supply chain (Singh and Agrawal 2019).

Some authors are very critical of the expected benefits of agricultural insurance, even when facilitated with premium subsidies. Binswanger (2012) refers to the 'hype' surrounding index-based agricultural insurance. His literature review, combined with economic theory, concludes that the primary problem with index-based insurance lies on the demand side: poorer farmers need insurance but cannot afford it, whereas better-off farmers likely have other risk mitigation strategies and may not need insurance. According to Binswanger, a premium subsidy will not resolve the liquidity constraints that limit insurance adoption among poorer farmers. Smith (2016) builds on this argument, highlighting the problems of basis risk and high fixed delivery costs of insurance for smallholder farmers, to argue that commercially priced index insurance will always face low demand.

Several solutions have been proposed in the literature to increase the demand for and adoption of insurance. Potential approaches include allowing farmers to pay premiums at the end of the harvest season (addressing liquidity constraints), investing in farmers' understanding of insurance, bundling insurance with other services, and making insurance compulsory. Each of these solutions has pros and cons that need to be carefully weighed. Casaburi and Willis (2018) show for Kenya that deferring the premium payment until harvest increased the adoption of insurance substantially from 5 percent to 72 percent. In an experimental study in Ethiopia, farmers' uptake of insurance increased from 8 percent to 24 percent when they were allowed to pay after harvest, and rose further to 43 percent when insurance was also distributed through an existing community group structure called *Iddir* (Belissa et al., 2019). Belissa et al. (2019) signalled an important downside to this model: the risk of default on the payment of the premium.

Are premium subsidies an effective tool to achieve developmental outcomes among farmer households?
One stream of literature looks at *whether agricultural insurance is a public good worth spending public money on,* and found mixed results. For example, simulation models suggest that insurance can increase productive investments among poor households by 25 percent, particularly when combined with credit, benefiting high-collateral households (Farrin and Miranda 2013). In China, insurance subsidies have been shown to positively influence grain production (Kong et al. 2023). However, simulations also indicate that negative wealth effects may arise if premiums are paid but no indemnity payouts occur, which can reduce demand for fertilisers (Murray and Farrin 2014).

Both premiums and premium subsidies affect credit default rates. Insurance can also reduce credit default rates by 10 percent, in models where the insurance pay-out is used to repay the lenders (Farrin and Miranda 2013). A premium subsidy can lead to lower credit default, whereas an insurance with a costly premium can achieve the opposite effect, because it can induce opportunistic behaviour among borrowers (Miranda and Gonzalez-Vega 2011).

In a European context, subsidised insurance may affect land use and agrochemical applications: it can provide an incentive for farmers to shift resources from uninsured to insured crops, encourage expansion of sown acreage into more marginal farmland, and incentivise greater use of agrochemicals, potentially resulting in negative environmental consequences (Capitanio and Adinolfi 2009). In a USA context, it was shown that crop insurance hardly affected crop acreage decisions, except in counties where more land was available (Burns and Prager 2018).

A second stream of literature investigates *whether premium subsidies can enhance the positive effects of agricultural insurance,* which is confirmed by several studies. Freudenreich et al. (2018) investigated how subsidised crop insurance can influence the adoption of better yielding hybrid seeds in Mexico. They tested insurance schemes with different levels of risk coverage and premium subsidies. They found a positive effect of the insurance on the adoption of hybrid seeds, both in the case of index insurance and indemnity-based insurance. The positive effect was stronger for full insurance coverage than for partial insurance coverage. Premium subsidies increased the adoption of hybrid seeds. Similar results were achieved in an Ethiopia study, where it was shown that a zero-cost crop insurance increased the likelihood of purchasing certified seeds, overall use of inputs and acreage sown (Bulte et al. 2020). In a Taiwan study, it was shown that an insurance would increase investments, by reducing

risk and uncertainty, and a subsidised insurance would enhance that effect even further (Lin et al. 2021). An RCT in Tanzania and Mozambique showed that insurance with a premium subsidy voucher reduced food insecurity and improved poverty scores, but no effects were observed on economic variables such as maize yields or agricultural productivity (Boucher et al. 2024). For the CISP premium subsidy programme in China, it was shown that crop insurance premium subsidies mitigate cropland abandonment. This relationship is primarily due to the stabilisation of household income growth, which incentivises farmers to augment agricultural inputs and enhance development resilience (Ma et al. 2024).

However, in some cases there is no proof of the effectiveness of premium subsidies. Some other studies do not find clear effects of premium subsidies on developmental outcomes. In their study on Ethiopia, Ahmed et al. (2020) find little to no effect of a premium subsidy voucher on fertiliser use, adoption of improved seeds, credit uptake, crop yields, or household income.

Are premium subsidies an effective tool for developing commercial agricultural insurance markets?
Our literature search did not generate any scientific evidence on whether premium subsidies effectively contribute to the development of commercial agricultural insurance markets. Such evidence may exist, but it would require a more focused, in-depth search strategy.

Are premium subsidies more cost-effective than other forms of subsidisation?
Our literature search did not identify any scientific evidence on whether premium subsidies are more cost-effective than other forms of subsidisation. Such evidence may exist, but verifying it would require a more focused, in-depth search strategy.

5.2 Regulatory good practices for agricultural insurance

Key messages:

- Agricultural insurance should be regulated under the general insurance law.
- Agricultural insurance needs specific regulatory provisions, regarding the use of index insurance and consumer protection.
- Pilots and innovations in agricultural insurance require an enabling and knowledgeable role of the regulator.

What evidence is known about successful regulatory approaches to promote innovation in agricultural insurance, to the benefit of smallholder farmers?
In this section, we will list the main regulatory approaches intended to responsibly promote innovations in the design, distribution and delivery of agricultural insurance. The section is based on a few key publications on the subject: the overview of government support policies for agricultural insurance by the World Bank (Mahul and Stutley 2010) and several publications of the International Association of Insurance Supervisors (IAIS) about the regulation of inclusive insurance markets (A2ii-IAIS 2014, IAIS 2012, IAIS 2014, IAIS 2017, IAIS 2018).

- Mahul and Stutley (2010) clarify that the regulatory framework for agricultural insurance should serve different purposes. It should allow both indemnity-based and index insurance to be developed, with room for innovation. It should enable the participation of insurance and reinsurance companies. And it should protect farmers against potential malpractice of insurance companies.
- Mahul and Stutley (2010) argue for applying general insurance law to agricultural insurance. They note that, although agricultural insurance differs somewhat from other forms of insurance, the general principles of regulation and supervision still apply. This ensures that insurance companies have the resources to make pay-outs when due and that farmers and other customers are treated fairly.
- Mahul and Stutley (2010) mention that, where appropriate, some specific provisions can be made for agricultural insurance under that general insurance law. For example:
  - The legal and regulatory framework should explicitly allow index-based insurance.
  - Cooperatives and microfinance institutions should be allowed to act as insurance agents.
- Along similar lines, A2ii-IAIS (2014) clarify that agricultural insurance is different from other forms of non-life insurance. It varies in the types of assets covered, the key risks, and the type and scope of coverage. Most of the risks covered are systemic rather than idiosyncratic, which increases the need for reinsurance. Coverage can be indemnity-based or index-based and can operate at the micro, meso, or macro level—that is, at the level of individual farmers or companies, at the portfolio level,

or at the state or national level. Agricultural insurance is, more than some other forms of insurance, an area of government policy, combining social and developmental objectives with purely economic motives.

- Index insurance requires access to large data sets, and inherently suffers from certain levels of basis risk[4] which can be technically complicated to evaluate. It requires specific technical expertise at the regulator's office to judge the quality of index-based products. It also requires specific provisions of consumer protection.
- IAIS has published an guideline on index-based insurance: the 'Issues paper on index based insurances, particularly in inclusive insurance markets' (IAIS 2018). This guideline treats the following subjects:
  - The legal status of index insurance: the paper treats a series of technical questions related to the legal status of index insurance. These technical subjects are important for the national regulator to clarify and take a position on.
  - Consumer protection issues:
    - Product development and basis risk.
    - The possibility of ex gratia payments.
    - Transparency and continuity of subsidies.
    - Competition and (the risk of) monopoly.
    - Product security and reinsurance.
  - The treatment of pilot projects: the guidelines treat in detail how the regulator can deal with pilot projects in agricultural insurance.
- IAIS has also published guidelines about the regulation of inclusive insurance in general (IAIS 2012) and about product oversight in inclusive insurance (IAIS 2017). These guidelines contain a rich overview of aspects to be taken into account when regulating inclusive insurance products.

These guidelines provide a rich basis of insights about how regulation can effectively protect the stability of the insurance system and the interests of the users (farmers), while at the same time providing sufficient flexibility for experimentation and innovation. Exploring these subjects in greater detail would go beyond the scope of this report.

[4] Basis risk is the difference between the actual damages suffered and the damages calculated by the index. A high-quality index insurance has low basis risk, meaning that farmers receive a pay-out when they have actually incurred the level of damage covered by the insurance. In lower-quality index insurance, basis risk is high, so farmers may experience losses without receiving a pay-out, or conversely, may receive a pay-out without having suffered a loss.

6 Impact evidence – impact for aggregators

Agricultural insurance is often distributed through aggregator companies from the private sector. These can be financial institutions, input suppliers or other agricultural service companies and platforms. In these cases, the decision to bundle the insurance with the credit or input services lies with the aggregator company, rather than with the farmers. Aggregators tend to make this decision because they expect that the insurance will de-risk their business model or because they expect the insurance to increase the demand for their own products (ISF Advisors 2018). In Sections 6.1 and 6.2, we will explore the scientific evidence for both these hypotheses. We found a total of 10 studies providing evidence about these expectations.

6.1 Impact on aggregators' de-risking

Key messages:

- There is evidence that insurance can help protect loan portfolios against the risk of loan repayment defaults. In certain situations, an insurance can also lead to higher loan defaults.
- We found no research conducted about de-risking effects for other types of aggregators, such as value chain companies or digital platforms, or for international investors.
- Bundling of insurance can help to enhance the uptake of insurance, but the package of services should provide real and additional value, both to the farmers and to the aggregators.

Does insurance de-risk the business models of the aggregators?

Most of the evidence on de-risking the private sector relates to financial service providers, such as banks, microfinance institutions, and other lenders offering loans to farmers. Very little, if any, evidence was found on the effects of insurance in de-risking value chain companies or digital platforms.

For financial institutions, the most important de-risking effect of insurance is the reduction of loan defaults. In their simulation model on credit-linked insurance, Farrin and Miranda (2013) show that loan default rates can be reduced by approximately 10 percent if the lender has a first right to pay-outs. Another simulation model demonstrated 'that index insurance can enhance loan performance and bank stability by helping borrowers manage agricultural risks, particularly when premiums are subsidised, leading to lower default rates' (Miranda and Gonzalez-Vega 2011). However, the authors also point at the possibility that the loan default rates are negatively influenced, if premiums are high and attract farmers with higher risk profiles. This would imply that insurance products and subsidies need to be designed to protect borrowers sufficiently, but also to maintain incentives for timely repayment.

Some studies verified if insurance could increase moral hazard (i.e., the risk that farmers' willingness to repay a loan would be affected) and found no proof for increased moral hazard. A lab-in-the-field experiment in Tanzania demonstrated that insurance can encourage farmers to undertake higher-return, higher-risk investments. The authors do not interpret that as related to moral hazard but rather as a healthy entrepreneurial attitude to grasp attractive investment opportunities, while knowing that the risk of defaulting on the loan is mitigated by the insurance (Gallenstein et al. 2021). In China, livestock insurance for pigs had no effect on moral hazard, as shown by the fact that the decrease in vaccine use did not lead to higher mortality rates (Zhang et al. 2016). These results contradict the fear that insurance could make pig farmers sloppy in managing their risks through other risk mitigation measures. Note that a carefully designed insurance programme can limit moral hazard by means of using deductibles and specific terms and conditions.

Some studies experimented with delayed payment of the insurance premium to address farmers' liquidity constraints and found a positive effect on adoption. An RCT in Ethiopia showed that a delayed premium payment – after the harvest - increased the adoption of insurance, but was also vulnerable to non-payment of the premium. This non-payment risk could be partly addressed with a more binding contract, in combination with a partnership with community groups (*Iddirs*) for the distribution of the insurance (Belissa et al. 2019 and 2020).

A wider international literature review (Marr et al., 2016) confirms that insurance can enhance access to credit and reduce default rates by mitigating risk for both borrowers and lenders. However, the review also identifies cases in which insurance may lead to higher default rates and tighter credit conditions if it adversely affects borrowers' repayment behaviour (Marr et al., 2016).

Finally, Binswanger-Mkhize (2012) observes that aggregators still show limited demand for agricultural insurance. He hypothesises that aggregators may have alternative ways to manage their weather-related risks and would therefore not demand insurance. Such alternative risk mitigation measures could be 'their diversification in domestic credit or product markets, their links to international parent companies, or the willingness of governments to bail them out.'

Does insurance de-risk the business models of impact and commercial investors?

Our literature search did not identify any scientific research on whether insurance helps to de-risk the business models of investors. Such evidence may exist, but verifying it would require a more focused, in-depth search strategy.

6.2 Impact on aggregators' sales of inputs and credit

Key messages:

- Although there is evidence that insurance can lead to increased use of inputs and credit, we found no direct evidence that this can benefit the sales of input providers or financial service providers who serve as aggregator for the insurance.

Does insurance reinforce the revenue models of the aggregators, through bundling and cross-selling?

There is little evidence on the effect of bundling insurance on the general sales of aggregators, whether credit providers or input suppliers. However, there is evidence that insurance can increase farmers' demand for credit and inputs. In Section 4.5, we presented evidence that insurance can increase farmers' use of credit. In Section 4.2, we showed that, in certain situations, insurance can also lead to greater uptake of productivity-enhancing agricultural inputs, such as improved rice and maize seeds, fertiliser, irrigation, chemical inputs, and animal health services. This would imply an increased sales potential for the companies providing these inputs, or for the financial service providers, and as such can constitute a commercial argument for aggregators to bundle insurance with their services.

We have not found any direct evidence that this sales potential is effectively realised when an input supplier or financial institution bundles insurance with their service offering. Such evidence may exist, but verifying it would require a more focused, in-depth search strategy. In general, an increase in the use of inputs or credit does not necessarily indicate that these inputs or loans are purchased from the aggregator distributing the insurance. For example, farmers may buy inputs elsewhere or simply shift inputs from one crop to another, which can dilute the cross-selling effect for the input supplier involved in the insurance scheme.

7 Evidence gaps[5]

The available literature provides nuanced and varying levels of evidence for the different impact domains, for different stakeholders, including farmers, aggregators and policymakers. While a substantial number of studies (59 articles) underscore insurance's role in shaping farmers' socioeconomic conditions, there remain notable evidence gaps that limit a holistic understanding of its impact. Insurance has demonstrated potential value in enhancing financial resilience (32 articles) and contributing to food security (11 articles), yet research on these impacts is often short-term and lacks the **longitudinal data** necessary to assess sustained benefits. Similarly, while 10 studies explore insurance's effect on climate adaptation, the nuanced, long-term role of insurance in fostering adaptive capacity under evolving climate pressures remains underexplored.

On top of the gap in long-term longitudinal evidence, another important evidence gap is the evidence on the **cost-effectiveness** of insurance as a policy tool. Although some studies examine cost-benefit aspects, only three studies provide direct insights into the broader economic viability of insurance-based interventions. This limited focus on cost-effectiveness constrains the development of scalable, financially sustainable insurance models. Similarly, the cost-effectiveness of premium subsidies is hardly researched, although there is a reasonable basis of evidence around the impact of premium subsidies.

Additionally, the assessment of insurance impacts across **gender** lines (6 articles) points to a lack of robust, gender-sensitive evidence on how insurance can influence equity and economic empowerment among marginalised groups, which is a critical aspect for inclusive socioeconomic transformation.

Another limitation lies in the **unstandardised indicators** used to measure impacts in existing studies, which makes it challenging to generalise the observed effects across different regions and agricultural contexts. The lack of in-depth **comparative studies** on different types of insurance and aggregator models, in different contexts, also limits understanding of their distinct benefits.

Finally, we signal important evidence gaps related to the de-risking effects on aggregators other than financial service providers, as well as the effects of insurance on the cross-selling of aggregators' services.

[5] We chose not to include a separate Conclusion section. Instead, the summary chapter concludes by presenting the available evidence from the perspectives of policymakers, private-sector aggregators, and researchers.

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[6] Beyond the 92 articles found through the search protocol, some additional references were used for the chapters on Premium Subsidies (5.1), Regulation (5.2) and Private Sector impact.

Appendix 1 - Abbreviations

3ie	International Initiative for Impact Evaluation
A2ii	Access to Insurance Initiative of the IAIS
AII	Agricultural index insurance
ARM	Agricultural risk management
AYII	Area-yield index insurance
CISP	Crop Insurance Premium Subsidies Program, China
DID	Difference in difference method
FAO	Food and Agriculture Organization of the United Nations
FRA	Financial Resilience in Agriculture initiative, IRFF/UNDP
GAP	Good Agronomic Practices
GIIF	Global Index Insurance Facility
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation of the World Bank Group
ILO	International Labor Organization of the United Nations
IRFF/UNDP	Insurance and Risk Finance Facility, UNDP
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agronomic Practices
GIIF	Global Index Insurance Facility
IA	Impact Assessment
IAIS	International Association of Insurance Regulators
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation of the World Bank Group
ILO	International Labor Organization of the United Nations
ISF	Initiative for Smallholder Finance
M&E	Monitoring and Evaluation
MPCI	Multi-Peril Crop Insurance
NVDI	Normalised difference vegetation index
OECD	Organization for Economic Cooperation and Development
PSM	Propensity Score Matching method
RCT	Randomised Control Trial
ROI	Return on Investment
TOC	Theory of Change
UNDP	United Nations Development Programme
WFP	World Food Program
WII	Weather Index Insurance
WTP	Willingness to pay
WUR	Wageningen University & Research

Appendix 2 - Technical terms

Term	Explanation
Aggregator	Intermediary structure through which insurances are distributed to the end users. In other words, the intermediary aggregates the demand for insurance.
Agricultural risk management	The prevention, mitigation and transfer of different agricultural risks, such as weather and climate risks, pests & diseases, price risks, market risks.
Amount insured	The maximum amount an insurance company will pay out to cover an insurance claim.
Area-yield index insurance	Index insurance based on the realised (harvested) average yield of an area such as a county or district.
Basis risk	Basis risk is the difference between the damages suffered in reality, and the damages calculated by the index.
Bundling	The combination of different services into one package, for example an insurance with a loan, or an insurance with the provision of inputs.
Climate adaptation	Process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities.
Climate resilience	The degree to which people, organisations, societies or ecosystems are prepared to bounce back from certain climate hazards.
Climate risk	Potential for negative consequences for society or ecosystems from the impacts of climate change (IPCC).
Coverage (cover, risk cover)	Amount of risk, liability, or potential loss that is protected by insurance
Cross-selling	Selling multiple services to the same client.
De-risking	Process of minimising or eliminating potential risks and uncertainties in financial ventures.
Financial resilience	The degree to which people, organisations, societies are prepared to bounce back financially from certain shocks and stressors.
Idiosyncratic risks	Hazards that affect individual subjects (households, companies) or assets, without necessarily affecting their neighbours. Examples: illness, death, fire, unemployment.
Impact	The effect of a project's activities, outputs and outcomes on the final objective of the project.
Indemnity-based insurance	Insurances where the pay-out to the client is based on the occurrence of risks for the individual farm. The risk needs to be assessed by an inspector of the insurance company.
Index insurance	Insurances where the pay-out to the client is based on the occurrence of risks for a certain geographical area, rather than for the individual farm.
Livestock insurance	Insurance of cattle, pigs, poultry or other animal production
Loss rate	The percentage of an insurance company's premium revenues that is spent on pay-outs for damage.
Multi-Peril Crop Insurance	An agricultural insurance that covers multiple types of risks, such as (depending on the type of insurance) weather risks, pests and diseases, insect and bird plagues, animal mortality, fire.
Outcome	The effect of a project's activities and outputs on the desired result indicators of the project.
Output	The immediate product or result of a project activity.
Parametric insurance	Index insurance
Pay-out	Compensation payments by the insurance company for damage under the insurance contract.
Premium (insurance premium)	The price paid for an insurance policy
Pricing	The calculation of the adequate premium for a certain insurance product, in function of the risks covered and the operational expenses.
Risk	Risk refers to decision-making situations under which all potential outcomes and their likelihood of occurrences are known to the decision-maker. (Park and Shapira 2017)
Risk-contingent credit	Credits with payments of capital or interests that vary when certain risks occur.
Risk transfer	The transfer of risks to another entity or person, through instruments such as insurance or calamity funds.
Systemic risk	Hazards that affect multiple neighbouring subjects (households, companies) or objects/assets at the same time. Examples: drought, floods, locust infestations.
Uncertainty	Uncertainty refers to situations under which either the outcomes and/or their probabilities of occurrences are unknown to the decision-maker.(Park and Shapira 2017)
Weather index insurance	Index insurance based on weather parameters. Examples are insurances based on rainfall indices, NVDI, relative evapotranspiration, soil moisture.
Willingness to pay	The maximum price at or below which a consumer will definitely buy one unit of a product (Wikipedia).

Appendix 3 - Key data for the 92 articles

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
1. Agahi, H., Zarafshani, K., and Behjat, A.M.	2008	Middle East & North Africa	Regression analysis	Indemnity insurance (agri)	Multi-peril	n.a.	social & economic transformation	Farmers that have crop insurance tend to have higher technical efficiency compared to those without insurance. However, the results vary across regions.
2. Agbenyo, W., Jiang, Y., and Ntim-Amo, G.	2022	Sub-Saharan Africa	PSM	crop insurance (unspecified)	multi-peril	cocoa	social & economic transformation	The study conjecture that purchasing crop insurance for a cocoa farm leads to an increase in farmers income. The interpretation of this result would imply that a cocoa farmer who purchases crop insurance tends to earn a higher income than their counterparts who did not purchase crop insurance by 8.3 percent and 6.8 percent, for nearest neighbour and kernel matching respectively.
3. Ahmed, S., McIntosh, C., and Sarris, A.	2020	Sub-Saharan Africa	Experiment	WII	Excess rain	n.a.	climate adaptation; social & economic transformation; premium subsidies	The impact of insurance vouchers was limited, with strong uptake but minimal effects on fertiliser use, improved seed adoption, and credit usage. Agricultural yields and household income remained unchanged. Despite overall improvements in farming practices and welfare, insurance showed little direct impact during the study period.
4. Barooah, B., Kaushish, B., Puri, J., and Leach, B.	2017	Global - LMICs	Literature review	n.a.	n.a.	n.a.	social & economic transformation; financial resilience	Agricultural insurance plays a crucial role in enhancing technical efficiency by providing financial stability and mitigating risks, allowing farmers to invest in new technologies and improved management practices. It reduces income uncertainty, enables better resource allocation and adoption of specialised or mechanised farming methods. This financial security fosters a more resilient farming environment, leading to increased productivity and efficiency across wheat farms.

	Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
5.	Belissa, T., Bulte, E., Cecchi, F., Gangopadhyay, S., and Lensink, R.	2019	Sub-Saharan Africa	RCT	n.a.	n.a.	n.a.	private sector; premium subsidies	In a drought insurance experiment in Ethiopia, uptake rates showed substantial increases due to delayed payment options and community-based marketing. Standard insurance uptake was initially low at 8 percent, but allowing farmers to pay after harvest raised uptake nearly threefold to 24 percent. When combined with promotion through community groups, uptake rose even further to 43 percent. The weather insurance product was particularly beneficial for liquidity-constrained farmers, though differences in uptake between groups were not statistically significant. Default rates for the delayed payment option averaged around 17 percent, and were particularly high in four out of 90 community groups, all within one region. To counteract this risk, a binding contract was introduced, slightly reducing uptake but maintaining higher rates than standard insurance at a significant level. This experiment shows that uptake can be increased with tailored payment structures and trusted community support, although managing default risks remains a critical challenge for sustainability.
6.	Belissa, T., Bulte, E., Cecchi, F., Gangopadhyay, S., and Lensink, R.	2020	Sub-Saharan Africa	RCT	n.a.	n.a.	n.a.	private sector	First, it was revealed that the weather insurance product intervention significantly increased uptake, especially when combined with community-based marketing. However, the requirement for binding contracts limited uptake for weather insurance products unless coupled with community group marketing. Second, a more standard legal contract improved uptake relative to the stricter initial contract, but still required marketing support to achieve significant gains. Combining weather insurance products with community group marketing also helped reduce default rates, indicating an added benefit of social marketing in both uptake and compliance. Further analysis highlighted that over half of the farmers showed a preference for weather insurance products, even with a premium increase, although income and understanding of the product influenced willingness to pay.
7.	Bertram-Huemmer V., and Kraehnert, K.	2015	East Asia & Pacific	Panel data analysis with bias-corrected matching estimator	index-based livestock insurance	Multi-peril	livestock	social & economic transformation	A significant, positive and economically large effect of Index-Based Livestock Insurance (IBLI) indemnity payments on herd size was found, one and two years after a shock. In 2011, treated households own on average 15 to 16 percent more livestock than control households; in 2012, they own between 22 percent and 27 percent more livestock; and in 2013, they own about 17 percent more livestock. This corresponds to a difference in herd size between treated and control herders of about 20, 32, and 27 animals in 2011, 2012, and 2013 respectively. However, by 2014, four years post-shock (catastrophic weather disaster), both insured and uninsured households had smaller herds as compared to 2009 levels.
8.	Biglari, T., Maleksaeidi, H., Eskandari, F., and Jalali, M.	2019	Middle East & North Africa	Cluster analysis; regression analysis	Indemnity insurance (livestock)	Livestock mortality	livestock	financial resilience; climate adaptation	Livestock insurance significantly boosts herders' resilience to climate change by providing financial protection and enhancing their ability to cope with climate risks. Households with more insured livestock and a

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
								positive perception of insurance services showed higher resilience. Insurance, combined with higher income and livestock ownership, acts as a safety net against climate-related losses.
9. Binswanger-Mkhize, H.P.	2012	Global - LMICs	Literature review	Index insurance	Multi-peril	n.a.	private sector; premium subsidies; (gender) inequality	The effects of agricultural insurance, particularly index-based insurance, are complex and vary significantly among different farmer groups with different demographics. For wealthier farmers, insurance often serves as a supplementary tool rather than a necessity, as they typically have sufficient self-insurance mechanisms in place, such as diversified investments and strong social networks that mitigate risks effectively. As a result, demand for insurance products among these farmers is low. Conversely, poorer farmers face significant liquidity and credit constraints, limiting their ability to invest in insurance even though they would benefit from it. Many of the poorest farmers cannot afford premiums, leading to a paradox where those who need insurance the most, are often excluded from accessing it.
10. Boucher, S.R., Carter, M.R., Flatnes, J.E., Lybbert, T.J., Malacarne, J.G., Mareyna, P.P., and Paul, L.A.	2024	Sub-Saharan Africa	RCT	WII + AYII	Drought	maize	premium subsidies; financial resilience; social & economic transformation	The insurance-voucher bundle led to a 4.8-point reduction in food insecurity scores compared to controls, but did not significantly increase maize yields (145-159 kg/hectare more than controls) or input expenditures. The poverty probability score improved by 4.6 percent, indicating better economic status among treatment households. However, overall impacts on agricultural productivity were minimal.
11. Brown, A.A., Sasser, M., and Herrman, T.	2024	North America	Decision-making modelling & financial impact modelling	crop insurance (unspecified)	n.a.	maize	climate adaptation; financial resilience; cost-effectiveness; social & economic transformation	Crop insurance provides farmers with coverage for up to 85 percent of losses due to fumonisin (FUM) contamination in maize, helping mitigate financial risks. During the 2017 FUM outbreak, insured farmers gained a total of $52 million by claiming Zero Market Value for maize with FUM levels exceeding 2.1 mg/kg. In contrast, uninsured farmers faced significant challenges, with approximately 60 percent of their maize classified as non-salvageable, leading to considerable financial losses.
12. Bulte, E., Cecchi, F., Lensink, R., Marr, A., and van Asseldonk, M.	2020	Sub-Saharan Africa	RCT	n.a.	n.a.	n.a.	premium subsidies; social & economic transformation	The provision of free hybrid crop insurance significantly impacted smallholder farmers in Kenya, leading to a 14.6 percentage point increase in the likelihood of purchasing certified seeds, which rose from 45 percent to nearly 60 percent in the treatment group. Additionally, the average expenditure on certified seeds increased by approximately 400 KSh, and overall investments in complementary inputs rose by nearly 1,690 KSh. Farmers also expanded their cultivated land by about a quarter of an acre on average, with significant increases in the acreage of maize (0.181 acres) and sorghum (0.107 acres). Moreover, willingness to pay (WTP) for future insurance rose by 7–8 percent among treated farmers, although their bids remained below the full market price of 609 KSh. These results indicate that access to subsidized insurance encouraged greater agricultural investments and increased interest in insurance products.

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
13. Burns, C.B., and Prager, D.L.	2018	North America	Regression analysis	Indemnity insurance (agri)	Multi-peril	n.a.	premium subsidies; social & economic transformation	Higher net premiums paid for crop insurance (NPP) did not lead to increased acreage operated; for example, a $1,000 increase in NPP only resulted in an increase of about one-thousandth of an acre. This means that crop insurance doesn't significantly affect farm production decisions. On the other hand, farms in counties with more acres in the Conservation Reserve Program (CRP), which dropped from about 37 million acres to 30 million acres, were more likely to expand. This suggests that factors like land availability and soil productivity are more important for farm expansion.
14. Cai, J.	2016	East Asia & Pacific	DID	Indemnity insurance (agri)	Multi-peril	n.a.	social & economic transformation	Insurance provision has a significant positive impact on tobacco production, increasing the production area by 23.2 percent and its share of total agricultural land by 10.8 percent among treated households. However, it also leads to a decrease in loan sizes by 16.1 percent. While insurance enhances net savings by 36.3 percent and saving rates by 38.7 percent, it does not significantly affect flexible-term savings. Additionally, early adoption of insurance is associated with reduced borrowing and saving trends, illustrating the complex relationship between insurance, agricultural output, and household financial behaviors in tobacco farming.
15. Capitanio, F., and Adinolfi, F.	2009	Europe	Literature review	Multiple	Multi-peril	n.a.	financial resilience; premium subsidies; private sector	Under subsidized insurance policies, farmers face premium costs that average €1,649 annually, net of EU aid, translating to a net premium of approximately €660 per year. However, even with subsidized coverage, the loss ratios indicate that the reimbursements only cover a small portion of the total damage; only 35 percent of losses are reimbursed. In contrast, supplementary policies, which require an additional premium averaging €355, significantly increase reimbursement efficiency, indicating that reimbursements exceed the net premiums paid. Despite this, none of the insurance options fully cover damages; farmers still bear a substantial part of the financial burden from weather-related incidents. On the other hand, insurance companies benefit from subsidized policies that help maintain profitability, but they also face challenges in balancing risk exposure with client needs. The necessity for supplementary policies can lead to higher claims and requires insurers to adapt their pricing and policy structures to remain viable.
16. Cariappa, A.G.A., Mahida, D.P., Lal, P., and Chandel, B.S.	2021	South Asia	PSM	crop insurance (unspecified)	Drought	not specified	financial resilience; social & economic transformation; (gender) inequality	When looking at the effect of insurance on the use of credit, on average, the treatment group (with insurance) has 15361 INR (rupees) less debt than the control group (without insurance), and 6379 INR more income than the control group.

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
17. Casaburi, L., and Willis, J.	2018	Sub-Saharan Africa	RCT	subsidised insurance	n.a.	n.a.	premium subsidies	The findings indicate that while uptake for the full-price insurance was only 5 percent, delaying premium payment until harvest significantly increased uptake to 72 percent, demonstrating a clear preference among farmers for risk reduction without upfront costs. Additionally, a 30 percent discount on the upfront premium did not lead to a statistically significant increase in uptake, highlighting that pricing alone is insufficient to drive adoption in this context.
18. Cecchi, F., Duchoslav, J., and Bulte, E.	2016	Sub-Saharan Africa	Probit estimation + choice experiment	n.a.	n.a.	n.a.	(gender) inequality; social & economic transformation	data suggest formal insurance crowds out social capital. It was found that wealthier households are more likely to adopt insurance, with a 12 percent increase in adoption probability per standard deviation of wealth, and 20 percent lower likelihood of adoption among poor households. Contributions to public goods (local cooperation) decrease by an average of 0.281 tokens for insured households, while non-adopters with access contribute 0.4 tokens less than those without access, indicating that the decline in social capital primarily stems from reduced contributions by uninsured or poorer households.
19. Cha, J., Deng, Y., Zheng, S., and Li, F.	2024	East Asia & Pacific	(Empirical) regression model & mediation effect model	crop insurance (unspecified)	n.a.	pears	social & economic transformation	The acquisition of crop insurance increases the income of pear farmers. Crop insurance enhances agricultural labor and machinery inputs, and encourages pear farmers to adopt green production techniques, thereby boosting their income. The beneficial impact of crop insurance on pear farmers' income is even more pronounced when farmers are members of cooperatives. Heterogeneity analysis showed that for pear farmers who make individual decisions and have smaller land areas, crop insurance can increase their income, while its impact on farmers who make group decisions or have larger land areas is not significant.
20. Chang, H.H., Mishra, A.K., and Livingston, M.	2011	North America	Regression analysis	Indemnity insurance (agri)	Multi-peril	n.a.	social & economic transformation	Crop insurance significantly increases fuel expenses across most percentiles, with estimates ranging from $3.77 to $7.58 per acre. This positive effect suggests that insured farmers engage in more fuel-intensive activities.
21. Chang, H.H., and Mishra, A.K.	2012	North America	Regression analysis	Indemnity insurance (agri)	Multi-peril	n.a.	social & economic transformation	The study finds that farmers with crop insurance are more likely to increase their usage of fertilisers and chemicals, as insurance mitigates financial risk and encourages riskier but potentially more productive farming practices. This leads to higher expenses on these inputs throughout the entire distribution, suggesting a moral hazard effect where insured farmers feel more secure to intensify input use.
22. Clarke, D., and Kalani, G.	2011	Sub-Saharan Africa	Framed field experiment	WII & indemnity	not specified	not specified	financial resilience; private sector	Found evidence that the relationship between index insurance take-up and wealth is nonlinear, and subjects with intermediate levels of wealth have the highest take-up, with low demand for index insurance from the poorest and the richest.
23. Cole, S., Giné, X., and Vickery, J.	2017	South Asia	RCT	WII	Extreme rainfall	n.a.	social & economic transformation	Insurance increases cash crop planting by 6 percent, and land use for cash crops by 8.6 percent. It raises the share of land and inputs for cash crops

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
								by 4.7 percent and 3.4 percent, respectively. The effect is stronger for educated farmers, with each additional year of education increasing crop planting by 1.8 percent.
24. Cole, S.A., Giné, X., and Vickery, J.I.	2013	South Asia	WTP + field experiment	WII	Rainfall	cash crops	social & economic transformation; social & economic transformation	Insurance increases cash crop planting by 6 percent, and land use for cash crops by 8.6 percent. It raises the share of land and inputs for cash crops by 4.7 percent and 3.4 percent, respectively. The effect is stronger for educated farmers, with each additional year of education increasing crop planting by 1.8 percent.
25. de Janvry, A., Ramirez Ritchie, E., and Sadoulet, E.	2016	Latin America & Caribbean	Regression discontinuity analysis	n.a.	n.a.	n.a.	social & economic transformation	Weather index insurance significantly enhances agricultural productivity and household economic conditions for rural farmers. Insurance payments allow farmers to expand their cultivated land area by approximately 39 percent in the season following a weather shock. Given that the average treatment municipality receives payment for 45 percent of said land, we would expect the average effect of receiving payment to be approximately 17 percent. Economically, households in municipalities receiving these payments experience increases in per capita expenditures and income by around 27 percent and 38 percent, respectively, translating to additional incomes of 6,000 to 8,000 pesos.
26. De Nicola, F.	2015	Sub-Saharan Africa	Dynamic stochastic model	WII	not specified	not specified	financial resilience; security	The provision of weather insurance as well as credit leads to an increase in consumption and a decline in precautionary investment in riskless return-free assets. While qualitatively similar, these choices are quantitatively different as captured by the vast differences in the level of welfare gains that can be achieved. At each level of wealth, weather insurance enables farmers to achieve larger welfare gains which are decreasing in wealth.
27. Deryugina T., and Konar, M.	2017	North America	IV regression	crop insurance (unspecified)	n.a.	cotton	social & economic transformation; climate adaptation	The analysis shows that a 1 percent increase in insured crop acreage results in a 0.223 percent increase in irrigation withdrawals, primarily sourced from groundwater aquifers. A key driver of this increase is the expansion of groundwater-fed cotton farming. Specifically, a 1 percent rise in insured crop acreage leads to a 0.624 percent increase in cotton acreage, equivalent to an additional 95,602 acres.
28. Duchoslav J., and Van Asseldonk, M.	2018	Sub-Saharan Africa	PSM	crop insurance (unspecified)	n.a.	maize	financial resilience; security	The direct impact of insurance on well-being was mixed; adoption was correlated with a 1.800 reduction in the probability of experiencing money shortages, but no significant effects were found on food security, suggesting that benefits were likely tied to the accompanying credit rather than the insurance itself
29. Farrin, K., and Miranda, M.J.	2013	Global - LMIC	Normative model	index insurance	n.a.	technology adoption	private sector; social & economic transformation; (gender) inequality;	Formal insurance can increase productive technology investments among poor households by 25 percent, particularly when combined with credit, benefiting high-collateral households. Additionally, models prioritising lender claims may reduce default rates by approximately 10 percent, facilitating a trickle-down effect to borrowers. However, despite these advantages, only about 30 percent of households show interest in

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
							premium subsidies	purchasing insurance due to high upfront costs and liquidity constraints, hindering overall uptake.
30. Murray, A.G., and Farrin, K.	2014	Sub-Saharan Africa	Normative model	WII	n.a.	Maize	social & economic transformation; financial resilience; premium subsidies	Results show that index insurance, by reducing the disposable wealth of households in years where no payouts occur, can dampen demand for fertiliser at the farm level.
31. Freudenreich, H., and Mußhoff, O.	2018	Latin America & Caribbean	Simulation game + regression analysis	Multiple	Multi-peril	n.a.	premium subsidies	All insurance schemes significantly increase the degree of adoption of the higher yielding seed, though, partial insurance schemes perform worse than full insurance. Weather index insurance with geographical basis risk performs no worse than indemnity insurance, and premium subsidies significantly increase the adoption effect of indemnity insurance, but not that of index insurance.
32. Fu, L.S., Qin, T., Li, G.Q., and Wang, S.G.	2024	East Asia & Pacific	Endogenous Transformation Model	agricultural insurance (unspecified)	not specified	not specified	climate adaptation; social & economic transformation	The aveage treatment effect for agricultural insurance participation shows significant improvements: The actual cultivated area increased by 8.5 percent, annual capital input per acre of agricultural land by 16 percent, and degree of agricultural mechanisation by 24 percent. Additionally, the degree of water conservancy application Degree rose by 49.1 percent, number of agricultural technology items by 19.4 percent, and production level by 5.6 percent. These figures indicate substantial advancements across various agricultural inputs and practices.
33. Fu, X., Li, X., Xu, X., Wang, Y., and Liang, P.	2020	East Asia & Pacific	DID	agricultural insurance (unspecified)	n.a.	n.a.	regulations; social & economic transformation	In the regression models, as more control variables were added, the estimation coefficients for policy-based agricultural insurance consistently showed a significantly negative effect of 2 percent on fertiliser use reducing non-point source pollution
34. Gallenstein, R.A., Flatnes, J.E., Dougherty, J.P., Sam, A.G., and Mishra, K.	2021	Sub-Saharan Africa	framed field experiment	index insurance	n.a.	n.a.	private sector	Index insurance significantly increased the rate of risky project choices by 35 percentage points. Default insurance alone raised risk-taking by 28 percentage points, while additional income coverage further increased this effect of risk-taking by 9.3 percentage points.
35. Gebrekidan, T., and Kaiyu, L.	2019	Sub-Saharan Africa	Fixed-effect model regressions	index-based livestock insurance	n.a.	livestock	financial resilience	The effect of insurance on livestock offtake shows that insured herders tend to sell fewer animals compared to those without insurance. On average, insured households reported selling 2.63 animals, while uninsured households sold 2.25 animals. This results in a difference of 0.38, with insured herders having a slightly lower offtake. This difference is statistically significant, indicating that insurance may play a role in reducing the number of livestock sold. The overall average across all households was 2.54 animals.
36. Gebrekidan, T., Guo, Y., Bi, S., Wang, J., Zhang, C., Wang, J., and Lyu, K.	2019	Sub-Saharan Africa	Fixed-effect model regressions	index-based livestock insurance	Drought	n.a.	social & economic transformation	Insured herders spent more on livestock expenses and had higher savings. On average, insured households spent 3,701.71 Birr ($196.06) on livestock, which is 182.83 Birr ($9.68) more than uninsured households. This

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
								suggests a strong link between insurance uptake and increased investment in livestock. Additionally, insured households had higher average savings of 1,241.19 Birr ($65.73), which is 410 Birr ($21.73) more than uninsured households. This significant difference highlights the financial benefits of insurance in supporting both livestock investment and savings.
37. Gebretsadik, Y.H., and Tesfay, K.G.	2023	Sub-Saharan Africa	PSM	WII	n.a.	n.a.	food security; social & economic transformation	Insurance significantly enhances food security by improving food availability, access, and stability. Households with insurance experienced increased food crop yields, indicating greater self-sufficiency in food production. Additionally, insurance contributed to higher household food expenditure, facilitating better access to nutritious food. Improved access to safe drinking water was also observed, highlighting the broader benefits of insurance. Furthermore, insurance reduced household vulnerability to food insecurity, making households more resilient to shocks. Overall, these findings suggest that insurance plays a crucial role in strengthening food security through enhanced production, consumption, and risk management
38. Giannakas, K., Schoney, R., and Tzouvelekas, V.	2001	North America	Statistical decomposition analysis	Indemnity insurance (agri)	Extreme rainfall	n.a.	social & economic transformation	The impact of crop insurance on technical efficiency shows a significant negative relationship, suggesting that reliance on insurance payments may reduce farmers' incentives to maximise production. This finding indicates that government and crop insurance income correlate with lower efficiency scores, possibly due to complacency in performance.
39. Hample, K.C.	2021	Sub-Saharan Africa	Experimental design	formal insurance	n.a.	n.a.	climate adaptation; Kenya	The adoption of formal insurance was found to significantly reduce reliance on informal group sharing, particularly among low adopters. In the regular treatment order, low adopters made more transfers (5.8 tokens) and received slightly more (5.9 tokens) compared to high adopters, who transferred significantly fewer tokens. In the reverse treatment order, low adopters received 9.5 tokens, while high adopters received only 3.3, indicating that those with formal insurance had less need for informal transfers. Overall, the findings suggest that formal insurance reduces informal sharing, and individuals with a history of relying on informal networks are less likely to adopt formal insurance.
40. Hill, R.V., Kumar, N., Magnan, N., Makhija, S., de Nicola, F., Spielman, D.J., and Ward, P.S.	2019	South Asia	Regression analysis	Hybrid	Drought	n.a.	social & economic transformation	Purchasing insurance increased average input expenditures by approximately BDT 1,830 (16 percent) more than for farmers in the comparison group. Insurance also encouraged farmers to invest an additional BDT 610 in agricultural inputs. Specifically, for the boro crop, insurance led to increases in expenditures on irrigation (BDT 311), pesticide (BDT 48), fertiliser (BDT 546), and labor (BDT 658), representing increases of 11 percent, 13 percent, 17 percent, and 21 percent respectively, compared to the comparison group.

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
41. Ifft, J., Kuethe, T., and Morehart, M.	2015	North America	PSM + Regression analysis	Multiple	Multi-peril	n.a.	social & economic transformation; financial resilience	Farmers who purchase insurance tend to experience an increase in short-term debt, with an estimated average rise of nearly $64,000 at the end of 2011. This relationship is further underscored by the finding that participating in the insurance scheme is linked to a notable increase in short-term debt relative to operating expenses, suggesting that crop insurance may serve as a tool for managing financial risks associated with seasonal production costs. However, the effects on long-term debt appear to be minimal, indicating that insurance primarily impacts short-term financial strategies rather than broader, long-term borrowing decisions
42. ISF Advisors	2022	Global - LMICs	Literature review + interviews	Multiple	Multiple	Multiple	private sector; regulations; subsidies	
43. Janzen, S., Jensen, N.D., and Mude, A.G.	2016	Sub-Saharan Africa	Case study	index-based livestock insurance	Livestock mortality from biotic and abiotic risks (production risk)	n.a.	social & economic transformation	Index-based Livestock Insurance (IBLI) in northern Kenya leads to a 29.1 percent increase in household incomes for insured families compared to non-insured ones. Additionally, child health improves significantly, as indicated by better Mid-Upper Arm Circumference (MUAC) scores, and milk productivity rises by 10 percent to 20 percent due to enhanced livestock health investments. While the program encourages strategic herd size reduction, only about 20-30 percent of poorer households opt for insurance, suggesting a critical need for public support to reduce premium costs and expand coverage among vulnerable populations.
44. Janzen, S.A., and Carter, M.R.	2013	Sub-Saharan Africa	Field experiment	index-based livestock insurance	drought	Livestock	food security; financial resilience	Insurance helps to prevent cutting on consumption for asset poor households and to prevent selling assets for asset-rich households.
45. Jensen, N., Ikegami, M., and Mude, A.	2017	Sub-Saharan Africa	Regression analysis	index-based livestock insurance	multi-peril	not specified	financial resilience; social & economic transformation	With insurance, households increase investments in livestock health services, reduce herd size, experience increase in milk productivity and total (milk) income, increase livestock sales during shock seasons. Enrollment in insurance also reduce precautionary savings
46. Jensen, N.D., Barrett, C.B., and Mude, A.G.	2017	Sub-Saharan Africa	IV regression	index-based livestock insurance & cash transfers	mortality, income	livestock	financial resilience; social & economic transformation; food security	Index Based Livestock Insurance reduces distress sales during shocks, increases non-shock livestock sales, and boosts productivity through investments in animal health. Livestock insurances increase income and milk productivity, reducing reliance on herd size as savings
47. Jin, Y., Wang, X., and Wang, Q.	2024	East Asia & Pacific	Panel data two-way fixed effects model	agricultural insurance (unspecified)	n.a.	?	climate adaptation	Agricultural insurance significantly reduces carbon emissions in the agricultural sector, with a 1 percent increase in insurance development leading to a 0.025 percent overall reduction. In the crop sector, emissions can decrease by 0.041 percent for each 1 percent increase in insurance, while the livestock sector sees a reduction of 0.021 percent.
48. Kaphle, M., and Bastakoti, N.	2017	South Asia	Before-after analysis	Indemnity insurance (livestock)	Livestock mortality from biotic and	n.a.	financial resilience; food security; social &	The livestock insurance program significantly boosted dairy farming, increasing the number of insured livestock from 134 to 250 and raising the number of participating farmers from 66 to 126 over three years. During

Authors	Year	Region	Methods	Insurance product type	Hazards covered	Crop/animal	sub-Topic	Effect size
					abiotic risks (production risk)		economic transformation	this period, average milk production per animal increased by 42 percent, and farmers' incomes rose by over 67 percent, enhancing food security for many by up to 11.3 additional months. Additionally, access to agricultural services jumped from 36.5 percent to 79.3 percent, and financial services from 38.8 percent to 71.4 percent, indicating substantial improvements in resources and support for farmers.
49. Karlan, D., Osei, R., Osei-Akoto, I., and Udry, C.	2014	Sub-Saharan Africa	Field experiment	WII and cash grants	unpredictable rainfall	Maize	social & economic transformation	Demand for index-insurance is strong, and insurance leads to significantly larger agricultural investment and riskier production choices in agriculture
50. Kaur, S., Singh, H., Roy, D., and Singh H.	2024	South Asia	Logistic regression framework	crop insurance (unspecified)	pest attacks	cotton	private sector; financial resilience; social & economic transformation; cost-effectiveness	Farmers in Bathinda and Mansa experienced significant financial improvements when they had insurance. In Bathinda, without insurance during 2015-2016, farmers lost Rs. 22,790, but with insurance, they made a profit of Rs. 22,753. Similarly, in Mansa, without insurance, farmers lost Rs. 24,209, but with insurance, they gained Rs. 25,546. By 2021-2022, the insurance claims per hectare had grown to Rs. 57,024 in Bathinda and Rs. 56,897 in Mansa, offering farmers substantial financial support and reducing their losses.
51. Kazianga, H., and Udry, C.	2006	Sub-Saharan Africa	Regression analysis	Indemnity insurance (agri)	Livestock mortality from biotic and abiotic risks (production risk)	n.a.	food security; financial resilience; (gender) inequality	Crop insurance enhances financial stability. It significantly boosts household consumption while reducing the need to sell livestock. Households with crop insurance experience higher consumption due to increased crop income, which in turn helps reduce reliance on livestock sales for income. Specifically, in regions like Other regions and Northern-Guinea, crop income increases consumption by 129 percent and 33 percent, respectively. The presence of adult females in Northern-Guinean households further leads to a significant 554 percent increase in consumption. However, this increase in crop income does not significantly impact livestock sales. Overall, crop insurance helps stabilise household finances, encouraging more spending on goods and services and reducing the need to sell livestock for income.
52. Knapp, L., Wuepper, D., Dalhaus, T. and Finger, R.	2021	Europe	Regression analysis	crop insurance (unspecified)	Hail (weather risks)	Fruit crops	climate adaptation	Insurance helps farmers manage climate risks more effectively. Findings show that on-farm activities are positively linked to insurance uptake, meaning that these activities and insurance work well together as complementary strategies for managing risk. On the other hand, off-farm activities are negatively correlated with insurance uptake, suggesting that farmers may view these activities as substitutes for insurance in their overall risk management approach.
53. Kong, Q., Li, R., Peng, D.A.N., and Wong, Z.	2023	East Asia & Pacific	DID	multiple	not specified	not specified	social & economic transformation; food security; premium subsidies	The study finds that the agricultural insurance financial subsidy policy has a significant positive effect on the overall level of food security (food security composite indix).

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54. Li, Z., Zhang, D., and Zhang, J.	2021	East Asia & Pacific	Panel regression	agricultural insurance (unspecified)	production and market risks	unknown	financial resilience	Agricultural insurance has not been effective in reducing poverty among rural residents with an annual per capita income below RMB 4628.55. The data shows a small impact, with a regression coefficient of 0.0196, which is statistically significant at the 5 percent level. This means the effect is real but too small to make a meaningful difference in improving poverty levels for this income group
55. Lin, Y.-H., Lin, H.-I., Wen, F.-I., and Sheu, S.-J.	2021	East Asia & Pacific	Field experiment	crop insurance (unspecified)	Multi-peril	staple crops	private sector; premium subsidies; social & economic transformation	Insurance reduced perceived risk by 1.29 and increased tolerance for ambiguity by 1.35. Additionally, subsidised insurance further enhanced ambiguity tolerance by 4.92 and lowered concerns about risk. Insurance also mitigated the impact of low payoffs, making investment more appealing. Overall, both regular and subsidised crop insurance increased the likelihood of investment by reducing risks and uncertainty. Premium subsidies increase chances of payoff.
56. Ma, B., Peng, C., and Yu, L.	2024	East Asia & Pacific	DID	crop insurance premium subsidies	crop land abandonment	not specified	premium subsidies; social & economic transformation	Insurance is associated with a reduction in the probability of cropland abandonment by approximately 2.3 percent
57. Mahdid, M., and Boulfoul, N.	2024	Sub-Saharan Africa	Panel models	agricultural insurance (unspecified)	n.a.	wheat and barley, fruit trees and vines	social & economic transformation	A 1 percent increase in agricultural insurance leads to a 0.48 percent increase in production, showing that insurance helps improve productivity. However, the benefits differ depending on the type of crop. Fruit trees benefit the most, with a big increase of 36.20 percent, vineyards see a smaller boost of 5.48 percent, but wheat and barley are negatively affected, with a decrease of 41.67 percent. This shows that insurance works better for some crops than others
58. Mahul, O., and Skees, J.R.	2007	East Asia & Pacific	Case study	index-based livestock insurance	mortality	livestock (cattle, horses, camels, sheep and goats)	financial resilience; regulations	Insurance significantly mitigates financial risks for herders, with a 70-94 percent probability of receiving payouts, enhancing income stability. Additionally, the program provides a government safety net for catastrophic losses exceeding 25-30 percent mortality rates, reducing individual fiscal burdens during crises.
59. Maisashvili, A., Bryant, H.L., and Jones, J.P.H.	2020	North America	Expected utility maximisation	crop insurance (unspecified)	n.a.	soybean, wheat	premium subsidies	Eliminating crop insurance subsidies at 75 percent coverage levels or higher could save $2.5 billion but result in a $3 billion loss in farmers' expected net revenue (ENR). For soybean and wheat producers, subsidy savings exceeded ENR losses, while for corn, the ENR loss was slightly higher. On average, subsidy savings were $372 million, with an ENR loss of $384 million.
60. Marr, A., Winkel A., van Asseldonk, M., Lensink, R., and Bulte, E.	2016	Global - LMIC	Literature review	n.a.	n.a.	n.a.	social & economic transformation; financial resilience; private sector	Index-insurance boosts resilience in several ways. By providing a safety net against adverse weather events or crop failures, it helps farmers manage risk more effectively, reducing the likelihood of severe financial losses. With insurance coverage, farmers are more likely to invest in riskier but potentially more profitable crops or technologies, leading to increased productivity and income over time. Additionally, index-insurance can

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								enhance a farmer's creditworthiness, making it easier to access loans for necessary investments. It allows farmers to reduce precautionary savings, as they no longer need to set aside as much money to buffer against risks, enabling those funds to be used for productive investments instead. Furthermore, having insurance encourages better risk management practices, as farmers may adopt strategies like crop diversification, knowing they have some level of protection. In the event of a loss, timely payouts from insurance help farmers recover quickly, maintain their livelihoods, and avoid the need to sell off assets or take on debt. Insurance can enhance access to credit and lower default rates by mitigating risk for borrowers and lenders, but it may also lead to higher default rates and tighter credit conditions if it changes borrower behavior negatively. The effectiveness of bundling insurance with credit remains uncertain, with mixed evidence on its impact on investment outcomes.
61. Matsuda, A., Takahashi, K., and Ikegami, M.	2019	Sub-Saharan Africa	IV regression	index-based livestock insurance	Drought	n.a.	financial resilience; social & economic transformation	Index-based livestock insurance (IBLI) positively impacts household income, with increases of approximately 22,337 ETB for IBLI 2 and 35,273 ETB for IBLI 4, along with a significant rise in milk production (about 20,914 ETB for IBLI 4). Households also increased spending on veterinary services, while savings significantly decreased for IBLI 1 and 4 due to premium payments. Additionally, insured households experienced higher informal transfers during payout periods, enhancing their resilience.
62. McIntosh, C., Sarris, A., and Papadopoulos, F.	2013	Sub-Saharan Africa	Field experiment	WII	Adoption of agricultural technologies (fertiliser)	fertiliser	financial resilience	A palliative and not transformative role of weather index insurance is found. Weather index insurance does not help to buy more input, but rather protects those who are already using high levels of input
63. Miranda, M.J., and Gonzalez-Vega, C.	2011	Global - LMICs	Normative model	index insurance	not specified	not specified	premium subsidies; private sector	Index insurance can enhance loan performance and bank stability by helping borrowers manage agricultural risks, particularly when premiums are subsidised, leading to lower default rates. However, high unsubsidised premiums may increase default rates and negatively impact bank profitability. Policymakers should focus on designing insurance products that protect borrowers while maintaining incentives for timely loan repayment.
64. Mishra, K., Gallenstein, R.A., Miranda, M.J., Sam, A.G., Toledo, P., and Mulangu, F.	2021	Sub-Saharan Africa	RCT	(Micro & Meso) index insurance and agricultural loans	Drought	Maize	financial resilience	In one RCT treatment, farmer groups were invited to apply for production loans bundled with an index insurance contract that, in the event of a drought, indemnifies farmers directly (micro-insured loans). In the second treatment, farmer groups were invited to apply for production loans bundled with an index insurance contract that, in the event of a drought, indemnifies the lender on the condition that the indemnity be used to retire the farmer's debt obligation (meso-insured loans). Farmer groups in the control category were invited to apply for uninsured loans. We find that insured loans increase farmers' likelihood of receiving credit by between 15 and 21 percentage points, for micro-insured loans and meso-insured loans

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								respectively. Exploring the mechanisms of this effect, we find no impact on the likelihood that farmers apply for credit but do find an increase in the likelihood of loan approvals of between 17 and 25 percentage points.
65. Mishra, K., Gallenstein, R.A., Sam, A.G., Miranda, M.J., Toledo, P., and Mulangu, F.	2023	Sub-Saharan Africa	RCT	index insurance and agricultural loans	Drought	maize	social & economic transformation	The analysis of the impact of micro-insurance indicates a significant increase in the likelihood of using compound fertiliser, with an increase of 7.8 percentage points, translating to approximately a 9 percent rise relative to the control group's baseline average. However, the micro-insurance bundle also resulted in an 8.9 percentage point decrease in the likelihood of using broad-spectrum herbicides, representing a 19.5 percent decline. Despite these changes, there were no statistically significant impacts on the adoption of straight fertiliser, selective herbicide, or hybrid seeds, nor did meso-insurance show any effect on adoption.
66. Mishra, A.K., and Cooper, J.C.	2017	North America	Free cash flow modelling	Multiple	Multi-peril	Multiple crops	financial resilience; food security; premium subsidies	Decoupled payments positively impact expenditures by about $5 to $14 annually for each $1,000 increase, mainly supporting savings and smoothing income during low-income years. Coupled payments also have a positive effect, increasing spending by approximately $3 annually per $1,000 increase, as they are tied to production decisions and contribute to farm income stability. Both payment types provide modest financial support for farm households.
67. Möhring, N., Dalhaus, T., Enjolras, G., and Finger, R.	2020	Europe	Regression analysis	crop insurance (unspecified)	multi-peril	multiple crops	social & economic transformation; cost-effectiveness	At the extensive margin (land use effects), insurance is positively related to cropland expansion. At the intensive margin (pestice use per hectare), we find that insurance is related to increases in pesticide expenses per hectare in France, while we find no significant association in Switzerland.
68. Noritomo Y., and Takahashi, K.	2020	Sub-Saharan Africa	Randomised experiment	index-based livestock insurance	mortality	livestock	financial resilience	The study found that receiving payouts from Index-Based Livestock Insurance (IBLI) in Kenya helped pastoralist households maintain their herd sizes after a drought, reducing the need to sell or slaughter livestock by 2 percent compared to the comparison group.
69. O'Donoghue, E.J., Roberts, M.J., and Key, N.	2009	North America	Regression analysis	Indemnity insurance (agri)	Multi-peril	Multiple crops	social & economic transformation	We find that the insurance subsidies caused a modest increase in enterprise specialisation and production efficiency. Estimated efficiency gains are far less than the subsidies. For larger farms, crop insurance subsidies translate into an estimated annual increase in net income of about $12.4 million.
70. Patt, A., Suarez, P., and Hess, U.	2010	Sub-Saharan Africa	Experimental design	not specified	Rainfall	crops (not specified)		Our results suggest a generally poor understanding of basic insurance concepts, and are consistent with past results in suggesting that better understanding correlates with greater willingness to purchase it. Our results also suggest that role-playing games may be an important tool for improving understanding, but that they do not necessarily out-perform more conventional training practices.
71. Porrini, D., Fusco, G., and Miglietta, P.P.	2019	Europe	Regression analysis	Indemnity insurance (agri)	Multi-peril	Multiple crops	social & economic transformation; food security	The analysis evaluates how the reimbursed value issued by insurance companies in favor of agricultural firms, as recovery from natural adversities, affects farmers' profitability. A 1 percent increase in insurance

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								reimbursement results in a 0.3 percent decrease in Gross Farm Income, indicating inadequate coverage of total losses. Additionally, insurance reimbursement positively influences Total Intermediate Consumption, highlighting its importance in managing operational expenses.
72. Ramirez Ritchie, E.	2015	Latin America & Caribbean	Regression discontinuity analysis	WII	Drought/ Rainfall	Maize	food security; (gender) inequality; social & economic transformation; financial resilience	The effect of insurance, particularly in the context of the CADENA program's weather index insurance, is twofold. First, it provides direct financial support through payments when adverse weather conditions, such as droughts, occur, which helps farmers smooth their consumption and secure necessary resources for subsequent planting seasons. This direct effect is evident in the observed increase in the area of insured crops sown, as farmers who receive payments are more likely to expand their cultivation. Secondly, the insurance can have indirect effects by reducing risk, thus enabling farmers to make more ambitious investment decisions, including the adoption of riskier yet potentially more profitable agricultural practices. The evaluation shows that while insurance payments significantly increase the log hectares of maize sowed, they also positively impact economic outcomes like income and expenditures per capita in rural communities, particularly for municipalities where a higher percentage of agricultural land is farmed by eligible producers. However, these economic benefits seem to vary with the proportion of land farmed by eligible producers, indicating that the impact of insurance may be greater in areas with higher eligibility. Overall, while the insurance payments enhance agricultural investment and economic well-being, the nuances in their effects highlight the need for further analysis to understand the underlying mechanisms fully.
73. Sibiko K.W., and Qaim, M.	2020	Sub-Saharan Africa	Regression analysis	WII	Drought	maize	social & economic transformation	WII uptake increases the amount of fertiliser used by 51 percent. Similarly, WII uptake increases investment in maize seeds by 65 percent. WII uptake increases maize yields by about 62 percent.
74. Singh, P., and Agrawal, G.	2019	Global	Literature review	WII	Different products for different hazards	Different products for different crops	climate adaptation; financial resilience; premium subsidies; food security	Efficacy of WII is significantly influenced by the impacts of climate change. Low adoption of WII products among farmers is a major challenge for insurers. Adverse weather conditions significantly threaten agricultural productivity, but Weather Index Insurance (WII) offers financial protection to farmers against crop losses due to droughts, floods, or extreme temperatures. Furthermore, well-designed WII products, enhanced by advancements in technology like remote sensing, can effectively reduce yield risks and improve financial stability for farmers. Importantly, WII not only contributes to poverty reduction and food security in rural areas but also addresses climate change impacts, such as increased weather variability, altered growing conditions, and the rise in extreme weather events. WII not only contributes to poverty reduction and food security in rural areas but also addresses climate change impacts, such as increased weather variability,

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								altered growing conditions, and the rise in extreme weather events. These climate change impacts can exacerbate basis risk and challenge the adaptability of WII products. Therefore, WII must evolve to accommodate these changes, ensuring that insurance coverage remains relevant as farmers adapt their practices in response to shifting climatic conditions. The impact of subsidies on Weather Index Insurance (WII) is significant, as heavily subsidised crop insurance is widely adopted in industrialised countries, but for better scale-up of WII in developing nations, a robust legal and regulatory framework is necessary to enhance profitability and scalability while benefiting farmers and the overall WII supply chain.
75. Smith, V.H.	2016	Global - LMIC	Literature review	n.a.	n.a.	n.a.	social & economic transformation; financial resilience; food security; premium subsidies	Insurance significantly enhances risk management for smallholder farmers by providing a safety net against financial shocks from extreme events like droughts and floods. It helps stabilise consumption, maintain food security, and encourages investment in productivity and technology. However, challenges like basis risk—where payouts do not match actual losses—can lead to skepticism and lower adoption rates. Free riding in group schemes can also undermine the value of insurance, discouraging participation. Despite these issues, effective insurance can promote risk management culture, strengthen rural financial markets, and increase resilience among farming households. However, subsidising insurance may introduce inefficiencies and moral hazards, indicating that direct aid or public investments in agricultural infrastructure might be more beneficial alternatives.
76. Stoeffler, Q., Carter, M., Guirkinger, C., and Gelade, W.	2022	Sub-Saharan Africa	RCT	AYII	multi-peril	cotton	social & economic transformation; social & economic transformation	The results of the Intention to Treat (ITT) estimates show that offering crop insurance leads to a reduction in cereal production by 377.7 kg, while the likelihood of cultivating sesame increases by 8 percent. The chance of renting-in land increases by 7 percent. Additionally, infrastructure investment increases by 3.7 thousand CFA. In the Treatment on the Treated (TOT) estimates, cereal production decreases by 464 kg, sesame cultivation rises by 17 percent, and renting-in land rises by 21 percent. Infrastructure investment experiences a substantial increase of 7.8 thousand CFA.
77. Stoeffler Q., and Opuz, G.	2022	Sub-Saharan Africa	RCT	AYII	multi-peril	cotton	premium subsidies	The results suggest that price, subsidy and having played the initiation game are important determinants of the demand for the index insurance product. Farmers seem particularly sensitive to price, with a 1 percent decrease in price generating a 0.6 percentage point increase in the likelihood to purchase the insurance product. Playing the initiation game, on the other hand, increases the likelihood to buy the insurance approximately 28 percentage points. This suggests that playing the initiation game is roughly equivalent to receiving a 50 percent premium subsidy in terms of stimulating demand for the product.

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78. Tadesse, M.A., Shiferaw, B.A., and Erenstein, O.	2015	Sub-Saharan Africa	Literature review	WII	Drought	Multiple crops	social & economic transformation; financial resilience; private sector	Weather index insurance adds financial protection to smallholder farmers by providing timely payouts based on specific weather events, such as insufficient rainfall or extreme temperatures, that correlate with crop losses. It allows farmers to transfer the financial risk of weather-related crop losses to the insurer, enabling them to manage unexpected expenses without depleting savings or taking on debt. Unlike traditional crop insurance, which often requires verification of losses, weather index insurance offers immediate payouts based on measured weather indices, helping farmers recover quickly and maintain cash flow. Knowing they have a safety net can encourage farmers to invest in inputs like seeds and fertilisers, leading to potentially higher yields and better productivity. By stabilising farmers' incomes, this insurance contributes to financial stability, making it easier for them to plan for future seasons and invest in their farms. Successful implementations, like Ethiopia's HARITA project, highlight the importance of integrating insurance with existing safety nets to enhance acceptance and effectiveness.
79. Tang, Y., Yang, Y., Ge, J., and Chen, J.	2019	East Asia & Pacific	Field experiment & DiD model	WII	Multi-peril	crops (not specified)	private sector	The adoption of improved seeds increased significantly among farmers in the treatment group after the introduction of index insurance. Specifically, the adoption ratio rose from 70.35 percent to 81.98 percent in the third round, and from 73.26 percent to 85.47 percent in the fourth round. In contrast, the control group saw a more modest increase in adoption, rising from 76.74 percent to 80.81 percent over the same period. Overall, the treatment group experienced a much larger increase in the adoption of improved seeds compared to the control group.
80. Tong, Q., Swallow, B., Zhang, L., and Zhang, J.	2019	East Asia & Pacific	Stochastic frontier analysis	Indemnity insurance (agri)	Multi-peril	Rice	social & economic transformation	The study finds that conventional crop insurance does not significantly improve farmers' technical efficiency (TE) in rice production, possibly due to moral hazard issues. It suggests that risk-averse farmers might engage in inefficient practices when insured.
81. Van Asseldonk, M., Onumah, G., and Lensink, R.	2022	Sub-Saharan Africa	Natural field experiment	credit-linked insurance bundle	Drought	maize	social & economic transformation; private sector	The attribution of credit-linked insurance highlights that smallholders who lost access to the insurance bundle significantly reduced their fertiliser purchases by 36 percent. This restriction on input usage led to diminished harvests, resulting in a 27 percent decrease in yield and a 31 percent reduction in the quantity sold. The findings underscore the critical role of credit-linked insurance in enabling smallholders to invest in essential inputs, thereby enhancing their agricultural productivity and market participation.
82. Vyas, S., Dalhaus, T., Kropff, M., Aggarwal, P., and Meuwissen, M.	2021	Global	Literature review	agricultural insurance (unspecified)	multiple	Multiple		Insurance research is focused on high-income countries while crops are the dominating agricultural product insured (33 percent of the papers). Large producers in production systems like fruits and vegetables (South America), millets (Africa) and fisheries and aquaculture (South-east Asia) are not focused upon in the literature. Research on crop insurance is taking place where historical extreme weather disasters are frequent (correlation

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								coefficient of 0.75), while we find a surprisingly low correlation between climate change induced temperature increases in the future and current research on crop insurance, even when sub-setting for papers on the research theme of climate change and insurance (−.04). There is also limited evidence on the role of insurance to scale adaptation and mitigation measures to de-risk farming. Further, we find that the study area of livestock insurance papers is weakly correlated to the occurrence of livestock epidemics in the past (−.06) and highly correlated to the historical drought frequency (.51).
83. Walters, C.G., Shumway, C.R., Chouinard, H.H., and Wandschneider, P.R.	2012	North America	Model simulation + regression analysis	Indemnity insurance (agri)	Multi-peril	n.a.	social & economic transformation; climate adaptation	We find that environmental effects are generally small and as often beneficial as adverse. More importantly, we find that results are specific to local conditions and to particular environmental indicators and may be hidden in aggregate analysis. Participation in crop insurance significantly influences acreage allocations across various crops, with notable impacts observed in regions like North Dakota and Eastern Colorado. Specifically, insurance led to a 4 percent increase in barley acreage in North Dakota and a 4 percent decrease in corn acreage in Eastern Colorado, highlighting both positive and negative effects on farmers' planting decisions. Additionally, the environmental implications of these acreage shifts included increases in nitrogen loss and changes in soil organic carbon, underscoring the complex relationship between crop insurance and agricultural practices.
84. Weber, J.G., Key, N., and O'Donoghue, E.	2016	North America	Regression (DiD?)	Indemnity insurance (agri)	Multi-peril	Multiple	social & economic transformation	10 percent increase in insurance coverage is associated with a 0.11 percentage point increase in the share of acres harvested, a 4.4 percent increase in fertiliser and chemical expenses per acre, and a 3.3 percent rise in the value of production per acre.
85. Wong, H.L., Wei, X., Kahsay, H.B., Gebreegziabher, Z., Gardebroek, C., Osgood, D.E., and Diro, R.	2020	Sub-Saharan Africa	Randomised field experiments	WII	Drought	not specified	social & economic transformation	The insurance-voucher bundle increased land cultivation by 0.26 timad (1 timad = 0.25 ha) and sharecropping by 0.17 timad in the first year but had no impact in the second year. It did not significantly raise seed or fertiliser purchases or increase farm output. Farmers reduced their own labor for sowing by 0.73 days but did not increase substantially casual labor hiring.
86. Woodard, J.D., Sherrick, B.J., and Schnitkey, G.D.	2010	North America	Multi-crop insurance model	MCPI	revenue risk; crop yield risk	Multiple	private sector	The analysis shows that Group Risk Income Protection with Harvest Revenue (GRIP-HR) is much more effective at reducing revenue risk compared to Revenue Assurance with Harvest Price (RA-HP), especially in multicrop scenarios. GRIP-HR provides greater risk reduction across different outcomes, while RA-HP is less effective, particularly when only one crop is insured. Overall, GRIP-HR offers better protection in both single- and multicrop situations, making it a stronger option for managing farm revenue risks.

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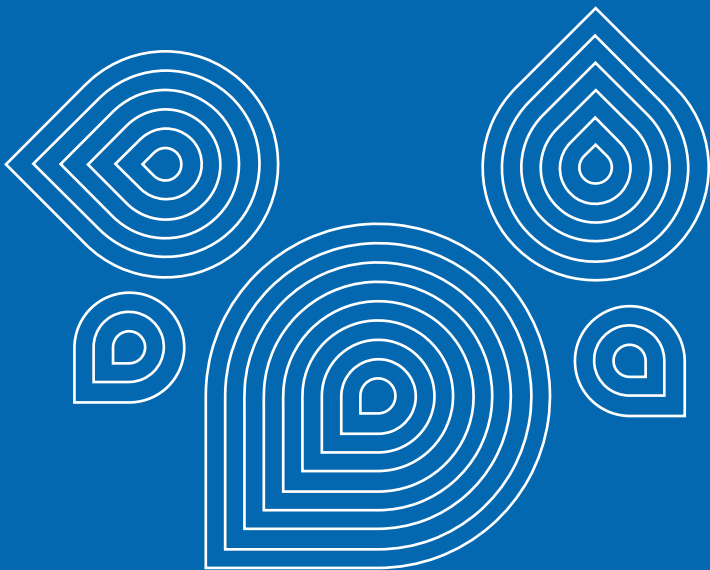
87. Xie, S., Zhang, J., Li, X., Xia, X., and Chen, Z.	2024	East Asia & Pacific	Regression model (OLS), heterogeneity analysis	agricultural insurance (unspecified)	multi-peril (pests, diseases, floods, high temperatures, and hail)	wheat	financial resilience	Each unit increase in farmers' participation in agricultural insurance results in a 10.8 percent increase in household economic resilience.
88. Zentner, R.P., Basnyat, P., Brandt, S.A., Thomas, A.G., Ulrich, D., Campbell, C.A., ... and Fernandez, M.R.	2011	North America	Cost-benefit analysis	Indemnity insurance (agri)	Multi-peril	Grains	social & economic transformation; private sector; financial resilience	Insurance provided financial protection that reduced income variability for risk-averse producers. Organic production systems with all-risk crop insurance were preferred by low and medium risk-averse farmers, enhancing profitability. Additionally, it supported the transition to organic practices by mitigating financial risks during the critical certification period.
89. Zhang, Y., Zhu, X., and Turvey, C. G.	2016	East Asia & Pacific	DiD, PSM	Indemnity insurance (livestock)	mortality	livestock	social & economic transformation; private sector	Farmers who dropped their insurance produced 22.8 percent (DID) or 29.6 percent (PSM) less hogs than those who remained insured, and 25.1 percent (DID) or 17.6 percent (PSM) less than those who were never insured. Insurance had no effect on moral hazard, as the decrease in vaccine use did not lead to higher mortality rates
90. Zhang, Y.H.	2011	East Asia & Pacific	Experiment	Agricultural insurance pool	Multi-peril	not specified	social & economic transformation	Participation in the agricultural insurance program in Zhejiang province increased annual net returns by an average of \$21 ha^{-1}, with increases ranging from \$10 to \$37 ha^{-1} across different treatments.
91. Zhao, L., Shi, J., Kang, X., and Hong, H.	2019	East Asia & Pacific	Fuzzy comprehensive evaluation methods (regression model)	crop insurance (unspecified)	Multi-peril	not specified	social & economic transformation	Crop insurance led to a slight increase in farmers' overall economic status and significantly improved their psychological well-being by enhancing their sense of security and confidence in agricultural production. However, it also resulted in negative environmental impacts due to increased fertiliser use, alongside a reduction in leisure time as farmers focused more on agricultural activities. Thus, while insurance provided financial stability and mental reassurance, it came at the cost of deteriorating environmental conditions and diminished non-economic benefits.
92. Zhao, Y., Chai, Z., Delgado, M.S., and Preckel, P.V.	2016	East Asia & Pacific	DiD, PSM	Indemnity insurance (agri)	Multi-peril	not specified	social & economic transformation	Farmers participating in the crop insurance program experienced an average income increase of 29.1 percent compared to non-participants, which is significant at the 10 percent level.



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