

Dalberg

IDF Evidence Mapping Report

Final Report

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FMO

Entrepreneurial
Development
Bank

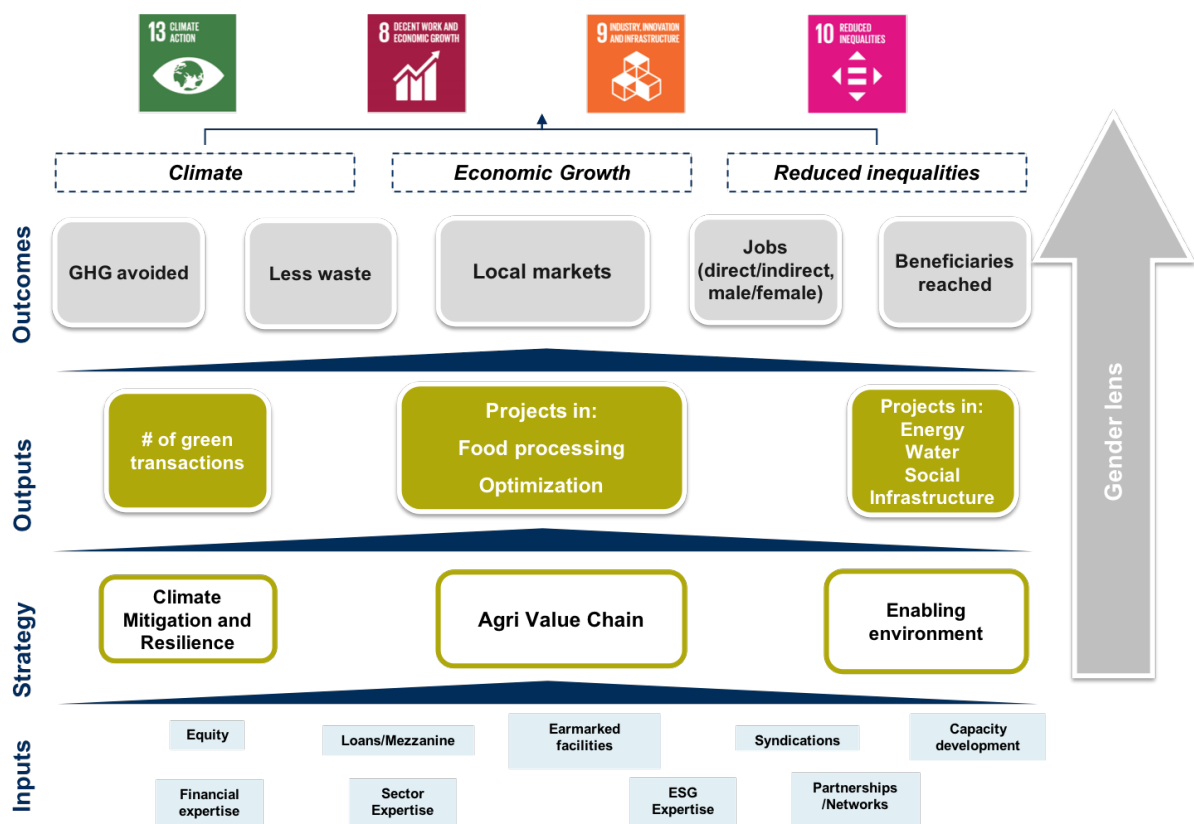
EXECUTIVE SUMMARY

Context

The Infrastructure Development Fund (IDF) was set up in 2002 to meet a lack of finance for high impact infrastructure projects in low-income countries. Recently, the IDF mandate was extended and revised. FMO and the Dutch Ministry for Development and Trade have agreed on a renewal of the investment mandate for another 10 years. The renewal of the mandate involved some modifications in the fund’s strategy and its Theory of Change.

The new Theory of Change (ToC), shown below, has a strong focus on agri-business (incl. forestry) and supporting infrastructure, since investments in this sector have high potential to spur inclusive private sector development.

Exhibit 1: IDF Theory of Change



FMO is also adopting a more targeted approach to evaluations. A key goal is to identify the gaps where IDF’s impact evaluations can contribute to the body of knowledge and identify other methods that can be used in areas where there is more evidence. Through this process, FMO also intends to contribute to the learning of the fund. An evidence map can identify which of IDF’s ToC linkages require further testing and which are already proven. It will also uncover the conditionalities that need to be met to reach that impact.

The detailed objectives of this report include:

- **Reviewing existing evidence** to identify which of IDF's most important ToC linkages require further testing and which are already proven, and under what conditions
- **Mapping the key gaps** where impact evaluations can support the IDF ToC's validation
- **Informing FMOs evaluation strategy** for IDF, and possible ToC revisions

We conducted stakeholder interviews and workshops as well as desk research to develop testable hypotheses for key intervention/investment areas¹. This included discussions with the FMO evaluation and investment team, the DDE team in the ministry, and external evaluation experts, as well as a workshop with the fund manager and investment team. This process resulted in the identification of five hypotheses to test, and a mandate to break out gender impact in the evidence mapping exercise. Based on the anticipated investment trends of the fund and impact goals, we prioritized intervention and impact areas. We also developed detailed research questions to test each of these hypotheses. For each of the hypotheses, we disaggregated evidence by gender (where available) to ensure that we capture this dimension as well. The hypotheses are:








1. **Increased producer participation in value chains (agricultural value chain strengthening²):** Investments in specific parts of the agricultural value chain lead to increased farmer participation in agricultural value chains.
2. **Access to energy infrastructure:** Access to energy infrastructure leads to increased farmer participation in agricultural value chains
3. **Private sector development:** Agricultural value chain strengthening leads to private sector development in the country leading to macroeconomic improvements and food security
4. **Reduced inequalities:** Targeted investments in specific agricultural value chains (e.g horticulture) or specific parts of the agricultural value chain (e.g. storage) lead to reduced inequalities
5. **Climate change mitigation and resilience:** Sustainable agricultural methods, reduced waste and forest conservation/restoration lead to climate change and resilience

Reader guidance/legend: For each hypothesis, we scanned the literature to understand both the *strength of evidence* (how much, and what quality of evidence is available) and the *direction* of the evidence (supportive of the hypothesis, in contradiction or mixed/uncertain). We summarized the evidence using symbols – these are explained in the exhibit below.

¹ This scope of this mapping extends to the agribusiness interventions in the IDF ToC. For impact of energy interventions, please refer to the AEF evidence map/its summary in the Annex.

² Approaches/interventions that attempt to improve the linkages between different parts of the agricultural value chain. These could be horizontal linkages (linkages between actors that sit at the same level of the agricultural value chain e.g.: producers) or vertical linkages (linkages between upstream/downstream value chain actors). In this evidence mapping, strengthening linkages refers primarily to the linkages between producers and the rest of the agricultural value chain. Metrics like increased farmer incomes, better access to output markets (through higher volumes, quality, or price), higher input usage are treated as indications of improved producer participation in value chains.

Exhibit 2: Legend for summary of findings

Direction of evidence	Strength of evidence
 Positive	 High
 Slightly positive	 Medium
 Mixed	
 Negative	 Low

Synthesis of findings

Hypothesis 1: Producer participation in value chains / agricultural value chain strengthening.

Investments in last mile input distribution, storage facilities and technologies, agri-processing, integrated production, and forest production increase farmer participation in the agricultural value chain indirectly, through increased incomes, and improved market access.

- There is substantial evidence that **investment in last mile input distribution** (especially of hybrid seeds and fertilizers) increases yields. However, this does not necessarily translate into higher income/profits for farmers unless the marginal cost of the input outweighs the marginal revenue gains from the yield increase.
- **Storage technology** (metal silos, cold storage, etc.) reduce on-farm post-harvest losses. The state of complementary infrastructure has an impact on post-harvest losses – investments in paved roads, railroads, and reliable electricity alongside storage infrastructure minimize post-harvest losses. Access to storage technology also helps farmers capture higher value, improving their market participation and visibility in the value chain. Subsidies, credit, and technology demonstrations increase storage adoption.
- For **investment in agri-processing**, there is strong evidence indicating that such investments result in the expansion of exports of higher-value products, and that they create jobs at the macro level, although these jobs may have varied quality.
- There is overall little evidence studying the impact of **investments in integrated production** (investments in companies with close connections to production and other parts of the agricultural value chain) on improving linkages for producers across other parts. However, among indicators studied, evidence indicates that higher access by farmers to inputs, markets, and higher yields.
- Finally, **forest production** (logging, collection and processing of shea nuts, etc.) can have a positive employment and income benefits to communities dependent on forests. However, some imply that the quality was low, or benefits did not reach poor, forest-dependent communities. Financial sustainability of interventions was an issue, indicating that follow-on impact was not possible.

Exhibit 3: Producer participation in value chains / value chain strengthening: Summary of findings

S. No	Summary of findings	Direction of evidence	Strength of evidence
1a	Investment in last mile input distribution can increase yields, with training and simultaneous adoption of multiple inputs. Income impact depends on cost structures. Impact on smallholder resource efficiency is not well researched.	↑	»»
1b	Investment in storage can reduce post-harvest losses and improve value capture for farmers. Impact increases with access to credit and extension, and supporting infrastructure.	↑	»»»
1c	Investments in agri-processing results in macroeconomic benefits, e.g.: expansion of exports and jobs. Firm level impacts are not as well researched.	↑	»»
1d	Investments in integrated production benefit farmers through access to inputs, increased yields, and better access to markets. Training, credit and contract enforceability are important. Higher yields are only beneficial if input costs are outweighed by receipts.	↑	»
1e	Forest production could have a positive impact on job creation. Mechanisms need to be put in place to ensure that benefits reach the local communities (e.g. community control). Financial sustainability also needs to be ensured. Impact on downstream activities is not as well researched.	→	»»

Hypothesis 2: Access to energy infrastructure

The findings indicate that investments in energy infrastructure have a high potential to increase farmer participation in value chains if the financial sustainability of off-grid infrastructure, such as mini-grids, is ensured, e.g. through grant support from donor and government agencies and flexible payment models for smallholder farmers.

- There is strong evidence that shows that access to energy infrastructure, particularly **mini-grids**, can boost agricultural productivity and rural incomes in diverse geographies, such as SSA and India. Given that reliable power supply is a pre-condition for a number of other interventions, access to energy enables farmers and rural businesses to increase their yields and reduce energy costs, leading to higher incomes.
- **Biomass captive power plants** can lead to increased farmer participation in value chains by improving supporting activities, such as irrigation and primary processing facilities, such as mills – however, this is not well researched.

Exhibit 4: Energy infrastructure: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
2a	Investments in access to energy, particularly mini-grids, lead increased farmer participation in value chains, but the financial sustainability of mini-grids is uncertain without donor support	↑	»»»
2b	Although there is little research, existing evidence indicates that dedicated-biomass captive power plants lead to increased farmer participation in value chains by stimulating rural development and boosting incomes	↑	»

Hypothesis 3: Private sector development

This hypothesis studies whether investments in value chain strengthening result in private sector development (indicated by stronger local markets), and its subsequent impact on growth and food security. Overall, investments in value chain strengthening leads to improved private sector development through increased productivity among small farmers and increased input and output market access. This then contributes positively to growth, job creation, and food security. However, the causal link between agricultural value chain strengthening investments and private sector development/local market development is not explored to its full potential as existing research does not focus on impact on than agribusinesses.

- Substantial evidence shows that **strengthening the agricultural value chain** by improving the horizontal and vertical linkages between actors in the agricultural value chain increases market access for farmers, especially for inputs. To maximize the impact of agricultural value chain strengthening on private sector development and on the economy, farmers need to be provided with the necessary training and lower volatility (e.g.: fixed price guarantees) where possible.
- At the **macro level**, strong evidence suggests that agribusinesses contribute to GDP growth. DFI investments in agriculture and agribusiness in lower income countries have contributed to increased GDP and have a higher impact on GDP growth than investments in manufacturing. Agribusiness output is also granger causal with GDP. Strong evidence also contributes to higher producer household income. Economic diversification effects are unobserved at the macrolevel.
- Strong evidence indicates that private sector development through value chain strengthening in agriculture generates **direct and indirect employment (equivalent to or more than other sectors e.g.: manufacturing)**, although the extent of contribution to each at the macro level is unclear in developing countries where manufacturing and agribusiness and processing jobs are not disaggregated. In some cases, these jobs are potentially low value added.
- There is strong evidence that investments in strengthening the agricultural value chain have positive impacts on **food security**, at the household level and directional evidence of its positive impact at the national level, by increasing food availability, farmer incomes, and reducing on farm post-harvest losses and food supply variability.

Exhibit 5: Private Sector Development: Summary of findings









S.N	Summary of findings	Direction of evidence	Strength of evidence
3a	Agricultural value chain strengthening improves output and input market access for farmers, potentially contributing to steadier volumes for buyers, and expanded consumer bases for input dealers. Impact on other private sector development indicators are not well researched.	↑	➤
3b	Private sector development through agricultural value chain strengthening improves economic wellbeing at the household/community level and at the macroeconomic level. Economic diversification requires further research.	↑	➤➤
3c	Private sector development through agricultural value chain strengthening in agriculture generate direct and indirect jobs (and these can exceed jobs generated by other manufacturing), but the extent of each type is unclear, and some of these jobs may be poor quality.	↑	➤➤➤
3d	Private sector development through agricultural value chain strengthening in agriculture leads to food security through increase food availability, increased yields, improved food supply variability, and reduced wastage.	↑	➤➤➤

Hypothesis 4: Reduced inequalities

Overall, investing in the agriculture sector can boost incomes, create jobs, and lead to self-sufficiency. However, investments in strengthening agricultural value chains without sensitivity towards historically disadvantaged communities could exacerbate inequality. Targeted investments in specific agricultural value chains (e.g.: horticulture) or parts of the agricultural value chain (e.g.: production and storage) have a high potential to reduce inequalities. Women specific investments have the potential to increase yields and productivity.

- **Stronger value chains** overall, where **linkages between producers, and vertical integration** exist have the potential to boost incomes, for e.g.: farmer ownership in the processing factories through KTDA, earns them 75% of the tea price, compared to 40% in Rwanda. However, the existence of stronger value chains alone does not diminish inequalities, as pre-existing inequalities can widen where already vulnerable communities are not specifically targeted during the intervention. For instance, women's lack of mobility, access to capital and land, etc. result in their concentration in lower remuneration jobs in the value chain (closer to production), and therefore strengthening efforts require to account for this to reduce inequalities. Without a targeted effort, women are likely to remain invisible.
- There is a strong link between **investments in specific agricultural value chains (e.g.: horticulture) or specific parts of the agricultural value chain (e.g.: storage)** and reduced inequalities; however, the specific agricultural value chains with high impact will vary by country.
- Existing studies show that **gender-specific agricultural value chain investments** can improve women farmers' yields and productivity by 10-80% for different crops and, by extension, increase income.
- Evidence to shows that investments in the agricultural value chain can lead to **macro-economic improvements (contribution to GDP and jobs)** relative to investments in other manufacturing activities and services.

Exhibit 6: Inequality: Summary of findings









S.N	Summary of findings	Direction of evidence	Strength of evidence
4a	Increased farmer participation in value chains can lead to reduced income inequalities. To reduce gender-based inequalities, gender sensitive interventions are important, as without them, pre-existing inequalities could exacerbate.		
4b	Targeted investments in specific agricultural value chains (e.g.: horticulture) or specific parts of the agricultural value chain (e.g.: storage, processing) lead to reduced inequalities but the agricultural value chains with high impact will vary by country.		
4c	Investments that focus on women can improve yields relative to cases that concentrate resources in the hands of men.		
4d	Investments in the agricultural value chain can lead to macro-economic improvement, particularly in rural areas, and can create more jobs and spur more GDP growth relative to other manufacturing activities.		

Hypothesis 5: Climate change mitigation and resilience

Sustainable agricultural methods (organic farming, no-till agriculture, agro-forestry, investments in yield improvements) have a high potential for climate change mitigation and resilience (GHG avoidance), but the benefits of adopting these methods need to outweigh the costs for it to result in increased income for farmers and agribusinesses.

- There is substantial evidence showing that investments in sustainable agricultural methods lead to **mitigation of adverse climate change effects** through organic farming, yield improvement and agro-forestry. These results are improved in the presence of wider technology usage, adoption of adaptive management practices, access to insurance and credit, and extension services. Forest conservation investments mitigate adverse climate effects in isolation, but must be accompanied by structural changes to disincentivize deforestation in order to have a net impact and catch up to the scale of deforestation.
- There is a substantial evidence that investments in sustainable agricultural methods and forestry can improve **climate resilience**.
- There is substantial evidence that **climate vulnerability** tends to be more concentrated at the production end of agricultural value chains. Overall, investments in some parts of the agricultural value chain such as storage in particular across all value chains will lead to climate resilience.
- Lastly, while **lower post-harvest losses** could result in increased income for farmers due to the extra revenue earned from higher sales, the cost of incorporating post-harvesting practices that result in lower post-harvest loss can exceed the benefits of reduced post-harvest losses for small-scale farmers in SSA.

Exhibit 7: Climate change: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
5a	Investments in sustainable agricultural methods and forest conservation lead to lower GHG emissions and less environmental degradation. Financial and technical support aids adoption of these practices. Forest conservation needs to be accompanied by disincentives for deforestation in order to have a <i>net</i> positive effect on climate change mitigation.		
5b	Investments in sustainable agricultural methods and forest conservation results in less vulnerability to shocks through the use of resilient inputs. Results depend on geography and technology.		
5c	Investments in specific parts of an agricultural value chain (especially closer to production) lead to more climate resilience, however, this varies by crop. Building awareness is important.		
5d	Lower post-harvest losses could result in increased income (and thus climate resilience) due to the extra revenue earned from higher sales. However, the cost of incorporating post-harvesting practices that result in lower post-harvest loss can exceed the benefits of reduced post-harvest losses.		

Recommendations

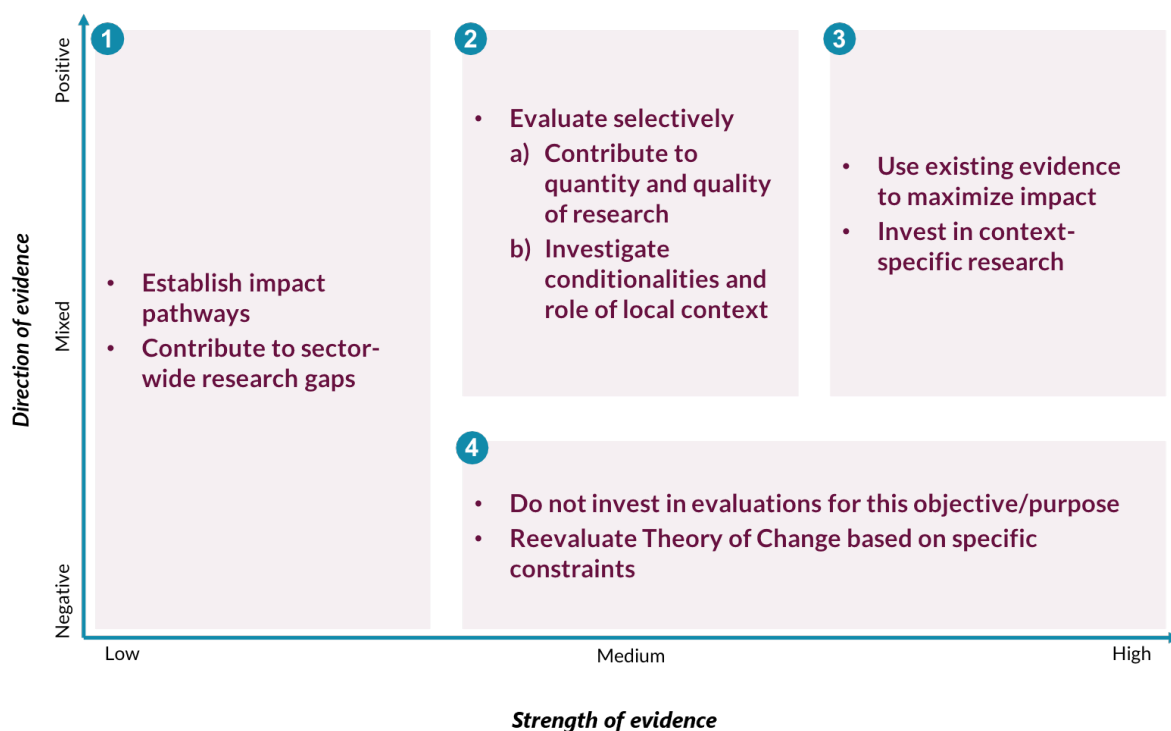
The recommendations have been developed building on the learnings of the evidence gap mapping and FMOs evaluation process. FMO can consider three main uses of the results of the evidence map.

1. **Evaluation planning:** Understanding the evidence landscape can help the evaluation team identify evaluation and research projects. It is also helpful in assessing which research methods to apply.
2. **Refining the Theory of Change:** The evidence map can help in refining and iterating the Theory of Change, especially in terms of better understanding impact pathways and articulating conditionalities.
3. **Augmenting impact:** The evidence map can also support FMO in maximizing impact by a) helping investment teams better analyse and explain the impact potential of investees and b) helping to identify opportunities where technical assistance or a coordinated investment can augment the impact of an investee.

To map the results of the evidence mapping with the above 3 pathways for FMO, we have used a framework as highlighted below

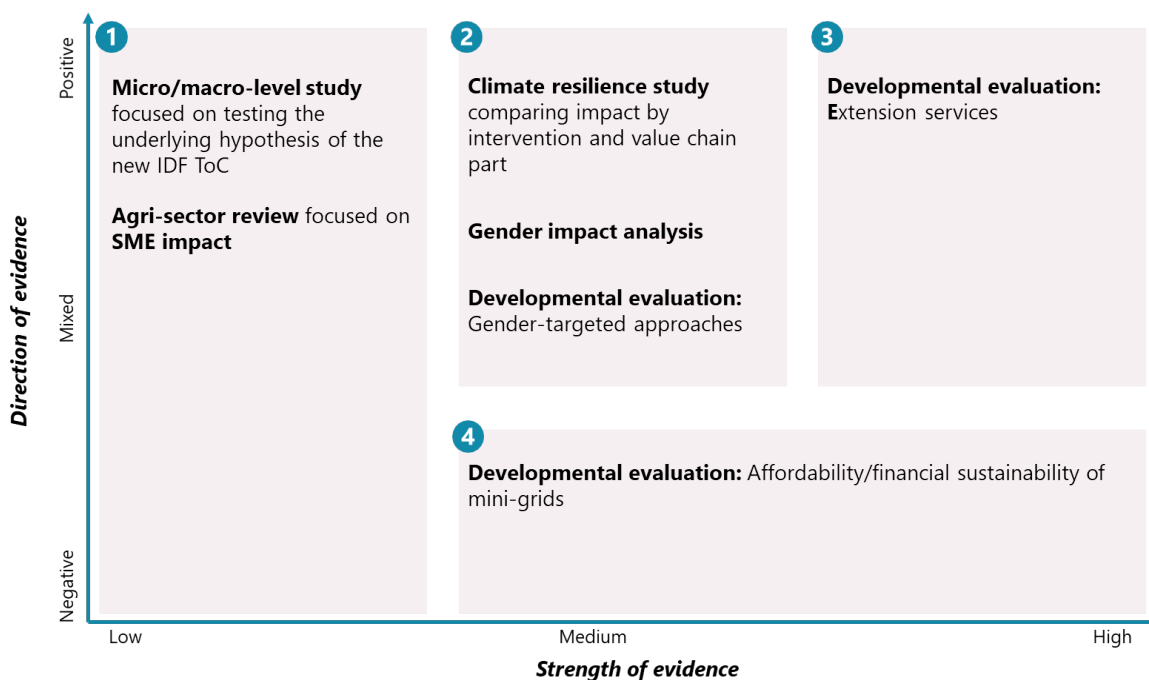
The results of the evidence mapping exercise can be used to determine what to evaluate, why to evaluate it and how to evaluate it. Given the need to use evaluations to support the underlying assumptions in the IDF ToC, we have identified four categories of evidence which can be used to guide the evaluation choice. The objectives of future research for each of these categories are highlighted in the diagram below:

Exhibit 8: Framework to evaluate evidence



The framework shown in Exhibit 8 was used to understand the areas for further evaluation, what evaluation methods can be used, and what the implications for impact monitoring are. Exhibit 9 highlights for key areas, how the evidence maps to the framework.³

Exhibit 9: Priority evaluations mapped to evidence framework



³ For a more detailed mapping of the findings and recommendations to their respective categories, please see the Recommendations section of the report.

Ideally, this will be a living document that is updated regularly. The gaps in the evidence map can become focal areas for the evaluation team. In Exhibit 10, we provide both a suggestion for evaluation or research studies that can address evidence gaps, and recommendations for impact monitoring.

Exhibit 10: Recommendations for evaluation and monitoring

Theme	Evaluation suggestion	Cross-cutting focus	Impact monitoring implications
Underlying hypothesis: Agri-investments lead to relatively more equitable growth	<ul style="list-style-type: none"> • Micro/macro study using results of an impact evaluation of an investee focused on SME impact, jobs and inequality – combined with secondary data and research across several IDF target countries focused on impact of agri investments on SME entry and growth, rural GDP, jobs, GINI, gender, etc. compared to non-agri manufacturing and services 	<ul style="list-style-type: none"> • Evaluate gender outcomes and impact • Evaluate impact of agri-value chain investments on agri-SMEs and equitable growth • Geographical focus: SSA 	
Agri-sector review	<ul style="list-style-type: none"> • Agri-sector review including: <ul style="list-style-type: none"> ○ SME impact (and farmer impact where possible) ○ Gender impact ○ Availability, role, and impact of supporting infrastructure (where possible) • Secondary literature summary with country specific impact of investments in specific value chains/value chain parts 	<ul style="list-style-type: none"> • Evaluate gender outcomes and impact • Evaluate impact of agri-value chain investments on agri-SMEs • Geographical focus: SSA 	<ul style="list-style-type: none"> • Monitor gender impact / outcomes • Track cost-effectiveness of new technology adoption for farmers (where possible)
Gender	<ul style="list-style-type: none"> • Cross-case analysis of gender impact (partner DFI data, if provided, can be used to broaden the case pool) • Build comparable case studies that seek to identify successful gender-targeted solutions, enabling conditions for gender impact (e.g., women’s land ownership, presence of women’s cooperatives, access to finance, etc.), and risk factors • Developmental evaluation with an agricultural value chain investee to develop and refine gender-targeted approaches 	<ul style="list-style-type: none"> • Evaluate gender outcomes and impact • Include impact on agri-SMEs (incl. women-led SMEs) 	<ul style="list-style-type: none"> • Monitor gender outcomes across all IDF (or all agri/forestry) investees (crucial because agricultural value chain investments could lead to negative gender outcomes)
Climate resilience	<ul style="list-style-type: none"> • Cross-case analysis of climate resilience impact (with a broad range of interventions and agricultural value chain stages; partner DFI data, if provided, can be used to broaden the case pool) • Build comparable case studies that seek to identify the differential climate resilience impact of specific interventions (e.g. organic farming, agro-forestry, sustainable yield improvement) and agricultural value chain stages, as well as key enablers and constraints 	<ul style="list-style-type: none"> • Include gender impact • Geographical focus: SSA 	<ul style="list-style-type: none"> • Tag climate <i>resilience</i> impact and monitor climate <i>resilience</i> outcomes • Disaggregate data by gender

Based on the above analysis, the specific recommendation pathways for FMO are as follows:

1. Plan evaluations

Evaluation and monitoring priorities

Across all the interventions examined in this evidence mapping, **gender impact and the need to support technology adoption through extension services and cost-effective solutions for farmers** are key to achieving impact for IDF's investments and their financial success. They should be included in all studies undertaken by the evaluation team. Gender is particularly important because modern value chains can have a negative gender impact. Extension services need not be delivered by FMO or the investee, but their availability and effectiveness should be considered as a key factor driving impact.

We also found inadequate evidence on the **impact of agriculture value chain interventions on agri-SMEs** (including upstream and downstream SMEs). Therefore, this should be a priority for future studies.

The **underlying hypothesis of the new IDF Theory of Change** – that investments in the agri-value chain lead to stronger local markets and equitable growth – would be strengthened by more targeted research. A deeper understanding both the micro-level impact pathways and the macro-level comparison with investments in other manufacturing and services in terms of both growth and inequality would be helpful.

2. Refine Theory of Change

Internally reframe ToC elements

FMO can build on the evidence map to refine the ToC once the IDF portfolio has shifted to reflect the new strategy. FMO can share the findings on impact pathways and conditionalities with the fund management and investment teams. The teams can then build on these findings and emerging investment trends to identify key interventions, and to more clearly map pathways from inputs, to outputs, outcomes, and impact.

Once the team has gained more experience, a ToC workshop would be helpful. This will help to consolidate and visualize the conditionalities that have emerged from the evidence mapping exercise as well as insights from the ToC refinement process. The main conditionalities identified through the evidence mapping are presented below in Exhibit 11.

3. Augment impact

The evidence map can also support FMO in maximizing impact by a) helping investment teams better analyse and explain the impact potential of investees and b) helping to identify opportunities where technical assistance or a coordinated investment can augment the impact of an investee.

Support investment teams to achieve impact

The IDF investment team can use results of the evidence mapping exercise to outline and clearly communicate the impact pathway for their investments. Investment teams can use the results during the contracting process to document the kind of impact the investment would be expected to achieve as well as conditionalities that may apply to the investment. For example, for a storage-related investment, investment teams can highlight the contribution of storage technology to reduced post-harvest losses and increased value capture. If additional conditionalities are met, these can be described as improving impact (e.g. existence of reliable power supply).

Exhibit 11: Conditionalities to include in the Theory of Change

Hypothesis	Conditionality	Why?
1. Farmer participation / value chain strengthening	Storage: complementary infrastructure is needed to achieve impact	The state of complementary infrastructure- investments in paved roads, railroads and reliable electricity- has an impact on post-harvest losses.
2. Infrastructure	Support for financial sustainability of mini-grids (e.g., grants and flexible payment models)	Mini-grid operators struggle to be financially sustainable: they typically rely on grant support. Flexible payment models, such as pay-as-you-go, contribute to better financial sustainability, but further support is needed. Achieving financial sustainability of mini-grids can lead to long-term positive effects such as higher rural and agriculture incomes.
3. Private sector development	Increased access to mechanization and markets; enabling infrastructure	Increasing yields depends on providing farmers access to mechanization; maximizing waste reduction depends on providing farmers access to markets and developing enabling infrastructure.
4. Inequality	Training and market linkages	Ecosystem investments such as training and market linkages are essential to enable farmers take advantage of the agricultural value chain investments.
5. Climate	Training and incentives to adopt sustainable agricultural practices	Farmers need to adopt environmental-friendly agricultural practices in order to have positive climate results. Currently, adopting these practices is not always profitable for farmers without training and/or additional financial incentives.
Gender	Gender lens in investments (this is implicit in the current theory of change)	Evidence shows that gender neutral approaches are ineffective in reducing gender inequalities. Gender-sensitive solutions such as improved access to land, finance, training, business development services and technical support are important tools to improve gender equity.

Support investees in creating impact

FMO can have learnings from evaluation or studies feed into what investee companies need to keep track of and aim to improve on. There should be a feedback loop such that evaluations are used to provide recommendations to the investee companies. E.g., developmental or learning evaluations can be used to help mini-grid investees improve business models to achieve affordability and financial sustainability.

FMO can support investees by favourably changing conditions. FMO (and partners or the investee itself) can find ways to improve conditionalities for the investee. For instance, given that extension activities underpin developmental impact for IDF investments, FMO can help investee companies by providing technical assistance where necessary. Given the problems of achieving financial sustainability for mini-grids, FMO can help investees access grant funding and/or innovate to increase affordability. Also, given the need for institutional support, e.g., in creating enabling environments for agribusiness growth, FMO can engage the regulatory authorities and institutions to provide a favourable operating environment.

Share learnings with partners and the broader sector

FMO can share learnings from the evidence mapping exercise to inform the ministry's thinking on the ToC. Key insights on the impact pathways can be shared with the ministry as well as plans for the incorporation of the key conditionalities into the theory of change.

Particularly, the ministry can be updated on the conditionalities surrounding the new focus on agribusiness investments, and the cross-cutting conditions of infrastructure and extension.

FMO can share learnings with other funders operating within the sector. This will contribute to collaboration across funders and can be used as an opportunity to become industry leaders in various sectors. FMO can partner with other DFIs on evaluations in order to research evidence gaps and potentially also to fix ecosystem issues that are key success factors for interventions. FMO can take evidence sharing a step further by creating a platform that synthesizes the evidence map results which other funders can review and update with evidence collected.

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1. INTRODUCTION

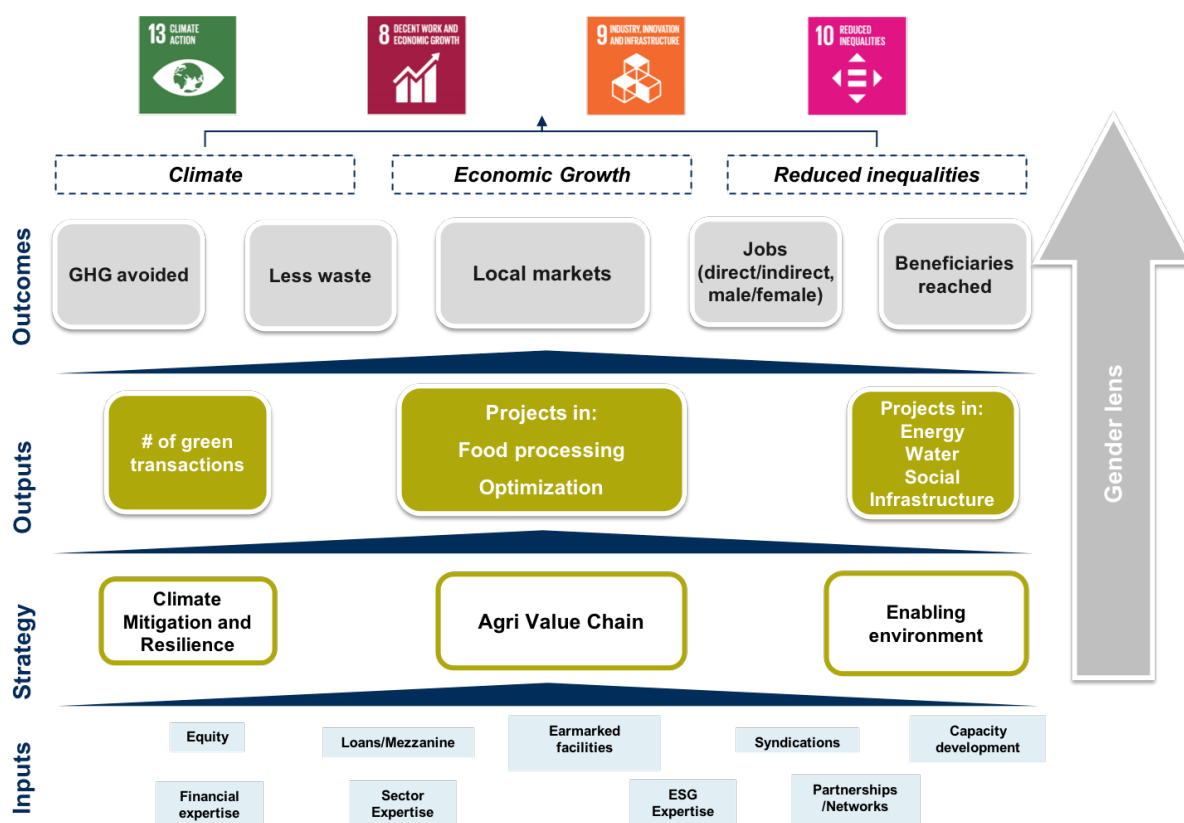
Project context

The Infrastructure Development Fund (IDF) was set up in 2002 to meet a lack of finance for high impact infrastructure projects in low-income countries. With an initial focus restricted to seven low income countries (six African countries, and Bangladesh), its mandate eventually expanded to include over thirty low- and middle-income countries spread across Sub-Saharan Africa and South Asia and later to 70 countries in Sub-Saharan Africa, South Asia, Latin America, Eastern Europe and Central Asia and Middle East and North Africa. The IDF portfolio primarily supported infrastructure projects in energy, telecom, and agribusiness through the provision of loans, equity, mezzanine funding, and grants. IDF is funded by the Dutch Government and managed by FMO with oversight from the Sustainable Economic Development Department (DDE). IDF, through its offer of high-risk capital and catalyzation of further funding for infrastructure projects in developing countries, seeks to spur private sector economic activity and drive environmentally sustainable socio-economic development in these countries.

Recently, the IDF mandate was extended and revised. FMO and the Dutch Ministry for Development and Trade have agreed on a renewal of the investment mandate for another 10 years. The renewal of the mandate involves some modifications in the fund's strategy and its Theory of Change.

The new Theory of Change (ToC) has a strong focus on agri-business (incl. forestry) and supporting infrastructure, since investments in this sector have high potential to spur inclusive private sector development. IDF's sectoral scope has been refocused to increasingly cover agriculture and agribusinesses, with some projects in energy, water and social infrastructure as enabling factors to private sector development. The overall IDF impact priorities include climate change and mitigation, reduced wastage, and gender inclusiveness in addition to the core goal of private sector-led socio-economic development. Investments along the agricultural value chain and forestry are intended to strengthen local markets, based on the understanding that this form of private sector development is especially likely to directly and indirectly benefit the poorest populations in developing countries. Investments will specifically target gaps within local value chains. Sustainable agri-business and forestry investments also have a positive climate outcome. Below is the new theory of change:

Exhibit 12: IDF Theory of Change



The IDF theory of change gives a simple visualization of how investment of IDF funds can lead to the desired outputs, sector outcomes and country impacts. The overall impact goals are centred around four Sustainable Development Goals (SDGs), namely SDG13-climate action, SDG8-decent jobs, SDG9-industry innovation and infrastructure and SDG10-reduced inequalities. SDG 2 (zero hunger) is a goal for FMO in the context of agri-investments, even though it is not explicitly mentioned in the theory of change or part of the direct mandate of IDF.

Meanwhile, FMO is adopting a more targeted approach to evaluations. Evaluations for the fund currently follow different approaches: impact evaluations, *ex-post* effectiveness studies, thematic studies and market or systematic reviews. Projects are currently chosen based on thematic relevance, how representative the project is for the fund, strategic topics, feasibility and availability of funding, with a significant portion of funding going towards rigorous, multi-year impact evaluations. FMO would like to rebalance its evaluation strategy towards providing more timely learnings for both investment teams and investees. In the future, FMO seeks to be more selective when choosing an investment for an impact evaluation. Evidence maps can help identify methods that are appropriate to the amount of evidence that already exists for a given impact pathway. Deep impact evaluations will focus on areas where the expected impact of an intervention is not clearly established through prior research. Interventions where the in-principle impact is well-documented (by FMO and others) can be evaluated through faster and/or lighter-touch methods.

Consequently, FMO sought to conduct a robust review on the state of evidence supporting IDF's theory of change in order to adapt the evaluation strategy, further refine the fund's Theory of Change, and be informed of conditions for impact. The evidence map helps to highlight which outcomes and impact goals need to be further researched by the evaluation

team and the priority of those gaps. It shows which impact mechanisms are well-supported; investments into related interventions can be assumed to be achieving impact in principle and can therefore be evaluated through methods that assess implementation, process learnings, etc. Gaps in the evidence map will highlight areas where impact has not yet been (sufficiently) established; these areas would be potential research areas for deeper, rigorous impact evaluations, which would help to establish IDF's impact and contribute to the broader sector's knowledge base. The evidence mapping exercise may also surface evidence that contradicts or qualifies current assumptions underlying IDF's theory of change; this evidence may be used to refine the ToC in the future. Finally, where there is impact, the mapping exercise will reveal critical conditions that are to be met to reach this impact, or conditions that can maximize pre-existing impact.

Goals of the project

The overarching goal of this engagement is to review evidence to identify which of IDF's ToC linkages require further testing and which are already proven, so as to inform FMO's evaluation strategy for the fund and possible revisions of the ToC. Dalberg conducted an evidence mapping exercise and is providing recommendations for the evaluation strategy and possible refinements of the ToC. Within the scope of this project, Dalberg did not develop a new theory of change or make investment recommendations. The evidence map can also be used by other teams within FMO, e.g. by investment teams to explain the impact rationale of their projects.

The detailed objectives include:

- **Reviewing existing evidence** to identify which of IDF's most important ToC linkages require further testing and which are already proven, and under what conditions
- **Mapping the key gaps** where impact evaluations can support the validation of IDF's ToC
- **Informing FMO's evaluation strategy** for IDF, and possible revisions of the ToC

Within the scope of this project, we examined businesses in the agricultural value chain including forestry. We also include renewable energy in its role as an industry that supports the agricultural value chain and rural development. IDF also invests in other infrastructure sectors: water and social infrastructure. These were not included in this evidence mapping project.

Methodology and hypotheses tested

Before mapping the evidence, we created hypotheses to test against existing evidence. To achieve this, we reviewed existing materials and engaged stakeholders and experts.⁴ This approach is outlined in the IDF inception report in detail. We sought to understand top priority areas for private sector development and agriculture and to gather the initial views and perspectives of the stakeholders. This involved reviewing IDF documents and agriculture reports as well as discussions with the FMO evaluation, fund management and investment teams; the DDE team; and external evaluation and sector experts. We then held a workshop with the investment team to understand anticipated investment trends, validate hypotheses, and map key priorities.

We identified five hypotheses to test and a mandate to break out gender impact in the evidence mapping exercise. Based on the impact goals and the anticipated investment trends of the fund, we identified specific interventions and impact pathways as the basis for our hypotheses. Hypotheses 1, 2, 4, and 5 chart the pathway of specific interventions/potential

⁴ This approach is outlined in the annex in detail.

investments, while hypotheses 3 moves higher up the ToC to study the linkage between the outcomes of private sector development and strong local markets and impacts of economic growth, decent work, and food security.

The hypotheses are:

1. Investments in specific parts of the agricultural value chain lead to increased producer participation in value chains (agricultural value chain strengthening)
2. Access to energy infrastructure leads to increased producer participation in value chains (agricultural value chain strengthening)
3. Investments in Agricultural Value Chain strengthening lead to private sector development (indicated by stronger local markets) in the country leading to macroeconomic improvements and food security
4. Targeted investments in specific agricultural value chains or specific parts of the agricultural value chain lead to reduced inequalities
5. Sustainable agricultural methods, reduced waste and forest conservation/restoration lead to climate change mitigation and resilience

For each hypothesis, we developed detailed research questions. We also decided to disaggregate gender impact in the available evidence, since the gender impact pathway in IDF's ToC is not yet well understood, and for agri investments, FMO is still refining its gender impact strategy, and studying its implementation.

Following this, we reviewed studies for relevance and quality; we extracted the results from these studies and synthesized them to determine impact. While identifying studies, our focus was on finding evidence of impact of the intervention itself (e.g.: the impact of storage technology accessible to farmers on post-harvest losses), and conditions required to reach that impact. The studies reviewed include a mix of pilot interventions deployed purely for research, donor funded initiatives, DFI projects, and private sector led initiatives. To cover a wide evidence base, we also reviewed sector reports and reviews that aggregated evidence across studies (e.g.: World Bank reports on the Agribusiness sector in Africa).

We developed a visualization map showing the impact pathway of the hypotheses. This map includes input components such as forestry and storage as well as impact-level components such as climate action and food security. This map will be used as a basis for charting the path for each hypothesis.

Exhibit 13: Visualization of the mapping of hypotheses⁵



Overview of the report structure

The rest of this document consists of:

- Evidence mapping results: This summarizes the results of the evidence mapping exercise for all the hypotheses tested
- Recommendations: This concludes the report and provides recommendations for FMO and IDF
- Annex: This includes the methodology, detailed findings, a summary of findings from the IDF evidence mapping report, and bibliography of sources

⁵ The boxes for water and social infrastructure are coloured grey because they are part of IDF’s Theory of Change, but are outside the scope of this evidence mapping report.








2. EVIDENCE MAPPING RESULTS

This section consolidates the evidence on the five hypotheses. Details on the methodology for gathering evidence are included in Annex C: Methodology.

The legend in Exhibit 14 below is provided to help readers navigate this section.

- **Direction of evidence** – Was the observed effect in line with the hypothesis?
- **Strength of evidence** – Was there adequate quantity and quality of evidence available across hypotheses?

Exhibit 14: Legend for reading evidence mapping results

Direction of evidence	Strength of evidence
 Positive	 High
 Slightly positive	 Medium
 Mixed	
 Negative	 Low

Hypothesis 1: Investments in specific parts of the agricultural value chain lead to increased producer participation in value chains (agricultural value chain strengthening)

Research questions

The research questions explored to test this hypothesis are:

- 1a Does investment in last-mile input distribution lead to increased producer participation in value chains?
- 1b Does investment in storage facilities in close proximity to farmers lead to increased producer participation in value chains?
- 1c Does investing in agri-processing companies lead to increased producer participation in value chains?
- 1d Does investment in integrated production lead to increased producer participation in value chains?
- 1e Does increased forest production lead to increased producer participation in value chains?

We screened 50 studies, of which 38 were included;⁶ the geographical coverage is Sub-Saharan Africa, South Asia, and Central Asia and Eastern Europe.

⁶ Included studies were treated as relevant to evaluating the research questions. Each paper was coded for relevance on the basis of geographical focus of the study, population studied, intervention conducted/phenomenon studied, and the extent to which research questions matched. Refer Annex C for more detail on the methodology.

Definitions

- **Integrated production:** This includes investments in companies that operate across the agricultural value chain (storage, processing and marketing) with close links to production, and seek to expand agriculture production within the agricultural value chain. This could also include companies that have close horizontal connections in the agricultural value chain.
- **Agricultural Value Chain (AVC) strengthening:** Approaches/interventions that attempt to improve farmers' connections to the agricultural value chain by strengthening the linkages between different parts of the agricultural value chain. These could be horizontal linkages (linkages between actors that sit at the same level of the agricultural value chain e.g.: producers) or vertical linkages (linkages between upstream/downstream value chain actors). In this evidence mapping, strengthening linkages refers primarily to the linkages between producers and the rest of the agricultural value chain. Metrics like increased farmer incomes, better access to output markets (through higher volumes, quality, or price), higher input usage are treated as indications of improved producer participation in value chains.

Overall summary

Overall, the evidence indicates that investments in last mile input distribution, storage facilities and technologies, agri-processing, integrated agricultural value chains, and forest production can increase farmer participation in value chains if supporting conditions are met.⁷

1a- Does investment in last-mile input distribution lead to increased producer participation in value chains?

- **Findings:** Substantial evidence suggests that investment in last mile input distribution (especially of hybrid seeds and fertilizers) increases yields. However, there is moderate evidence indicating that this increase in yield does not necessarily translate into higher income/profits for farmers unless the marginal cost of the input outweighs the marginal revenue gains from the yield increase.
- **Conditionalities:** To realize this potential, inputs usually need to be adopted simultaneously as a package of inputs, rather than individual inputs (e.g.: traditional seeds are less likely to respond to chemical fertilizer application). Additionally, training on the usage of these inputs has to be tailored to the local context of the farmers.
- **Evidence gaps:** The impact of last mile input distribution on resource efficiency and cost savings for farmers as a result is not as well documented, with existing evidence more focused on the impact on yields.

1b- Does investment in storage facilities in close proximity to farmers lead to increased producer participation in value chains?

- **Findings:** There is strong evidence that storage facilities and technology that are accessible to farmers can reduce on-farm post-harvest losses. Access to storage technology (e.g.: provision of hermetic bags on credit with grain as collateral, provision of metal silos as part of a national programme, design and provision of Group Savings and Reinvestment Accounts (GSRA) that made it easier to store maize) also allows flexibility in sale timing to leverage arbitrage opportunities, allowing farmers access higher incomes during lean seasons.

⁷ We screened 50 studies, of which 38 were included; the geographical coverage is Sub-Saharan Africa, South Asia. Of the 38 included studies, 32 are medium-quality and 6 are high-quality studies.

- Conditionalities: The state of complementary infrastructure has an impact on post-harvest losses – investments in paved roads, railroads, and reliable electricity are necessary alongside storage infrastructure investments to minimize post-harvest losses. Arbitrage opportunities are more likely to be capitalized upon when storage interventions are tied to access to credit interventions that ease farmers’ liquidity constraints. The purchase and usage of storage technology increases with extension services⁸ on processing and storage methods, and subsidies tied to the storage technology.
- Evidence gaps: The existing evidence on the impact of storage is more farmer focused. While the theoretical pathway towards increasing firm productivity through investing in storage infrastructure exists, this has not been deeply explored and documented. There is also little evidence on how the proximity of storage impacts the usage of storage by farmers and their cost savings.

1c- Does investing in agri-processing companies lead to increased producer participation in value chains?

- Findings: Evidence strongly indicates that improving the productivity of agri-processing, and expanding processing result in the production (and expansion of exports) of often higher value processed products, or of output of higher value. For instance, a study indicates that a 10 percent increase in productivity in processing of agricultural goods across Sub Saharan Africa would expand its export of processed agriculture by 30.3 percent; its exports for bulk and horticulture goods would decrease slightly. A more productive agri-processing sector also contributes positively to job creation, and can create more jobs than other manufacturing sectors for unit value added (Watanabe 2009). At the firm level, investments in processing technology and capacity expansion, and the provision of technical assistance have encouraged firms to improve processes and to produce higher quality products (e.g.: fortified foods).
- Conditionalities: Capacity utilization in processing requires reliable power and a steady supply of raw material and labour. Job creation is conditional on the use of labour augmenting technology rather than labour replacing technology.
- Evidence gaps: While wider, economy-wide impacts of improvement in productivity in agri-processing are relatively well documented, the impact of investments on agri-processing firms on economic outcomes at the firm and community level is less studied – e.g., whether an investment in a large processing firm acts as a pathway to stimulating small businesses in the region linked to this firm, or whether investing in a processing firm leads to the firm upgrading its machinery and capacity which then increases its profits, thus having effects across the agricultural value chain, is less known.

1d- Does investment in integrated production lead to increased producer participation in value chains?

- Findings: There is some evidence that investments in integrated production benefit farmers by giving them access to inputs, driving up their yields, and allowing them to better access the market, therefore improving their participation in the value chain, and bringing them closer to other value chain actors.
- Conditionalities: Training and extension services as well as access to credit maximize the establishment of these linkages. Given that contract farming represents a significant portion

⁸ Agricultural extension refers to the application of scientific research and knowledge to agricultural practices through farmer education. Generally, agricultural extension can be defined as the “delivery of information inputs to farmers” [source: Agriculture for Impact].

of agricultural value chain integration, strong regulatory mechanisms to enforce contracts will ensure that both buyers and farmers meet contractual obligations. Higher yields are only beneficial if input costs are outweighed by receipts.

- **Evidence gaps:** The pathway to increased farmer participation in value chains through investments in integrated production is the least researched pathway. Of the existing evidence, the direct impact on farmers is more researched, whereas the impact on linkages between farmers and the rest of the value chain often has to be inferred (e.g.: higher incomes signify more integrated producers). Increase in total food production, access to finance, and the impact of integrated production on competitiveness are also unexplored.

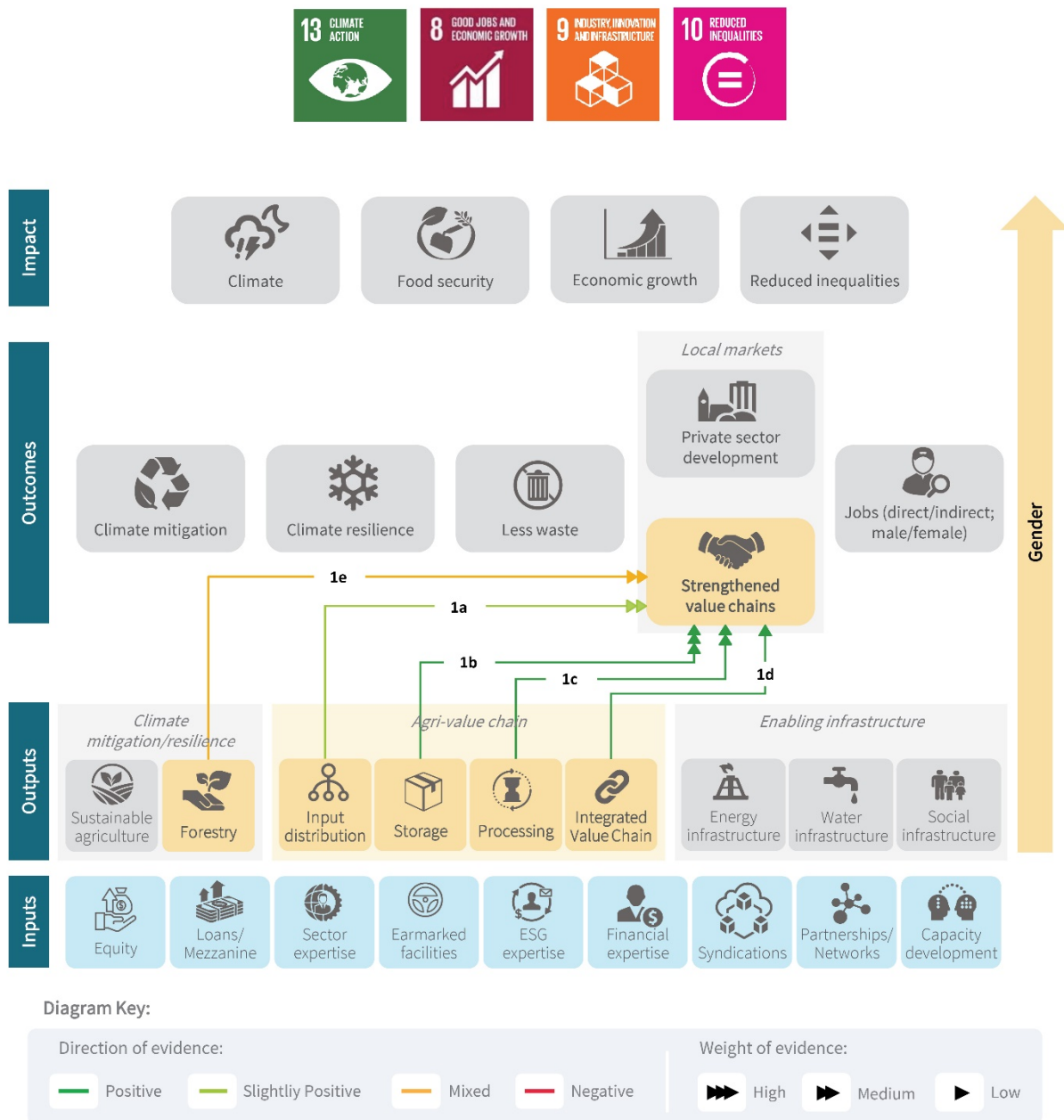
1e- Does increased forest production lead to increased producer participation in value chains?

- **Findings:** Forest production has a positive impact on employment overall, but the extent varies. In developing countries, growth of jobs in the forestry sector has approximately kept pace with the growth of employment. While most evidence indicates benefits to communities dependent on forests in terms of employment, in some cases the number of jobs was small, working conditions were poor, or the benefits went to the wealthy. One study called out that the forest enterprise was likely to bring in immigrant labour, and therefore had a lower impact on forest dependent communities themselves. Most evidence also speaks to the ability of these initiatives to alleviate poverty if they are run sustainably, but in Kenya, 21% of the Community Forest Associations could not meet their expenses for forest management interventions.
- **Conditionalities:** While the employment effect is positive, for this effect to be felt most deeply within local communities themselves, preconditions like community control and ownership and/or strong local institutions are required. It is also important to ensure the financial sustainability of the initiative so it can impact poverty and job creation positively.
- **Evidence gaps:** Whether forestry drives local demand for wood products is currently unexplored, but it is unclear whether this is owing to a gap in research, or because there is a different causal direction (i.e. demand for wood products drives production).

Exhibit 15: Producer participation / value chain strengthening: Summary of findings

S. No	Summary of findings	Direction of evidence	Strength of evidence
1a	Investment in last mile input distribution can increase yields, with training and simultaneous adoption of multiple inputs. Income impact depends on cost structures. Impact on smallholder resource efficiency is not well researched.	↑	»
1b	Investment in storage can reduce post-harvest losses and improve value capture for farmers. Impact increases with access to credit and extension, and supporting infrastructure.	↑	»»
1c	Investments in agri-processing results in macroeconomic benefits, e.g.: expansion of exports and jobs. Firm level impacts are not as well researched.	↑	»
1d	Investments in integrated production benefit farmers through access to inputs, increased yields, and better access to markets. Training, credit and contract enforceability are important. Higher yields are only beneficial if input costs are outweighed by receipts.	↑	»
1e	Forest production could have a positive impact on job creation. Mechanisms need to be put in place to ensure that benefits reach the local communities (e.g. community control). Financial sustainability also needs to be ensured. Impact on downstream activities is not as well researched.	→	»

Exhibit 16: Producer participation / value chain strengthening: Visualization of findings



Hypothesis 2: Access to energy infrastructure leads to increased producer participation in agricultural value chains (agricultural value chain strengthening)

Research questions:

The research questions explored to test this hypothesis are:

- 2e Does access to energy, particularly mini-grids, lead increased producer participation in agricultural value chains?
- 2b Do dedicated biomass captive power plants lead to increased producer participation in agricultural value chains?

We studied access to renewable energy in detail for the evidence mapping report for AEF. The findings from that report are partially relevant to IDF as well. They are summarized in Annex B and more detail is available in the full AEF report.

For the purposes of the IDF evidence map, we screened 34 studies, of which 11 were included⁹; the geographical coverage is SSA and South Asia (India).

Overall summary

Overall, the findings indicate that investments in energy infrastructure have a high potential to strengthen agricultural value chains if the financial sustainability of off-grid infrastructure, such as mini-grids, is ensured, e.g. through grant support from donor and government agencies, and flexible payment models for smallholder farmers.¹⁰

2a - Does access to energy, particularly mini-grids, lead to increased producer participation in agricultural value chains?

- **Findings:** There is strong evidence to show that access to energy infrastructure, particularly mini-grids, can boost agricultural productivity and rural incomes in diverse geographies, such as SSA and India. Given that reliable power supply is a pre-condition for a number of other interventions, access to energy enables farmers and rural businesses to increase their yields and reduce energy costs leading to higher incomes
- **Conditionalities:** For access to energy infrastructure, particularly mini-grids, to be financially sustainable in off-grid areas, grant support from donor agencies, flexible payment models such as pay-as-you-go, and community engagement are essential factors.
- **Evidence gaps:** There is an evidence gap in the ability of mini-grids to support higher loads in modern agricultural value chains. The existing evidence demonstrates that primary agricultural activities, such as refrigeration and basic processing can be supported by mini-grids, but it is unclear whether off-grid energy solutions can support higher loads. There is also a gap in the evidence on the impact of access to energy on agricultural SME's, since the existing evidence focuses on the economic benefits to farmers. Therefore, future research should examine the impact of access to energy on the outcomes of agricultural SMEs.

While the existing evidence demonstrates that grant support from donors or government agencies is essential to cover the upfront investment costs of mini-grids, there are limited up-to-date studies on the financial sustainability of solar mini-grids. Future research should

⁹ Included studies were treated as relevant to evaluating the research questions. Each paper was coded for relevance on the basis of geographical focus of the study, population studied, intervention conducted/phenomenon studied, and the extent to which research questions matched. Refer Annex C for more detail on the methodology.

¹⁰ We screened 34 studies, of which 11 were included; the geographical coverage is Sub-Saharan Africa, South Asia. Of the 11 included studies, 4 are low-quality, 5 are medium-quality and 2 are high-quality studies

examine the financial viability of solar-powered mini-grids, given falling technology costs and increasing adoption.

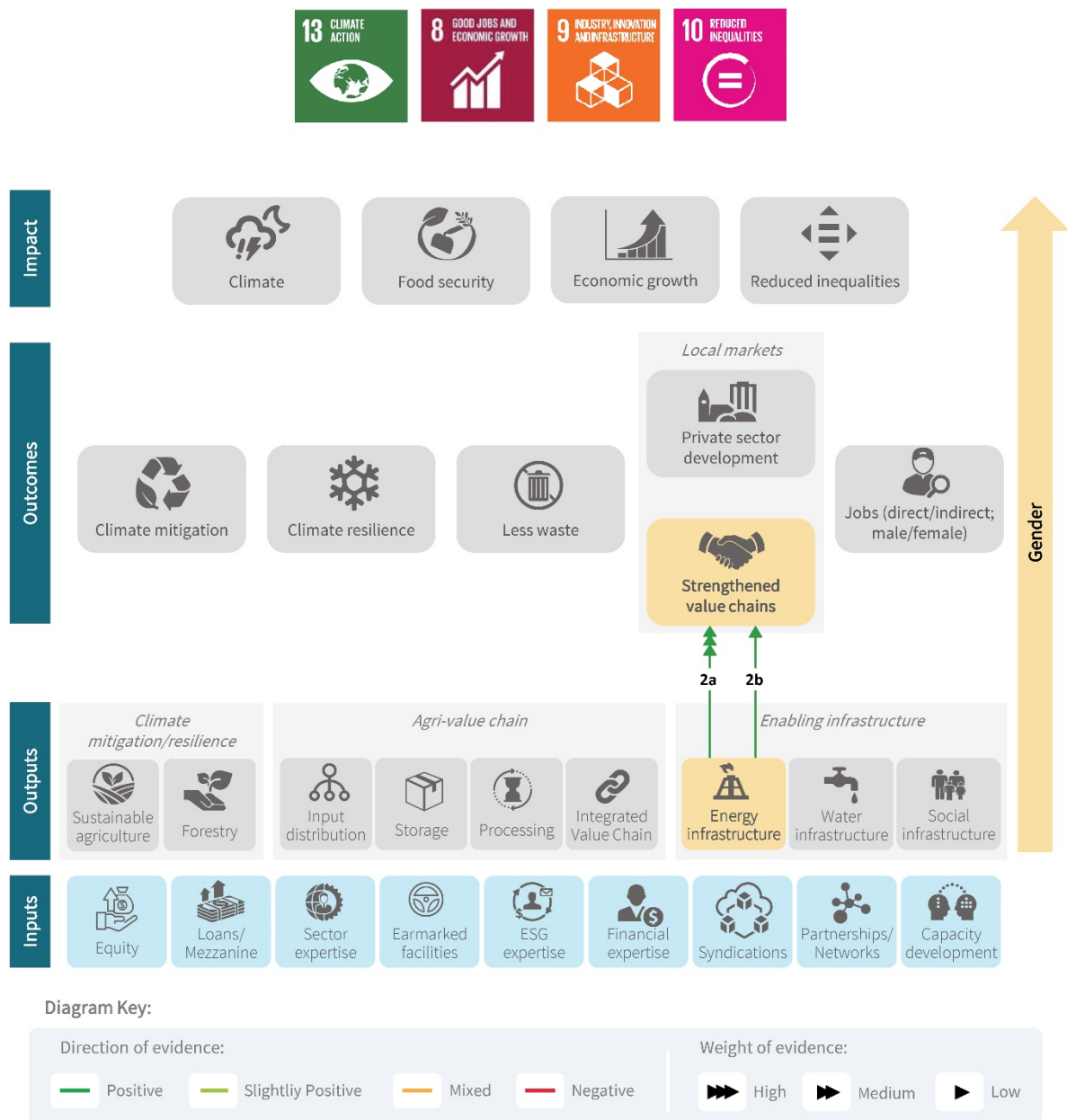
2b - Do dedicated biomass captive power plants lead to increased producer participation in agricultural value chains?

- **Findings:** There is limited evidence that biomass captive power plants can lead to increased farmer participation in value chains by improving supporting activities, such as irrigation and primary processing facilities, such as mills.
- **Conditionalities:** For captive biomass power plants to be effective in rural areas, there needs to be a stable supply of fuel sources, such as agricultural residues. Additionally, government subsidies and donor funding to cover developer costs are essential factors in ensuring the financial sustainability and adoption of biomass plants.
- **Evidence gaps:** There is an evidence gap on the impact of captive biomass powered mini-grids on rural development and SMEs. The existing evidence focuses on the socio-economic impact of shifting from subsistence to biomass crops for smallholder farmers. In terms of geographic coverage, there is limited evidence on the impact of captive biomass mini-grids in SSA, with the existing evidence focusing mainly on India. The evidence demonstrates that rice husks have been viable fuel source for biomass plants in India. There is also anecdotal evidence that electricity from sugarcane bagasse in Brazil and India provides essential services e.g. cooking, lighting, heating, water pumping, transport, industrial uses, etc.. However there is limited evidence in other geographical areas, such as SSA. Future research must focus on alternative crop residues that can power captive biomass plants in SSA.

Exhibit 17: Energy infrastructure: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
2a	Investments in access to energy, particularly mini-grids, lead to increased farmer participation in value chains, but the financial sustainability of mini-grids is uncertain without donor support	↑	»»»
2b	Dedicated-biomass captive power plants lead to increased farmer participation in value chains by stimulating rural development and boosting incomes	↑	»

Exhibit 18: Energy infrastructure: Visualization of findings



Hypothesis 3: Agricultural value chain strengthening leads to private sector development (PSD) in the country leading to macroeconomic improvements and food security

Research Questions:

The research questions explored to test this hypothesis are:

- 3a Does agricultural value chain strengthening lead to private sector development and investments in agriculture, and up-stream/down-stream sectors?
- 3b Does private sector development through agricultural value chain strengthening in agriculture lead to economic growth?
- 3c Does private sector development through agricultural value chain strengthening in agriculture lead to more jobs – direct and indirect?
- 3d Does private sector development through agricultural value chain strengthening in agriculture lead to food security?

We screened 30 studies, 25 were included¹¹; the geographical coverage is Sub-Saharan Africa, South and South East Asia, and Latin America, and the USA.

Definitions

- Agricultural Value Chain (AVC) strengthening: Approaches/interventions that attempt to improve the linkages between different parts of the agricultural value chain. These could be horizontal linkages (linkages between actors that sit at the same level of the agricultural value chain e.g.: producers) or vertical linkages (linkages between upstream/downstream value chain actors). In this evidence mapping, strengthening linkages refers primarily to the linkages between producers and the rest of the agricultural value chain.
- Private Sector Development (PSD): ‘Private Sector Development’ refers to the involvement and expansion of private sector organizations within the agriculture sector. This includes:
 - Increased access to finance (investments, credit)
 - Private Public Partnerships,
 - Increased entry and productivity of agribusinesses and small and medium enterprises (SMEs)
 - Increased market activity and market access for agribusinesses and farmers access markets.

¹¹ Included studies were treated as relevant to evaluating the research questions. Each paper was coded for relevance on the basis of geographical focus of the study, population studied, intervention conducted/phenomenon studied, and the extent to which research questions matched. Refer Annex C for more detail on the methodology.

Overall summary

Agricultural value chain strengthening leads to improved productivity among small farmers and increases their input and output market access. Private sector development (indicated by local market strengthening) in agriculture contributes positively to growth, job creation, and food security. However, the causal link between agricultural value chain strengthening and other private sector development indicators (outside of market access) like the expansion of businesses, an increase in PPPs, etc. remains unexplored. Evidence focuses on impact for farmers rather than agri-businesses.¹²

3a- Does agricultural value chain strengthening lead to private sector development and investments in agriculture, and up-stream/down-stream sectors?

- **Findings:** Substantial evidence shows that strengthening the agricultural value chain by improving the horizontal and vertical linkages between actors in the agricultural value chain increases market access for farmers. The evidence suggests that integrating farmer-producers within the agricultural value chain vertically (by linking them to big buyers) and horizontally (between producers) gives them a willing output market, as well as increasing their participation in input markets. For example, in Tanzania, farmers selling to grocery stores received significantly higher crop prices, illustrating the potential impact of vertical linkage. In addition, vertically linked farmers also had higher input expenditures (indicating a higher adoption of inputs, and for expanded production). Similarly, having horizontal linkages as a farmer was also significantly associated with higher prices and value of input purchased. This indicates higher market activity, and a potential pathway to private sector development in agriculture through expanded markets for input companies, and increased growth for aggregator firms.
- **Conditionalities:** To increase volumes and market access, vertically linked buyers often provide inputs and training to the farmers from whom they aggregate. Investments in management and leadership are important to the functioning of producer cooperatives, which is a form of horizontal integration.
- **Evidence gaps:** This pathway is currently poorly explored except for the impact of agricultural value chain strengthening on market access. The impact of strengthening the agricultural value chain on other private sector development indicators such as improved firm performance, increased entry of new businesses due to backward or induced effects, etc. and the overall business environment, e.g.: increase in firms offering business services because of thriving businesses, is unknown. The differential impacts between strengthening horizontal and vertical linkages are also not explored deeply.

3b- Does private sector development through agricultural value chain strengthening in agriculture lead to economic growth?

- **Findings:** At the macro level, a moderate level of evidence suggests that agribusinesses contribute significantly to GDP. In Sub-Saharan African countries, the share of agribusiness (including logistics and retail) in GDP is typically around 20%; the share of agricultural production is around 24% for low-income countries. An analysis of DFI investments (Massa, 2011) showed that overall, DFI investments induced economic growth in investee countries. In a subsample of lower-income countries, investments in the agriculture and agribusiness, and infrastructure sectors play the most significant role in promoting economic growth,

¹² We screened 30 studies, 25 were included; the geographical coverage is Sub-Saharan Africa, South and South East Asia, Latin America, and the USA. Of the 25, 4 are low quality, 16 are medium quality and 5 are high quality studies.

while investments in industry/manufacturing and infrastructure played a more significant role in higher income countries¹³.

The evidence also directionally indicates that private sector development in agriculture increases investments in the local economy. Strong evidence also indicates that farmer incomes increase. Finally, tentative evidence also indicates that private sector development and local market strengthening through agricultural value chain strengthening also leads to economic diversification at the small scale.

- Conditionalities: Overall, growth requires an enabling environment (trade openness and industrial policy development, FDI inflows) supporting infrastructure, and reliable raw material supply to enable businesses source volumes. Increases in farmer income often go hand in hand with supplying farmers with inputs and training, and credit.
- Evidence gaps: Further studies researching economic diversification caused by private sector development in agriculture are required to establish a stronger evidentiary link between the two.

3c- Does private sector development through agricultural value chain strengthening in agriculture lead to more jobs – direct and indirect?

- Findings: Strong evidence indicates that private sector development and agricultural value chain strengthening in agriculture generates employment, direct as well as indirect, although the extent of contribution to each is unclear. In Thailand, between 1990-2000, the number of poor employees per value added (1000 baht) in the agro-processing industry was 2.9 on average, which exceeded the average of manufacturing industries (2.4). In particular, the average of the labor intensity of the poor in the food industry is 5.2, which is more than double that of the average of the manufacturing industry. The agro-processing industry, particularly the food industry, tends to hire a greater number of the poor than other manufacturing industries. These jobs however may not always be high value.
- Conditionalities: Overall, skilling effort, technology upgradation, efficient input markets, and easier access to land and water complement private sector development efforts in agriculture and maximize their impact.
- Evidence gaps: While private sector development and agricultural value chain strengthening in agriculture has a significant impact on job creation, the disaggregated impact of this development from the contribution of agriculture and manufacturing is not always disaggregated, and the difference between direct and indirect and induced jobs is also not always clear.

3d- Does private sector development through agricultural value chain strengthening in agriculture lead to food security¹⁴?

- Findings: Private sector development and agricultural value chain strengthening in agriculture have positive impacts on food security by increasing food supply and incomes. At the household level, strengthening the agricultural value chain through increasing farmers' access to storage, and organizing farmers to take on value addition (e.g.:

¹³ The lower-income countries group includes both low-income and lower-middle-income countries according to the World Bank's country classification. The higher-income group includes both upper middle-income and high-income countries.

¹⁴ Food security refers to 1) increases in food availability and accessibility (through more yields, lower wastage, and higher income), 2) reduction in food supply variability, and 3) improvement in the quality and diversity of intake. Evidence for increases in food security both at the macrolevel (national and global), and within the household were considered during the mapping.

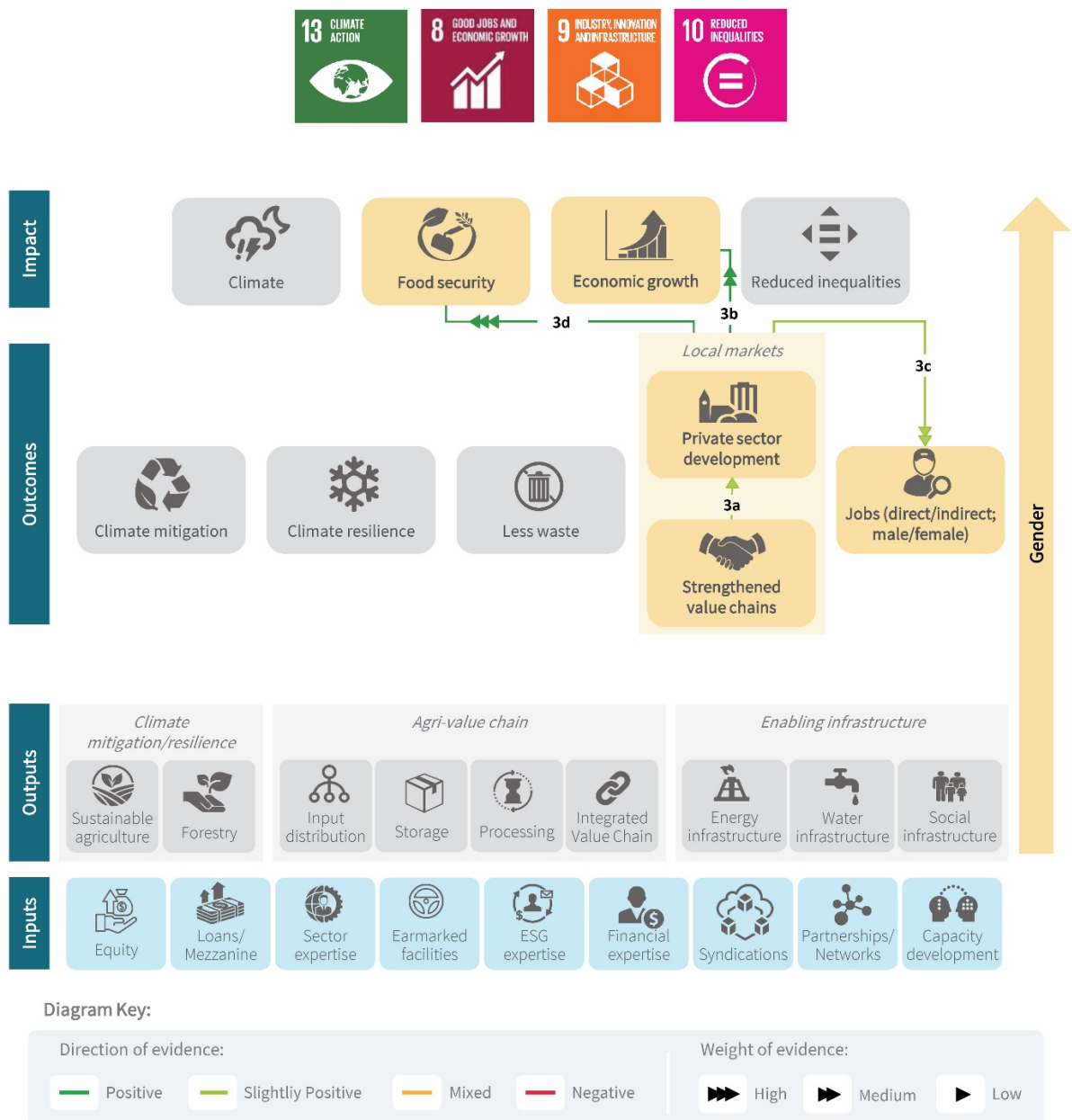
processing) improves their household food security (by increasing the probability of meeting a minimum acceptable diet with dietary diversity and the duration of grain availability respectively). At the national level, there is tentative evidence to show that private sector research and development (R&D) investment has a positive impact on national food security (by contributing to an increase in the yield and therefore availability of food crops), although this evidence is currently anecdotal and specific to India. Globally, the evidence tentatively suggests that private sector R&D has contributed more to reductions in per capita food supply variability than public sector R&D. Farmers linked to large buyers are also able to avoid and reduce their proportion of on-farm crop losses. Increased incomes (observed in 3b) can also potentially impact food security through investments in increased or higher quality food supply by households.

- **Conditionality:** Access to mechanization and modern inputs, and infrastructure and transport investments are important to increasing food yields. Successful growth of private sector R&D requires appropriate regulation and well administered enabling policies (e.g.: rationalization of taxes on agricultural commodities). Physical distance to input and output markets, access to credit, and access to extension services are also important determinants of per capita calorie consumption in the household.
- **Evidence gaps:** The impact of private sector development in agriculture on price stability and higher quality food products needs to be explored further. The impact of the private sector on *national* food availability also requires further research. Additionally, studies do not track whether an increase in income translates into increased expenditure on food. Further investigation is also required to understand the impact of improved local markets on food security.

Exhibit 19: Private Sector Development: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
3a	Agricultural value chain strengthening improves output and input market access for farmers, potentially contributing to steadier volumes for buyers, and expanded consumer bases for input dealers. Impact on other private sector development indicators are not well researched.	↑	➤
3b	Private sector development through agricultural value chain strengthening improves economic wellbeing at the household/community level and at the macroeconomic level. Economic diversification requires further research.	↑	➤➤
3c	Private sector development through agricultural value chain strengthening in agriculture generate direct and indirect jobs (and these can exceed jobs generated by other manufacturing), but the extent of each type is unclear, and some of these jobs may be poor quality.	↑	➤➤➤
3d	Private sector development through agricultural value chain strengthening in agriculture leads to food security through increase food availability, increased yields, improved food supply variability, and reduced wastage.	↑	➤➤➤

Exhibit 20: Private sector development: Visualization of findings



Hypothesis 4: Targeted investments lead to reduced inequalities.

Targeted investments can focus on specific agricultural value chains (e.g., shea butter or horticulture) or specific parts of the agricultural value chain (e.g., storage or processing).

Research questions

The research questions explored to test this hypothesis are:

- 4a Does connecting farmers to value chains (agricultural value chain strengthening) lead to reduced inequalities?
- 4b Do targeted investments (in specific agricultural value chains or specific parts of the agricultural value chain) lead to reduced inequalities?
- 4c Do targeted investments that focus on women (in specific agricultural value chains and parts of the agricultural value chain) have an effect of productivity and profitability for women owned businesses?
- 4e Do investments in the agricultural value chain lead to greater macroeconomic improvements, particularly for the BoP and people in rural areas, than investments in other sectors, such as manufacturing and services?

We screened 54 studies, 30 were included¹⁵; the geographical coverage is Sub-Saharan Africa, Latin America, South Asia, and South-East Asia (Indonesia and Philippines).

Definitions

Income inequality: This covers unequal opportunities and income among farmers (e.g. between smallholders and those with larger farms), within-country income inequality (rural vs urban) and gender inequality. This assumes that the groups would have access to finance and land.

Overall summary

Overall, investing in the agriculture sector can boost incomes, create jobs, and lead to self-sufficiency. Investments in strengthening agri value chains without sensitivity towards historically disadvantaged communities could exacerbate inequality. Investments in specific agricultural value chains (e.g.: horticulture) or parts of the agricultural value chain (e.g.: production and storage) have a high potential to reduce inequalities. Women specific investments have the potential to increase yields and productivity.¹⁶

4a- Does connecting farmers to value chains (agricultural value chain strengthening) lead to reduced inequalities?

- **Findings:** Stronger value chains overall, where linkages between producers, and upward vertical integration exist have the potential to boost incomes, for e.g.: in Kenya, farmers' ownership in the processing factories through KTDA, earns them 75% of the tea price, compared to 40% in Rwanda. However, the existence of stronger value chains alone does not diminish inequalities, as pre-existing inequalities can widen where already vulnerable communities are not specifically targeted during the intervention. For instance, women's lack of mobility, access to capital and land, etc. result in their concentration in lower remunerated jobs in the value chain (closer to production), and therefore value chain

¹⁵ Included studies were treated as relevant to evaluating the research questions. Each paper was coded for relevance on the basis of geographical focus of the study, population studied, intervention conducted/phenomenon studied, and the extent to which research questions matched. Refer Annex C for more detail on the methodology.

¹⁶ We screened 54 studies, 30 were included; the geographical coverage is Sub-Saharan Africa, Latin America, South Asia, and South-East Asia (Indonesia and Philippines). Of the 30, 8 are low-quality studies, 16 are medium-quality studies, and 6 are high-quality studies.

strengthening efforts need to account for this to reduce inequalities. Without a targeted effort, women are likely to remain invisible or fall further behind.

- Conditionalities: For agricultural value chain investments to have maximum impact, ecosystem factors such as access to finance, land tenure security and market information systems are essential. Additionally, gender-smart solutions can promote female entrepreneurship through improved access to land, finance, training, business development services and technical support.
- Evidence gaps: There is an evidence gap on the impact of gender sensitive value chain strengthening on gender inequality. The existing evidence demonstrates that wage disparity and asset ownership between men and women can vary significantly across different value chains. Future research should examine the impact of gender-sensitive agricultural value chain strengthening in reducing these disparities.
There are few studies on the impact of agricultural value chain investments outside of sub-Saharan Africa, particularly in South Asia. Given IDF's broad geographical focus, further research on the impact of agricultural value chain investments in different countries would be valuable. This is particularly relevant to gender outcomes: the current evidence suggests that gender-specific wage disparities can vary significantly in different countries. Therefore, future research should disaggregate outcomes by gender across different geographies.

4b- Do targeted investments (in specific agricultural value chains or specific parts of the agricultural value chain) lead to reduced inequalities?

- Findings: Strong evidence demonstrates that investments in specific agricultural value chains or specific parts of the agricultural value chain can reduce income inequalities; the specific agricultural value chains with high impact vary from country to country. For example, in Senegal, investments in horticulture led to a 4.2% decrease in the Gini coefficient from 2006 to 2013 while it increased by 1.1% in the rest of the country in the same period. As for the specific parts of the value chain, investments at the production end (where women are concentrated), storage, and processing show a positive impact on reducing inequality.
- Conditionalities: In order to impact inequality, agricultural value chain investments need to be complemented by other efforts that alleviate resource constraints through access and control over productive assets and resources such as farm land and improved seedlings.
- Evidence gaps: There are few studies on the impact of agricultural value chain investments outside of sub-Saharan Africa, particularly in South Asia. Given IDF's broad geographical focus, further research is needed on the impact of specific agricultural value chain investments in different countries.
There is anecdotal evidence to indicate that rural market access programs (e.g.: warehouse receipt systems that require a minimum volume as collateral) tend to advantage larger farmers, but this requires further exploration – overall, there is little research on interventions that reduce inequalities between large and small farmers.

4c- Do targeted investments that focus on women (in specific agricultural value chains and parts of the agricultural value chain) have an effect of productivity and profitability for women owned businesses?

- Findings: There is a lot of evidence on the impact of gender-specific agricultural value chain investments on women owned businesses; however, not much of it is rigorously researched. These studies claim that gender-specific agricultural value chain investments can improve yields and productivity between 10-80% for different crops and, by extension, income. For

example, in Kenya a nationwide information campaign targeted at women as part of a national extension project, resulted in the yield of maize increasing by 28%, beans by 80% and potatoes by 84%. In Burkina Faso it is estimated that if women had the same access as men to fertilizer and labour, household agricultural output would increase by between 10 to 20%.

- **Conditionalities:** Improving women’s access to inputs and support services such as land, labour, technology, extension services and credit are crucial to improving productivity and profitability.
- **Evidence gaps:** We found only 2 studies that utilized an experimental design in assessing the impact of agricultural value chain investments on inequality. Most studies are observational, focusing on case studies, and fail to prove causality between agricultural value chain investments and inequality. Many studies on the impact of agricultural value chains on women farmers record observations over a short time period and fail to consider the spill over effects of improved market linkages in the country

4d- Do investments in the agricultural value chain lead to greater macroeconomic improvements, particularly for the BoP and people in rural areas, than investments in other sectors, such as manufacturing and services?

- **Findings:** There are existing studies comparing the impact of investments in agricultural value chains on inequality to investments in other sectors such as manufacturing. The evidence shows that investing in the agri value chain over other manufacturing or service activities can spur more growth (Massa 2011) and job creation (Watanabe 2009).
- **Conditionalities:** Improvements in macroeconomic indicators through agricultural value chain investments, especially in rural areas require the creation of market linkages for subsistence farmers, the provision of extension services and high-quality inputs, and the development of infrastructure such as roads and power supply infrastructure.
- **Evidence Gaps:** There is limited research comparing the impact of agricultural value chain investments and investments in manufacturing/services on reducing inequality. Existing evidence compares, at the global level, GDP contribution. Future research must study this over a longer time horizon. A gap in the study design is the failure of some of the studies to attribute the outcomes to agriculture value chain investments, as these can also be driven by overall economic growth and broader public infrastructure development.

Exhibit 21: Inequality: Summary of findings









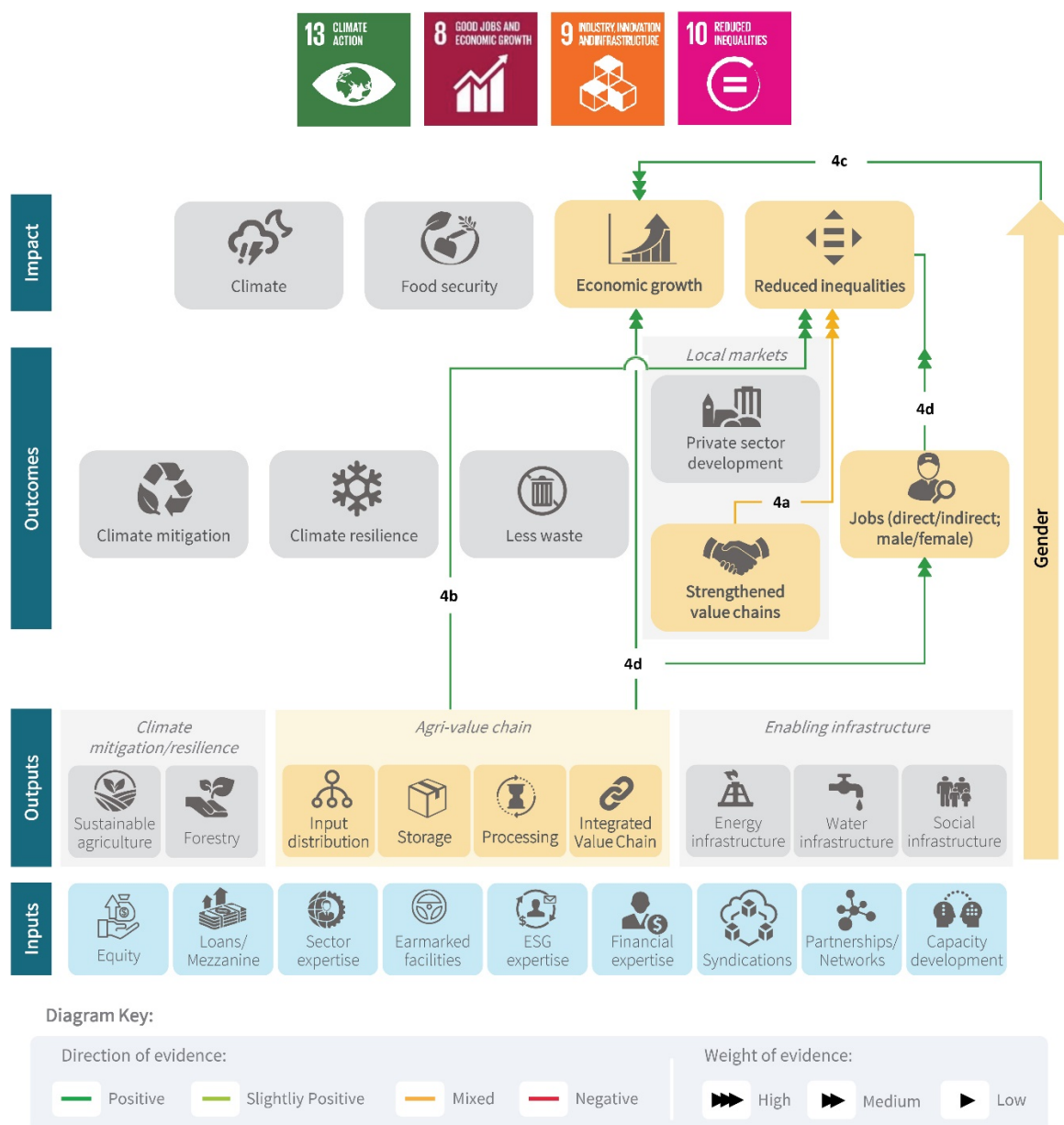
S.N	Summary of findings	Direction of evidence	Strength of evidence
4a	Increased farmer participation in value chains can lead to reduced income inequalities. To reduce gender-based inequalities, gender sensitive interventions are important, as without them, pre-existing inequalities could exacerbate.		
4b	Targeted investments in specific agricultural value chains (e.g.: horticulture) or specific parts of the agricultural value chain (e.g.: storage, processing) can lead to reduced inequalities but the agricultural value chains with high impact will vary by country.		
4c	Investments that focus on women can improve yields relative to cases that concentrate resources in the hands of men.		
4d	Investments in the agricultural value chain can lead to macro-economic improvement, particularly in rural areas, and can create more jobs and spur more GDP growth relative to other manufacturing and services activities.		

Exhibit 22: Inequality: Visualization of findings



Hypothesis 5: Sustainable agricultural methods, reduced waste and forest conservation/restoration lead to climate change mitigation and resilience.

Research questions

The research questions explored to test this hypothesis are:

- 5a Do investments in sustainable agricultural methods and forest conservation lead to mitigation of adverse climate change effects?
- 5b Do investments in sustainable agricultural methods and forest conservation lead to climate resilience?
- 5c Do investments in specific parts of the agricultural value chain lead to more climate resilience?

5d Does less waste lead to increased income for farmers and agribusinesses leading to climate resilience?

We screened 76 studies and 41 were included¹⁷. The geographical coverage includes Sub-Saharan Africa, South Asia (India and Nepal), Australia and South America (Brazil and Mexico).

Definitions

Sustainable agriculture: Sustainable agriculture is the production of plants and animal products in a way that protects the environment and communities. The evidence gathered covers methods such as organic farming, conservation agriculture, sustainable intensification and agro-forestry.

Overall summary

Sustainable agricultural methods have a high potential for climate mitigation and resilience (GHG avoidance) but the benefits of adopting these methods need to outweigh the costs for it to result in increased income for farmers and agribusinesses. While we did not find studies comparing the impact of sustainable agriculture methods, organic farms, agro-forestry and sustainable intensification strategies were found to have positive impacts on the climate. Although, forest conservation shows a mitigation effect, there are often financial incentives that need to be aligned for investments in forest conservation to yield the desired results.¹⁸

5a- Do investments in sustainable agricultural methods and forest conservation lead to mitigation of adverse climate effects?

- **Findings:** There is substantial evidence showing that investments in sustainable agricultural methods lead to mitigation of adverse climate effects through organic farming, yield improvement and agro-forestry. Organic farms have a lower carbon footprint than conventional agriculture (on average, conventional farms emit 111% more GHG). Improvements in yield contribute to mitigation by offsetting forest clearing. Agroforestry allows for carbon sequestration. Similarly, sustainable intensification strategies are backed by research that indicates that past investments in yield improvements have compared favourably with other mitigation strategies, by offsetting forest clearing. Forest conservation shows a clear mitigation effect but given misaligned incentives (e.g.: profits from activities driving deforestation), even billion-dollar investments have been unable to keep up with the scale and pace of deforestation.
- **Conditionalities:** In order for sustainable agricultural methods to have maximum intended climate impact, these methods should go hand in hand with wider technology usage, adoption of adaptive management practices, insurance and credit access, and extension services. Forest conservation investments could be sustainable with pay-for-performance schemes, low cost local management practices, and multi-stakeholder governance structures, but this has to be explored further.
- **Evidence gaps:** There is a gap in the evidence regarding the impact of sustainable agricultural methods on soil carbon sequestration. There is also a gap in comparing the different sustainable agricultural methods to determine the one with the highest impact on

¹⁷ Included studies were treated as relevant to evaluating the research questions. Each paper was coded for relevance on the basis of geographical focus of the study, population studied, intervention conducted/phenomenon studied, and the extent to which research questions matched. Refer Annex C for more detail on the methodology.

¹⁸ Of the 41 included studies, 1 study was of low-quality, 35 were medium-quality studies, and 5 were high-quality studies

climate. There are few studies on investments in forest conservation and climate mitigation in SSA and South Asia, with existing research focusing on Brazil, particularly in the Amazon region. Future research is needed on forest conservation in countries that have similar institutional and socio-economic characteristics to SSA and South Asia. Only three studies utilized an experimental design in assessing the impact of sustainable agricultural methods on climate mitigation and resilience, making a majority of them more observational in nature. Many studies also record observations during a short span and fail to consider the long-term emissions of agricultural land use changes and forest conservation.

5b- Do investments in sustainable agricultural methods and forest conservation lead to climate resilience?

- Findings: Investment in sustainable agricultural methods and forestry can improve climate resilience. Sustainable agroforestry leads to increased climate resilience through improving resource use efficiency (water, increasing resilience during droughts). Climate-resilient inputs by farmers can prevent the impact of climate hazards. e.g., in Uganda, climate-resilient rice seeds with improved heat tolerance, lower maturation times and drought resistance improved yields despite droughts. Sustainable farming also builds resilience through soil conservation.
- Conditionalities: The provision of extension services to educate farmers on the importance and usage of improved varieties and new management practices, innovative financing mechanisms and economic incentives that ease the constraints of the worst-off farmers, and technological support are necessary conditions to realizing climate resilience through sustainable agricultural practices.
- Evidence gaps: A gap in the study design is the failure of research studies to disaggregate the impact of investment in drought-resistant seeds and climate-resilient inputs, from that of broader infrastructure development such as public investment in roads, warehousing and irrigation facilities. Most literature reviews on the impact of agriculture on climate resilience focus on studies conducted in the early 2000's, however, climate science has significantly evolved over the past decade, necessitating further research.

5c- Do investments in specific parts of the agricultural value chain lead to more climate resilience?

- Findings: There is moderate evidence to suggest that climate vulnerability is concentrated at the production and storage ends of the agricultural value chain, implying that investments in these parts of the agricultural value chain are likely to have a greater impact on climate resilience building. For instance, a study in Uganda assessing the climate vulnerability of different actors along the coffee value chain, found that both farmers and processors were the most vulnerable to adverse climate shocks since they had limited diversification potential and weak organizational capacity. However, farmers also had to bear the negative effects of climate hazards along the agricultural value chain in the form of lower prices since most actors along the chain pass on the losses incurred from climate hazards to farmers in the form of lower prices. Additionally, the evidence suggests that improved post-harvest management and storage impacts climate resilience positively.
- Conditionalities: Support of the government and development partners in ensuring greater sensitization on climate risk management for all value chains and among the agricultural value chain actors contributes to increasing climate resilience for smallholder farmers and agricultural SMEs.

- **Evidence gaps:** The existing evidence is largely qualitative and does not compare the resilience outcomes achieved through investment in different parts (e.g.: impact on resilience gained from investing in production v. investing in distribution) – comparative case studies, experimental design-based studies, retrospective econometric analyses can all help isolate the impact investments in some parts have over others. A majority of the evidence is also currently based on experiences in the coffee value chain. Drawing upon experiences from other agricultural value chains is crucial to build a more generalizable evidence base.

5d- Does less waste lead to increased income for farmers and agribusinesses leading to climate resilience?

- **Findings:** Lower post-harvest losses could result in increased income due to the extra revenue earned from higher sales. However, the cost of incorporating post-harvest practices that result in lower post-harvest loss can exceed the benefits of reduced post-harvest losses for small-scale farmers in SSA. There is tentative evidence to show that environmental management can be improved when the incomes of farmers are increased significantly, because increased income increases propensity to adopt these practices.
- **Conditionalities:** Building resilience through the pathway of increased income is only possible when there are otherwise substantial on-farm losses, and the benefits from their sale outweigh the cost of storage. Economic incentives also improve the adoption of storage.
- **Evidence gaps:** The pathway of increased climate resilience through income improvements from adopting storage technology is not well explored. The existing evidence demonstrates that less waste can lead to climate resilience through improved food security and economic development, but an observational study found that the costs of investing in improve post-harvest technologies can exceed the benefits for smallholder farmers in SSA.

Exhibit 23: Climate change: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
5a	Investments in sustainable agricultural methods and forest conservation lead to lower GHG emissions and less environmental degradation. Financial and technical support aids adoption of these practices. Forest conservation requires appropriate incentive structures have a net positive effect in climate change mitigation.	↑	»»»
5b	Investments in sustainable agricultural methods and forest conservation result in less vulnerability to shocks through the use of resilient inputs. Results differ by geography and technology.	↑	»»»
5c	Investments in specific parts of an agricultural value chain (especially closer to production) lead to more climate resilience, however, this varies by crop. Building awareness is important.	↑	»»
5d	Lower post-harvest losses could result in increased income (and thus climate resilience) due to the extra revenue earned from higher sales. However, the cost of incorporating post-harvesting practices that result in lower post-harvest loss can exceed the benefits of reduced post-harvest losses.	→	»»»

Exhibit 24: Climate change: Visualization of findings

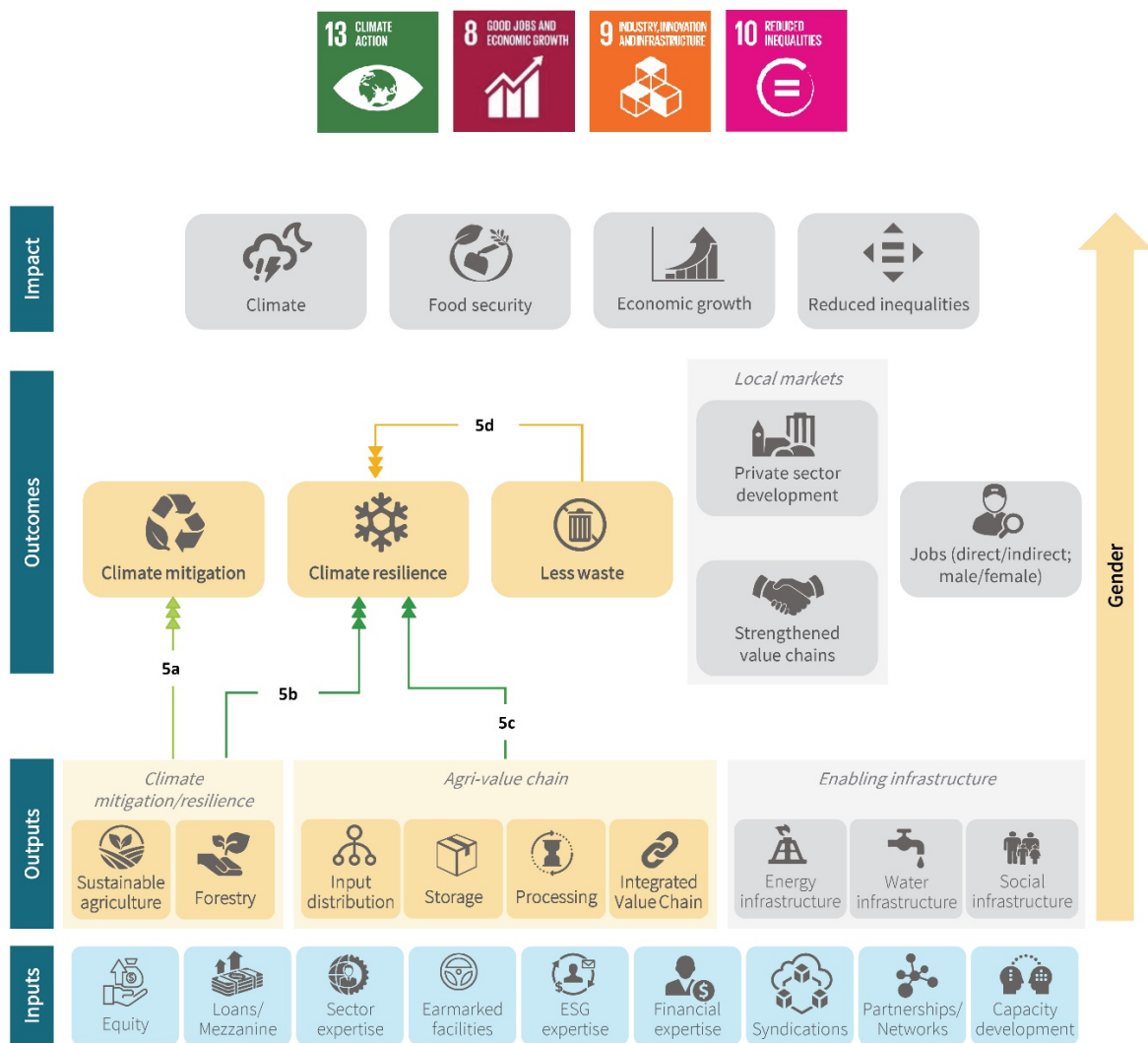
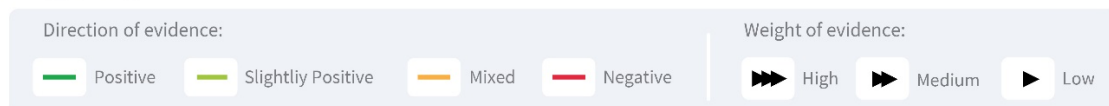


Diagram Key:



3. RECOMMENDATIONS

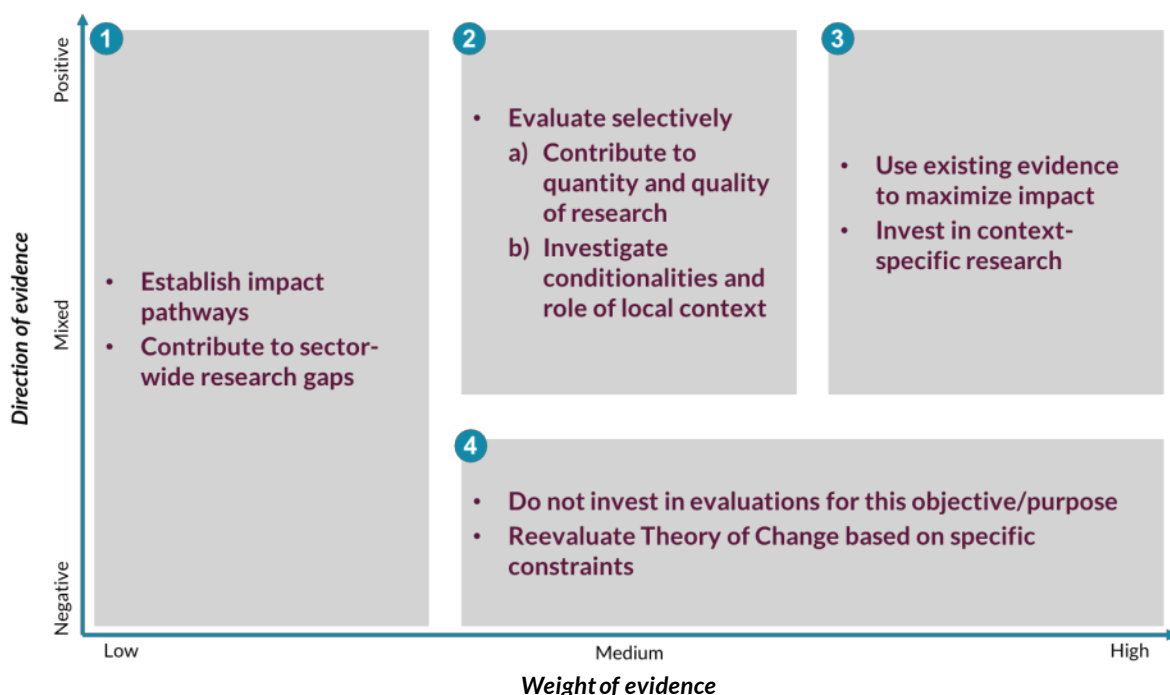
These recommendations have been developed building on the learnings of the evidence gap exercise and FMOs evaluation process. FMO can consider three main uses of the results of the evidence map.

1. **Evaluation planning:** Understanding the evidence landscape can help the evaluation team identify evaluation and research projects. It is also helpful in assessing which research methods to apply.
2. **Refining the Theory of Change:** The evidence map can help in refining and iterating the Theory of Change, especially in terms of better understanding impact pathways and articulating conditionalities
3. **Augmenting impact:** The evidence map can also support FMO in maximizing impact by a) helping investment teams better analyse and explain the impact potential of investees and b) helping to identify opportunities where technical assistance or a coordinated investment can augment the impact of an investee

Framework for matching evidence gaps to recommendations

The results of the evidence mapping exercise can be used to determine what to evaluate, why to evaluate it and how to evaluate it – and how to use results to augment impact and learning. We have identified four categories of evidence which can be used to guide the recommendations. The objectives of future research for each of these categories are highlighted in the diagram below:

Exhibit 25: Framework to evaluate evidence



The above goals set the defining context for the core strategic principles to guide evaluations across these categories. The overarching principles—timelines and generalizability/specificity—when applied to address existing gaps yield a number of specific design principles that should inform the evaluation methods used. These are outlined per category, using the framework from the above diagram.

Category 1 (low strength of evidence)

- a. Ensure evaluation methods are rigorous enough to establish impact and yield generalizable results
- b. Collect primary data from multiple geographies if possible

Category 2 (medium strength of evidence and positive or mixed results)

- a. Use evaluations to fill specific evidence gaps
- b. If possible, design studies to cover multiple investments in order to gain more clarity on conditionalities and local context. (E.g., cross-case analyses which could include interventions by other organizations if data/access is available)
- c. Prioritize faster research methods, so that results can be rapidly shared with fund management and investment teams – to inform both future investments and management of current investments

Category 3 (high strength of evidence and positive or mixed results)

- a. Invest less in these evaluations. Use existing evidence to focus on maximizing the investee's impact, rather than establishing an impact pathway
- b. Collect context-specific data to better understand conditionalities, where applicable

Category 4 (medium or high strength of evidence and negative results)

- a. Update knowledge on the hypothesis periodically from secondary research
- b. Re-evaluate ToC where there is strong negative evidence

Mapping the hypotheses to the categories of evidence

The framework outlined above is used in the following sections to understand the areas for further evaluation and what evaluation methods can be used. The evidence for each hypothesis is mapped to the framework above. Once IDF's investments in agriculture grow, individual investees can be assessed for their match to an evidence gap in one of the four categories.

Ideally, this will be a living document that is updated regularly. The gaps in the evidence map can become focal areas for the evaluation team. In the following tables, we provide a suggestion for both the mapping of hypotheses and research questions, and for evaluation or research studies that can address evidence gaps.

Exhibit 26 below summarizes the findings in each category by hypothesis and provides recommendations on possible research/evaluation studies that can help to close evidence gaps and on other activities that can help disseminate knowledge from well-researched impact pathways.

Exhibit 26: Mapping the hypotheses to the evidence categories and recommendations

Category 1 Low strength of evidence		Category 2 Medium strength of evidence, positive or mixed direction	Category 3 High strength of evidence, positive or mixed direction	Category 4 Negative direction of evidence
<i>Establish impact</i>		<i>Evaluate selectively</i>	<i>Maximize impact, research specific conditions</i>	<i>Re-assess</i>
Hypothesis 1: Producer participation / value chain strengthening: Investments in parts of the agricultural value chain lead to increased farmer participation in value chains				
Findings	While the impact of investments in integrated value chains is directionally positive, there is a significant gap in evidence on the impact for agribusinesses (rather than smallholder farmers).	Further research to develop conclusive evidence on the impact of investments in last mile distribution, agri-processing and forest production is needed. Data should also be collected on relevant conditionalities such as training and extension services.	Storage facilities have a clear positive impact on post-harvest losses. The extent of the impact depends on complementary infrastructure such as roads and reliable power. Further research is needed to better understand this interaction.	NA
Recommendations	<ul style="list-style-type: none"> - Use FMO investments to conduct in-depth evaluation of impact of agri-value chain investments on agri-business SMEs - Consider a sector review that includes impact on both farmers and SMEs, once enough investments are available. This will bolster the key hypothesis underlying IDF's ToC that agri-sector investments support more equitable growth (private sector development as well as reduced inequality) 	<ul style="list-style-type: none"> - Prioritize sectors (last-mile input distribution, agri-processing or forest production) for evaluation according to their relevance in the investment portfolio - Among these, conduct targeted evaluations or effectiveness studies to fill the specific gaps identified (cost-effectiveness of inputs for farmers, impact of agri-processing investment on upstream and downstream businesses; financial sustainability and jobs impact of forest production, and impact of forest production investments on local demand for wood products) - The need for training and extension services is common to interventions across all sectors of the agricultural value chain. <ol style="list-style-type: none"> a) Use secondary research or a cross-case analysis (of FMO and non-FMO investments) to identify successful models b) Share learnings with fund management and investment teams c) Consider using FMO technical assistance funds to provide training and extension services for select investments d) Include training and extension services as a focus area for evaluations, effectiveness studies and sector reviews 	<ul style="list-style-type: none"> - Share learnings with investment teams and investees, so they can improve decision-making and potentially coordinate with infrastructure investors <ol style="list-style-type: none"> 1) Investments in storage have high impact potential on agricultural value chain integration and income 2) Achieving impact depends on access to infrastructure - Include the role of enabling infrastructure as a conditionality in the agri-sector review 	

Category 1 Low strength of evidence		Category 2 Medium strength of evidence, positive or mixed direction	Category 3 High strength of evidence, positive or mixed direction	Category 4 Negative direction of evidence
<i>Establish impact</i>		<i>Evaluate selectively</i>	<i>Maximize impact, research specific conditions</i>	<i>Re-assess</i>
Hypothesis 2: Energy infrastructure: Access to energy infrastructure leads to agriculture increased farmer participation in value chains				
Findings	Available evidence suggests a positive impact of dedicated biomass plants on farmer participation in value chains. However, most studies are low or medium quality and focus on the socio-economic impact for smallholder farmers of shifting from subsistence to biomass crops. High-quality studies that demonstrate the impact of captive biomass-power (and potentially attached mini-grids) on rural development and SMEs are missing.	NA	There is clear positive evidence on the impact of investments in access to energy, particularly mini-grids, on farmer participation in value chains. However, financial sustainability of mini-grids is an issue: factors such as grant support and/or flexible payment models need to be in place to enhance the impact of mini-grids on the agriculture value chain. Further experimentation and research could help develop the business models.	NA
Recommendations	<ul style="list-style-type: none"> - Consider an in-depth evaluation of a rural captive (biomass) power investment to study impact on the overall value chain (not only farmers) 		<ul style="list-style-type: none"> - Share learnings on impact pathways with investment teams and investees: <ol style="list-style-type: none"> 1) Mini-grids have a well-demonstrated potential to increase access to energy and energy usage 2) RE mini-grids lead to GHG replacement and/or avoidance - Share learnings on conditionalities: <ol style="list-style-type: none"> 1) Affordability and financial sustainability are significant challenges - Use a lean data approach to collect financial sustainability and affordability data across multiple investees. Consider case study analyses of the best/worst performers to learn about successful models - For select mini-grid investees, support business model innovation to improve affordability for consumers - Support investees in accessing grant funding - Consider complementary investments, e.g. technical assistance funds, to create necessary conditions for financial sustainability 	

	Category 1 Low strength of evidence	Category 2 Medium strength of evidence, positive or mixed direction	Category 3 High strength of evidence, positive or mixed direction	Category 4 Negative direction of evidence
	<i>Establish impact</i>	<i>Evaluate selectively</i>	<i>Maximize impact, research specific conditions</i>	<i>Re-assess</i>
Hypothesis 3: Private sector development: Agriculture value chain strengthening leads to private sector development leading to macroeconomic improvements and food security				
Findings	While there is evidence showing the effect of value chain strengthening on farmer productivity and income, there is a dearth of evidence on broader private sector development.	Moderate evidence exists on the effect of private sector development on economic growth and on jobs. For economic growth, while the household effects are known, there is uncertainty around the effects at the macro level. Conversely, for job creation, there is evidence supporting the effect of private sector development on job creation at a macro level but limited evidence on a micro level.	There is clear positive evidence for the impact of private sector development on food security when farmers have enhanced access to markets as well as access to enabling infrastructure.	NA
Recommendations	<ul style="list-style-type: none"> - Invest in a macro-economic study on agricultural value chain strengthening and private sector development in the agri-sector on rural GDP, rural GDP growth, (rural) jobs, and inequality (e.g. GINI) - This can also inform FMO's models for impact estimates (e.g direct/indirect job creation) - This may require a more detailed definition of key metrics of private sector development that are of interest to FMO/the Ministry 	<ul style="list-style-type: none"> - Consider a more micro-level effectiveness study to understand the impact of agricultural value chain investments on households (income, jobs, resilience) to complement the macro-level study (proposed in the cell to the left) 	<ul style="list-style-type: none"> - Share learnings on impact and conditionalities with the investment team - If an evaluation or effectiveness study is conducted, include parameters on farmers' access to markets and access to enabling infrastructure 	

Category 1 Low strength of evidence		Category 2 Medium strength of evidence, positive or mixed direction	Category 3 High strength of evidence, positive or mixed direction	Category 4 Negative direction of evidence
<i>Establish impact</i>		<i>Evaluate selectively</i>	<i>Maximize impact, research specific conditions</i>	<i>Re-assess</i>
Hypothesis 4: Inequality: Investments in specific agriculture value chains or specific parts of the agriculture value chain lead to reduced inequalities				
Findings	NA	<p>Further research is needed on the impact of modern value chains overall on social inequities in developing nations, particularly gender disparities. While there is positive gender impact with gender-targeted investments, without this targeting, pre-existing inequities can create conditions that further marginalize women. However, most of the existing evidence is in the form of case studies.</p> <p>There is also limited evidence on the impact of agricultural value chain investments on rural development, compared to investments in other sectors such as manufacturing and services.</p>	<p>There is extensive evidence on the effect on inequality for individual investments in specific parts of the agricultural value chain (inputs, storage, etc.) and specific crops. However, results cannot be generalized. Impact varies by country and crop. Factors such as access to finance, land tenure security and business development services are necessary to maximize impact.</p>	NA
Recommendations		<ul style="list-style-type: none"> - Invest in a systematic review and/or cross-case analysis of the research on inequality to identify successful models of reducing gender inequality. Consider including rural/urban inequality in the study. - Use a lean data approach to collect gender data across multiple (or all) investees - Use a developmental evaluation with select investees to advance gender-targeted solutions - Consider a macro-level study that analyses the agri-sector investments with investments in other manufacturing and services in terms of impact on within-country inequality. (This can be part of the macro study suggested under H3 above.) 	<ul style="list-style-type: none"> - Through a systematic review of literature and/or a cross-case analysis of FMO agri-sector investments, create a database of findings by country. Share the database and insights on country-specific crops or agricultural value chain parts with investment teams. This can help investment teams assess the potential impact of new investments, considering country context - Share learnings on conditionalities with investment teams: <ol style="list-style-type: none"> 1) Access to finance, land tenure security, and business development services (or other extension services) are key to achieving impact through agricultural value chain investments for poorer, more rural populations and women 	

Category 1 Low strength of evidence		Category 2 Medium strength of evidence, positive or mixed direction	Category 3 High strength of evidence, positive or mixed direction	Category 4 Negative direction of evidence
<i>Establish impact</i>		<i>Evaluate selectively</i>	<i>Maximize impact, research specific conditions</i>	<i>Re-assess</i>
Hypothesis 5: Climate change mitigation and resilience: Sustainable agricultural methods, reduced waste and forest conservation/restoration lead to climate change and resilience				
Findings	NA	Moderate evidence on the effect of investments in specific parts of the agricultural value chain (production, storage) on climate resilience. The existing evidence is largely qualitative and does not compare the resilience outcomes achieved through investment in different parts of the agricultural value chain.	Well-established positive evidence shows that investments in sustainable agricultural methods and forest conservation lead to lower GHG emissions, less environmental degradation and lower vulnerability to shocks. To achieve a <i>net</i> reduction in GHG, disincentives to deforestation are necessary. Substantial evidence shows that less waste leads to increased income, when the cost of adopting sustainable agricultural methods is less than the benefit of reduced post-harvest loss.	NA
Recommendations		<ul style="list-style-type: none"> - Conduct cross-case comparisons to understand the differential impact of investment in different parts of the agricultural value chain (inputs, integrated production, storage, agri-processing) on climate resilience in order to compare resilience outcomes - Consider a deeper, quantitative impact evaluation on the effect of sustainable agriculture on climate resilience of rural/farming communities 	<ul style="list-style-type: none"> - Share learnings on sustainable agriculture and forestry with investment teams - Consider supporting training and extension services to increase adoption - Use case study research and developmental evaluations to increase affordability of sustainable agriculture inputs 	

1. Plan evaluations

Monitoring and evaluation priorities

The table above presents a range of suggested evaluations and studies. The following focus areas stand out across interventions and should generally be included in future studies.¹⁹

Across all the interventions examined in this evidence mapping, **gender impact and the need to support technology adoption through extension services and cost-effective solutions for farmers** are key to achieving impact for IDF's investments and their financial success. They should be included in the studies undertaken by the evaluation team where this is relevant and possible to track. Gender is particularly important because modern value chains can have a negative gender impact. Extension services need not be delivered by FMO or the investee, but their availability and effectiveness should be considered as a key factor driving impact.

We also did not find adequate research studying the **impact of agriculture value chain interventions on agri-SMEs** (including upstream and downstream SMEs). Therefore, this should be a priority for future studies.

The **underlying hypothesis of the new IDF Theory of Change** – that investments in the agri-value chain lead to stronger local markets and equitable growth – would be strengthened by more targeted research. A deeper understanding both the micro-level impact pathways and the macro-level comparison with investments in other manufacturing and services sectors in terms of both rural economic growth and inequality would be helpful.

Key evaluation studies to consider

Micro/macro-level study that tests the underlying hypothesis of the IDF Theory of Change (multiple hypotheses)

This study will strengthen the IDF ToC, fill an important research gap, and contribute to FMO's models for estimated impact. It will address the following questions:

- What is the impact of investments in the agri value chain on SME entry and growth (incl. upstream, downstream)? What is the impact on jobs (rural/urban, for men/women)?
- What is the impact of investments in the agri value chain on rural GDP growth and per capita rural GDP; SME entry, growth, and investment; (rural) employment; and GINI – compared to investments in non-agri manufacturing or services?

It can be built purely around secondary data and literature, or it can use a 2-step process: (i) an impact evaluation of one agricultural value chain strengthening investment that focuses on impact on SMEs and jobs, followed by (ii) a macro-level study that combines the results of the evaluation with existing secondary data and research across several IDF target countries, with an emphasis on SSA.

Agri-sector review (multiple hypotheses)

- For the next agri-sector review, ensure that the following parameters are covered:
 - Impact on SMEs (as well as farmers where possible)
 - Gender impact of agricultural value chain investments (call out successful gender-targeted interventions)
 - Availability, role and impact of supporting infrastructure (where possible)

¹⁹ In this context we include all forms of studies in “evaluations,” whether impact evaluations, effectiveness studies, sector reviews, cross-case analyses, or others.

- The sector review can be enhanced with a summary of secondary literature on country-specific impact of investments in specific value chains/value chain parts
This database can support the impact case for individual investments without conducting in-depth studies on specific country-context.

Gender impact analysis (*inequality hypothesis & gender lens across all hypotheses*)

- Conduct a cross-case analysis (e.g. gender leaders and laggards). If partner DFIs are willing to provide data and access to investees, their investments can be used to broaden the case pool. Build comparable case studies that seek to identify successful gender-targeted solutions, enabling conditions for gender impact (e.g., women's land ownership, presence of women's cooperatives, access to finance, etc.), and risk factors

Climate resilience study (*climate hypothesis*)

- Conduct a cross-case analysis (e.g. strive for a broad range of interventions and agricultural value chain stages). If partner DFIs are willing to provide data and access to investees, their investments can be used to broaden the case pool. Build comparable case studies that seek to identify the differential climate resilience impact of specific interventions and agricultural value chain stages as well as key enablers and constraints

Developmental evaluations (*multiple hypotheses*)

Developmental evaluations focus more on learning (for both the investor and the investee) than on measuring impact. This is particularly useful where innovation is required to overcome obstacles to achieving impact

- Work with a mini-grid investee to improve affordability and financial sustainability of business models
- Work with an agricultural value chain investee to develop and refine gender-targeted approaches
- Work with an agricultural value chain investee to develop innovative extension delivery, and credit and insurance provision systems

Key indicators for impact monitoring

Micro/macro-level study that tests the underlying hypothesis of the IDF Theory of Change (*multiple hypotheses*)

- Monitor SME impact through regular reporting
- Disaggregate indicators on jobs and wages by gender

Agri-sector review (*multiple hypotheses*)

- Monitor gender impact/outcomes through regular reporting
- Monitor cost-effectiveness of new technology adoption for farmers

Gender impact analysis (*inequality hypothesis & gender lens across all hypotheses*)

- Monitor gender outcomes across all IDF (or all agri/forestry) investees, e.g.: by collecting data as part of client credit reviews. This is crucial because agricultural value chain investments can potentially lead to negative gender outcomes

Climate resilience study (*climate hypothesis*)

- Tag climate *resilience* impact and monitor climate *resilience* outcomes across multiple relevant investees e.g.: by collecting data as part of client credit reviews
- Disaggregate data by gender

Developmental evaluations (*multiple hypotheses*)

- Monitor the presence and effectiveness of extension services and access to credit

2. Refine Theory of Change

Internally reframe ToC elements

FMO can internally work towards refining the IDF theory of change (ToC) by ensuring that each level in the theory of change is closely mapped to the next level, and that conditions for achieving impact are well understood. Existing evidence on impact and necessary conditions to achieve that impact can be shared across teams. After the new IDF strategy is implemented, there will be more clarity on the most relevant interventions/investments and on the strongest impact pathways. This will help establish links and refine the specific ToC elements at each level. The entire process will likely involve several rounds of discussion and iteration as the evaluation, fund and investment teams develop a shared understanding of the key impact pathways. Focusing on specific interventions at the input level will help to develop the necessary nuances.

Once the team has gained more experience, a ToC workshop would be helpful. This will help to consolidate and visualize the conditionalities that have emerged from the evidence mapping exercise as well as insights from the ToC refinement process. The visualization will help the evaluation team to design studies; it will help the fund management and investment teams to identify impact pathways and assess conditionalities.

Exhibit 27: Conditionalities to include in the Theory of Change

Hypothesis	Conditionality	Why?
1. Producer participation / value chain strengthening	Storage: complementary infrastructure is needed to achieve impact	The state of complementary infrastructure- investments in paved roads, railroads and reliable electricity- has an impact on post-harvest losses.
2. Infrastructure	Support for financial sustainability of mini-grids (e.g., grants and flexible payment models)	Mini-grid operators struggle to be financially sustainable: they typically rely on grant support. Flexible payment models, such as pay-as-you-go, contribute to better financial sustainability, but further support is needed. Achieving financial sustainability of mini-grids can lead to long-term positive effects such as higher rural and agriculture incomes.
3. Private sector development	Increased access to mechanization and markets; enabling infrastructure	Increasing yields depends on providing farmers access to mechanization; maximizing waste reduction depends on providing farmers access to markets and developing enabling infrastructure.
4. Inequality	Training and market linkages	Ecosystem investments such as training and market linkages are essential to enable farmers take advantage of the agricultural value chain investments.
5. Climate	Training and incentives to adopt sustainable agricultural practices	Farmers need to adopt environmental-friendly agricultural practices in order to have positive climate results. Currently, adopting these practices is not always profitable for farmers without training and/or additional financial incentives.
Gender	Gender lens in investments (this is implicit in the current theory of change)	Evidence shows that gender neutral approaches are ineffective in reducing gender inequalities. Gender-sensitive solutions such as improved access to land, finance, training, business development services and technical support are important tools to improve gender equity.

Examples of things to do:

- Include the core areas in which the fund will be investing as key interventions. E.g., last-mile input distribution, storage, processing, integrated production, and forestry
- Provide additional detail on how the theory of change flows logically from activities/inputs to outputs to outcomes to impact. For instance, investments in storage will lead to greater farmer participation in value chains and stronger local markets (outcomes) and eventually to economic growth (impact)
- Include assumptions and conditionalities that can enable and accelerate the impact of agricultural investments particularly for areas with well-established evidence. Examples of these assumptions that have clear and proven evidence are listed in Exhibit 27 above.

3. Augment impact

Support investment teams to maximize and document impact

The evidence map can help investment teams to assess and articulate impact theses for their investees. Investment teams can cite well-documented impact pathways and comment on how well-established conditionalities apply to their investments; they can use research on country-specific factors that affect their investees' potential. Where impact pathways are not generally well established, investment teams may find individual organizations that demonstrate the potential for a new pathway.

For example,

- Evidence shows that gender neutral approaches are ineffective. Thus, the investment team can look out for gender sensitive solutions when assessing the impact potential of investment opportunities
- Research shows that reduced waste leads to increased income for farmers and agribusinesses when the benefits of incorporating waste-reducing practices exceeds the costs. Thus, the investment team should be aware of the need for supporting infrastructure in roads and storage facilities to boost the impact of investments in post-harvest interventions

Support investees in creating impact

FMO can share learnings with investee companies. Information on well-established impact pathways and conditionalities within these areas can be provided to investees in order to enable them to maximize the impact of their interventions.

FMO can support investees in some cases by addressing the conditions that are necessary to achieve impact. FMO can do this by being an ecosystem builder, by providing targeted technical assistance, by coordinating with other investors, or by connecting investee companies with other companies that provide supporting services. For example, if FMO is investing in an input distribution company, given that awareness and knowledge on the use of the inputs are vital, FMO can connect the input distribution company with an organization which provides relevant training and extension services. Once clear investment trends for IDF emerge, FMO may identify strategic partnerships for certain investment themes.

Share learnings with partners and the broader sector

FMO can share learnings from the evidence mapping exercise to inform the ministry's thinking on the ToC. We believe that the Ministry will primarily be interested in the following:

- Conditionalities for achieving impact through the current Theory of Change will be of interest to the Ministry. The most relevant ones were summarized in Exhibit 25
- The role of private sector development in agriculture/agri-business in supporting economic growth, job creation and reduction of inequality is only partially understood. While we found evidence supporting the impact of specific interventions (e.g. storage), there are evidence gaps around the macro-level contribution of agri-focused private sector development to the impact goals. Given the high importance of rural jobs and economic development, the Ministry may be interested in deeper research
- Gender: the evidence clearly shows a potential for impact on gender inequality when investments are gender sensitive (not just gender neutral)

FMO can share learnings with other funders operating within the sector. This will contribute to collaboration across funders and can be used as an opportunity to become industry leaders in various sectors. Promoting a collaborative environment will enable funders share commonalities in findings and possibly partner on the building blocks required for agricultural investments.

FMO could first share the current evidence map with partners and/or make it public. **FMO can later create or support a platform to host these and future evidence map results** which other funders can review and update with evidence collected.²⁰ This will lead to up-to-date evidence from the field that can serve as a public data source for funders as well as implementers.

FMO can work with the other funders to identify areas that would benefit from joint studies (e.g. macro-level studies that are of interest to multiple funders). This can create savings on evaluation budget as well as lead to robust reports across the industry.

²⁰ Such a platform exists in the health sector as an independent organization: www.cochrane.org








ANNEX A: DETAILED FINDINGS

We present the detailed findings for each hypothesis and research question in this section. For each research question, we examine the direction of evidence and strength of evidence.

Direction of evidence indicates whether the findings confirm, deny, or are inconclusive regarding a hypothesis/research question. Positive directionality implies that a hypothesis has been proven, slightly positive directionality implies that the hypothesis is proven, but the effect tends to be small, negative directionality denies the hypothesis, and mixed directionality indicates uncertainty.

Strength of evidence indicates the quantity and quality of evidence that supports a finding. High strength indicates a high quality of evidence and/or a large quantity of medium-quality evidence. Medium strength of evidence indicates a medium quality and quantity of evidence. A low strength of evidence refers to a general lack of evidence, or the presence of exclusively low-quality evidence.


Exhibit 28: Legend for reading evidence mapping results


Direction of evidence	Strength of evidence
 Positive	 High
 Slightly positive	 Medium
 Mixed	
 Negative	 Low



1. Increased producer participation in value chains / agricultural value chain strengthening

To test this hypothesis, we examined 4 main research questions related to the hypothesis that investments in specific agricultural value chains or parts of the agricultural value chain are leading to reduced inequalities. We screened 50 studies, of which 38 were included; the geographical coverage is Sub-Saharan Africa, South Asia. The table below outlines the findings for each main research question as well as the conditionalities:



Exhibit 29: Producer participation / agricultural value chain strengthening evidence gap findings

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
1a	Does investment in last-mile input distribution lead to greater farmer participation in value chains (agricultural value chain strengthening)?	↑	 (Mostly SSA; other developing countries as part of a 58 country subsample)	<p>Increased availability of improved/modern inputs increase yields under the conditions that they are used simultaneously, extension services on their use is provided, and that they can be accessed easily through well-established input market linkages. Access to output markets are also important to drive adoption of available inputs. The increased yields have the potential to increase farmer incomes under the condition that the revenue from additional yield outweighs input cost. Further investigation is required to determine whether the increased availability use of modern inputs improve resource efficiency.</p> <p>Strong evidence indicates that yields increase with modern input use:</p> <ul style="list-style-type: none"> • In Tanzania and Burkina Faso, maize plots receiving modern inputs (hybrid seeds) saw yield increases by approximately 10% • In Mali, a 10% negative price shock to global fertilizer prices would increase fertilizer use by 0.8 kg/ha and increase yields by 7 kg/ha; in Jamaica, use would increase by 3.9 kg/ha and yields by 34 kg/ha • In Uganda, farmers who applied fertilizer on market-sourced improved (MSI) seed (considered best quality seed) obtained highest average yield <p>The evidence of increased income from increased yields is mixed:</p> <ul style="list-style-type: none"> • In Uganda, farmers who planted MSI seeds with fertilizer obtained highest yield, but those who planted MSI seeds without fertilizer obtained higher profit • In Kenya, without fertilizer or hybrid seed, the holding would produce about 8,000 Ksh worth of maize. Using ½ teaspoon of 	Alia, 2017, McArthur, 2017, Duflo, 2008, Okoboi, 2010



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				top dressing fertilizer per hole would increase agricultural income (net of fertilizer cost) by 1,100 Ksh.	
1b	Does investment in storage facilities in close proximity to farmers lead to agricultural greater farmer participation in value chains (agricultural value chain strengthening)?	↑	 (Mostly SSA, Latin America, and India)	<p>Investment in storage infrastructure/technology decreases post-harvest losses and enables farmers to store and sell produce during lean seasons. Investments to reduce post-harvest losses should also come with subsidies on the storage technology, training on the use of storage facilities and investments in enabling infrastructure (paved roads, railroads, electricity), whereas to realize the impact pathway to higher value capture, farmers' liquidity constraints should be eased (potentially) through a credit product. Impacts on transportation or other costs owing to storage proximity are yet to be studied.</p> <p>Substantial evidence supports the hypothesis that improved storage facilities reduces post-harvest losses</p> <ul style="list-style-type: none"> • Treated households in Uganda reported storage losses 2.2 to 2.5 percentage points lower than control households. This indicated that between 65 and 71% of the average reported losses in stored maize could be eliminated • In Kenya, at both two and four months of storage, grain damage was much lower in the hermetic bags – at two months, grain damage reduced from 6% to 0%, and at four months it reduced from 14% to 4% • In Bihar, India, because of the availability of cold storage, wastage numbers recorded were significantly lower than in previous estimates <p>A high strength of evidence indicates that storage facilities also induced the intent to sell produce later, and allowed farmers gain higher prices for the produce sold</p> <ul style="list-style-type: none"> • In Uganda, treated households stored maize with the intention of selling it one week later, over and above the 4 week storage period • In four countries in Latin America, maize stored in metal silos led to an average price markup of 1.85 USD/qq and maize stored in 	Rosegrant, 2015, Omotilewa, 2018, Bokusheva, 2012, Aggarwal, 2018, Ricker-Gilbert, 2018

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>other systems generated a price markup of 1.46 USD/qq compared to maize that had not been stored.</p> <ul style="list-style-type: none"> In Kenya, conditional on achieving a sale, sales in the treatment group were on average 1 month later than in the control group and fetched 6% higher prices. 	
1c	Does investing in agri-processing companies lead to greater farmer participation in value chains (agricultural value chain strengthening)?		 (Mostly SSA, South Africa, Bangladesh, Australia, and a mix of other countries)	<p>The evidence supporting business entry is limited, but an explicit mandate for the investment to encourage competition (e.g.: a competitiveness fund focused on new business creation), and the provision of skills training and processing equipment to rural communities seem to foster business entry. There is some indication that investments in agri-processing helps existing businesses expand. Expansion and capacity utilization are conditional on reliable energy supply, robust markets for secondary capital goods, low workplace absenteeism, easy access to raw materials, and improved access to finance. The evidence also indicates directionally that processing firms improve the quality of their processes and products. Investments in processing have the potential to create more jobs, conditional on the use of labour using rather than labour augmenting technology. The impact on income is less known. Finally, agri-processing investments are shown to have a positive impact on the total value of output produced/exported at the macro level.</p> <p>Although there is little research on this, existing evidence indicates the facilitation of new business entry:</p> <ul style="list-style-type: none"> In Kenya, diversity of processing equipment impacted positively on the number of agri-processing IGAs with 60% of farmers experiencing rapid increase in number of agri-processing units set up In South Africa, in terms of facilitating the entry or expansion of SMEs, results found that the fund supported the entry of 10 start-ups <p>A medium strength of evidence indicates that investments in agri-processing companies lead to expansion of existing businesses:</p>	Wilkinson, 2009, Fukase, 2016, Egbert, 2009, Isinika 2016, Bittar, 2013

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<ul style="list-style-type: none"> In Zimbabwe, it was found out that investment in technology was the most used strategy by all players in the industry and this has largely improved production levels in some segments of the industry. Since participating in the SAFE program, Chankwakwa increased volumes produced by 30MT annually and is working with 403 farmers (up from 199), and the increase in visibility from the advertisements and branding adjustments increased sales by 67% As FDI in food processing has risen, so has the proportion invested in highly processed foods for sale in the host market; FDI has proved more effective than trade in generating sales of highly processed foods, and enables TFCs to cut costs, gain market power and obtain efficiencies in distribution and marketing <p>A low to medium strength of evidence indicates that investments in processing encourage firms to improve quality</p> <ul style="list-style-type: none"> The immediate result of the commissioning of USD4 million rehabilitation of the sterilized milk plant was the enhancement of efficiencies with maintenance cost going down by 30% In Malawi, as a result of the project charters, PPB became ISO 22000 compliant, the shelf life of their products increased to 9 months for bottles and 24 months for sachets, and they saved USD 66000 YoY by sourcing cheaper non-fat dry milk <p>Strong evidence supports positive employment effects:</p> <ul style="list-style-type: none"> In a leading agri-processing firm in Bangladesh, where IFC helped finance capacity expansion, every USD 1 million in project costs translated to over 40 indirect jobs compared to 6 direct jobs In Tanzania, firms under study created 492 new jobs, being 49 per firm per year, with more temporary jobs which accommodated more female workers 	

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<ul style="list-style-type: none"> The SAFE program's 378 capacity building projects resulted in 574 new jobs <p>Strong evidence indicates that improvements in the agri-processing sector increase the value of goods produced and/or exported in the country</p> <ul style="list-style-type: none"> Non-traditional and other processed products expanded their participation in global exports, from around 31% in 1980–1981 to 50% in 2000–2001 In Tunisia, USD 1 million worth of investment in food processing is associated with USD 5.4 million value added A 35% increase in the annual growth rate of TFP of agri-processing activities brought about a 0.84% increase in real GDP from the base while a 25% and 21% increase in growth rate of TFP, real GDP growth rate increased by 0.58% and 0.41% respectively. The average growth rates of exports and imports also showed positive changes in all the three simulations 	
1d	Does investment in integrated production lead to greater farmer participation in value chains (agricultural value chain strengthening)?		 (Mostly SSA, Central Asia, Eastern Europe, Nepal, and China)	<p>Overall, this impact pathway is the least well understood, with the existing evidence being more farmer focused than it is firm focused. Integrated agricultural value chains have a positive impact on input access, yields, and market access and productivity. The positive impact from input access is conditional on farmer training. Impacts of integrated agricultural value chains on total food production, access to finance, and competitiveness are unexplored. Higher yields are only beneficial if input costs are outweighed by receipts.</p> <p>A medium strength of evidence indicates that farmers have improved access to inputs in integrated agricultural value chains:</p> <ul style="list-style-type: none"> In western Kenya, sourcing companies provided several inputs on credit including land preparation (ploughing, harrowing) in the replant cycles, fertilizer (DAP and UREA), harvesting, and transport to the mill 	Casaburi, 2012, Dries, 2004, Mishra, 2018, Ragasa, 2018, Igweoscar 2014, Omotilwea, 2018

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<ul style="list-style-type: none"> • In upper west Ghana that maize plots under a scheme were more likely to be treated with fertilizer, and in greater quantities, than those not • Across Central Asia and Eastern Europe, processors provided necessary inputs (e.g. high quality seeds, irrigation equipment or pigs of a special breed) and provide training opportunities (e.g. a demonstration farm has been set up) and extension services <p>A medium strength of evidence also mostly supports the hypothesis that integrated agricultural value chains increase yields:</p> <ul style="list-style-type: none"> • The yields of Contract Farming (CF) smallholder farms were higher than yields of independent farms by about NRs. 80 kg/ha in Nepal for lentils • In Upper West Ghana, scheme participation increased maize yield by 400–800 kg/acre • In Shandong in China, contract growers had 28% higher yields compared to independent apple growers <p>A study in western Kenya recorded however that the average yield in 2001-2006 was about 75% of the average yield in 1988-1995 when contract farming coexisted with this decline. Whether this was because of or despite contract farming remained unexplored.</p> <p>A high strength of evidence supports improved access to markets (taking price as a proxy) and improved competitiveness (taking productivity as a proxy):</p> <ul style="list-style-type: none"> • In Shandong in China, contract growers had 35% higher family labor productivity compared to independent apple growers; onion growers received higher prices owing to better quality compared to independent producers • The causal effect of CF adoption on profits (NRs. 10,911) suggested that profits of CF smallholder producers were higher than those of independent producers by about NRs. 10,911 per hectare, driven by output prices – contract producers received 	



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>higher prices (~NRs 75/kg) than independent producers (~NRs 71/Kg)</p> <ul style="list-style-type: none"> In South Eastern Nigeria, the productivity of the farmers under contract farming was higher than that of non-contract farmers 	
1e	Does increased forest production lead to greater producer participation in value chains (agricultural value chain strengthening)?		 (Major regions across the world, SSA)	<p>While there is little research on whether investing in the supply side through forest production increases local demand for wood products, investments in forestry are likely to positively impact employment in developing countries on the condition that they are economically sustainable, and that efforts are made to share profits with the communities.</p> <p>A high strength of evidence indicates that forest production creates jobs, but some evidence also indicates a lack of financial sustainability of community-based forestry projects:</p> <ul style="list-style-type: none"> There was a total of 23,000 people employed in all activities in the formal forest sector in Cameroon in 2008, of whom 13 000 were employed in forestry and logging, 8 000 in wood processing and 2 000 in the pulp and paper industry. Overall, the formal forestry sector's share of total employment is 0.3%, but when the informal jobs of chainsaw millers are also taken into account this triples to 0.9%. The contribution of forests to employment is yet higher if NWFPs are also considered. Africa Sustainable Forestry Fund's investees collectively provided approximately 8,000 jobs in regions with otherwise high unemployment, where over 70% of the populations are dependent on subsistence farming Developing Asia-Pacific, Latin America and the Caribbean and North Africa, Western and Central Asia combined created 1.1 million new jobs in the forestry sector between 2000 and 2011. In developing Asia-pacific, the number of persons employed expanded by 0.9 million (18%). In general, the forestry sector has been able to create new jobs at a rate that has almost kept up with the growth in the global labour force 	Lebedys, 2014, ASFF Case Study, Eisen, 2014

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<ul style="list-style-type: none"> In a long-term study on 11 community forest associations (CFAs) in Kenya, 21% of the CFAs could not meet their expenses for forest management interventions and hence could not invest in community development as they were running in losses. 	

2. Access to energy infrastructure

To test this hypothesis, we examined 2 main research questions related to the hypothesis that access to energy infrastructure leads to greater producer participation in value chains (agricultural value chain strengthening). We screened 34 studies, 11 were included; the geographical coverage is SSA and South Asia (India). The table below outlines the findings for each main research question as well as the conditionalities:

Exhibit 30: Energy infrastructure evidence gap findings



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
2a	Does access to energy, particularly mini-grids, lead to greater farmer participation in value chains (agricultural value chain strengthening)?		 Evidence mostly from SSA (Kenya, Tanzania, Ghana), and South Asia (India)	<p>There is positive evidence for the impact of investments in energy infrastructure, particularly through mini-grids, on farmer participation in value chains. A low-quality study found that a solar mini-grid project in rural Tanzania enabled farmers to shift from importing sunflower oil to processing their own sunflower seeds, thereby improving their profits. Multiple studies in SSA have demonstrated that solar mini-grids enabled rural enterprises to create processing facilities and purchase cold storages benefiting the local community and farmers.</p> <p>Multiple studies have demonstrated that access to energy infrastructure has enabled farmers and rural businesses to increase their yields and reduce costs, thereby boosting their profits. Two medium-quality studies in Kenya and Tanzania have demonstrated the positive impact of mini-grid electrification for off-grid fishing communities. Electrification enabled fishermen to utilize freezers for the preservation of fish, which increased their negotiation capacity with traders and other value chain actors. The replacement of kerosene for LED lights during night-time fishing increased their profits by 30 to 40%.</p> <p>A high quality impact study in India found that electrification facilitated by solar mini-grids benefited rural farm enterprises by reducing the cost of irrigation by 70%. A medium-quality study in Kenya found that solar-powered irrigation kits with high-efficiency drip irrigation systems achieved yield increases of up to 300% and water savings of up to 80%.</p> <p>Conditionalities: For access to energy infrastructure, particularly mini-grids, to be financially sustainable in off-grid areas, grant support from donor agencies, flexible payment models such as pay-as-you-go, and community engagement are essential factors.</p>	Pirzer et al, 2016, Rockefeller Institute SPRD impact report, 2017, Odarno et al, 2017, Best et al, 2016



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
2b	Do dedicated biomass captive power plants lead to increased farmer participation in value chains (agricultural value chain strengthening)?	↑	➤ Evidence mostly from SSA (Ghana, Kenya, Tanzania), and South Asia (India)	<p>There is positive evidence from observational studies for the impact of captive biomass power plants on farmer participation in value chains. A medium-quality study that examined a case study in India found that that electricity supplied by a biomass plant led to the creation of a flour mill and improved irrigation for an agrarian village community. A medium-quality review also found evidence that electricity from sugarcane bagasse in Brazil and India provides electricity which can support water pumping, transport, and agricultural activities.</p> <p>There is evidence that a hybrid solar and biomass technology, utilizing discarded rice husks can stimulate rural development and boost incomes. A low-quality study in India found evidence that a hybrid mini-grid, using solar and biomass technology stimulated local development. The bio-mass plants utilized discarded rice husks to generate clean energy for domestic and agricultural users. The technology was in the process of being launched in Ghana and Tanzania at the time of the study.</p> <p>Conditionalities - For captive biomass power plants to be effective in rural areas, there needs to be a stable supply of fuel sources, such as agricultural residues. Additionally, donor funding and government subsidies are essential in ensuring the financial sustainability of biomass plants in rural areas.</p>	Dasappa et al, 2011, Pirzer et al, 2016



3. Private sector development



To test this hypothesis, we examined 4 main research questions related to the hypothesis that agricultural value chain strengthening leads to private sector development (PSD) and that agricultural value chain strengthening and private sector development lead to macroeconomic improvements and food security. We screened 30 studies, 25 were included; the geographical coverage is Sub-Saharan Africa, South and South East Asia, and Latin America, and the USA. Of the 25 studies, 4 are low quality, 16 are medium quality and 5 are high quality studies. The table below outlines the findings for each main research question as well as the conditionalities:

Exhibit 31: Agricultural value chain strengthening evidence gap findings

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
3a	Does agricultural value chain strengthening lead to private sector development and investments in agriculture and upstream/downstream sectors?		 (Mostly SSA, and South Asia – Bangladesh and India)	<p>The evidence indicates that agricultural value chain strengthening increases farmer productivity and access to markets conditional on input adoption and usage. For the latter, anecdotal evidence points towards horizontal organization requiring investments in management and leadership. Impacts on business development have not been documented. The differential impacts between strengthening horizontal and vertical linkages are also not explored deeply. Overall, this causal link remains poorly explored.</p> <p>Substantial evidence shows that agricultural value chain strengthening improves access to inputs and markets:</p> <ul style="list-style-type: none"> • In Tanzania, farmers selling to grocery stores received significantly higher crop prices, gross and net revenues than farmers not, which illustrates the potential impact of vertical linkage. In addition, farmers vertically linked also had higher input expenditures. Having horizontal linkages as a farmer was significantly associated with higher prices and value of input purchased. • In Bangladesh, Comparing the conventional and contracting systems, the marketing channel of the conventional one is more complex. In the contracting system, farmers sell their poultry directly to the integrator, which helps to reduce the transaction costs associated with searching, collecting market information, negotiation, etc. It also establishes the necessary backward and 	Herrman, 2015; Begum, 2013; Neven, 2009;

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>forward linkage, provides all marketing facilities, and increases producers' prices. It was found that the gross margin and net return (18.2 taka and 17.2 taka, respectively) of contract farms in poultry were again much higher than those of independent farms (12.9 taka and 10.0 taka, respectively).</p> <ul style="list-style-type: none"> Farmers supplying to Kenyan supermarkets used, on average, twice the amount of inputs (fertilizer, manure, chemicals) per hectare as traditional channel farmers. Yields per hectare and per worker were therefore higher in the supermarket channel. 	
3b	Does private sector development and agricultural value chain strengthening in agriculture lead to economic growth?		 (Mostly SSA, Brazil, Palestine)	<p>Private sector development and agricultural value chain strengthening in agriculture has positive impacts on GDP growth/output/investment at the macro and community level. While it is documented that farmers have increased incomes owing to private sector development and agricultural value chain strengthening in agriculture (which conceivably has an impact on agribusinesses), the direct, firm-level impact on SMEs and agribusinesses requires further exploration. This improvement in income has often followed strategies that work with farmers to provide them inputs and train them in their usage. Finally, there is limited but positive evidence on economic diversification.</p> <p>Strong evidence supports the hypothesis that private sector development leads to increased GDP:</p> <ul style="list-style-type: none"> A PPP set up in the cassavan agricultural value chain Mozambique resulted in the payment of USD 4 million in taxes and USD 27000 injected into the local economy every month. An analysis of DFI investments showed that overall, DFI investments induced economic growth in investee countries. In a subsample of lower-income countries, investments in the agriculture and agribusiness, and infrastructure sectors play the most significant role in promoting economic growth, while investments in industry and infrastructure played a more significant role in higher income countries Agribusiness investment is significant at 10 percent indicating that an increase in the level of investment will lead to a 1.2 	Massa, 2011; Onwumere, 2013; Deloitte Reports, 2015; Begum, 2013; Nzomo, 2014

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>percent increase in GDP value in Nigeria. Meanwhile agribusiness output is statistically significant at 1 percent and positively related to GDP</p> <p>Strong evidence also indicates that agricultural value chain strengthening and private sector development increases incomes:</p> <ul style="list-style-type: none"> • In Kenya, the ability of agribusinesses to source higher volumes owing to small business loans resulted in a tenfold increase in incomes • In Kenya, 80% of mango farmers were part of the PPP, 'Project Nurture' programme and, on average, SHF income from mango doubled. • In Bangladesh, the non-contract and contract poultry farm earned 76,653 and 127,833 taka per year, respectively, only from poultry enterprises. Contract farmers satisfied 55% of their total income from poultry production. <p>A low strength of evidence somewhat supports the hypothesis that agricultural value chain strengthening and private sector development in agriculture/agri-business lead to economic diversification:</p> <ul style="list-style-type: none"> • In Kenya, the loans advanced to farmer groups enabled them open consumer shops where they stocked farm inputs and retailed them to members at subsidized prices. The farmer groups were also able to purchase processing machines for value addition of their produce which enabled them to fetch better prices and also differentiate their products and widen their market outlets. Value added products also had a longer shelf life. 	
3c	Does private sector development and agricultural value chain strengthening in agriculture lead to more jobs – direct and indirect?		 (Evidence from SSA, Thailand,	<p>Private sector development and agricultural value chain strengthening in agriculture generates employment, direct as well as indirect, although the extent of contribution of each type is unclear.</p> <p>Strong evidence supports the hypothesis that private sector development in agriculture generates employment:</p>	IFC Reports 2012 (Ukraine and Tunisia); Watanabe, 2009

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
			and Tunisia and the US)	<ul style="list-style-type: none"> In Tunisia, a million dollar investment in food processing created 584 direct and indirect jobs In the case of Thailand, for the period 1990-2000 not only was the number of employees per value added (1,000 baht) for agro-processing at or above the mean for manufacturing overall, the number of poor employees per value added in the agro-processing industry was substantially greater. The figures for food products (and the smaller wood and wood products sector) were more than double those of the average of the manufacturing industry, “implying that the agro-processing industry, particularly the food industry, tends to hire a greater number of the poor than other manufacturing industries An IFC study of the impact on jobs of an agribusiness investment in Ukraine between 2009-2011 also showed that for every direct job created through the investment, 5-10 indirect jobs²¹ were created due to improvements in related businesses (e.g.: suppliers, construction contractors, etc.). 	
3d	Does private sector development and agricultural value chain strengthening in agriculture lead to food security?		 (Mostly SSA and South Asia – India and Bangladesh)	Private sector development and agricultural value chain strengthening in agriculture improves household food security, reduces on farm losses of crop, and increases yield and productivity, conditional on access to mechanization, and increased household expenditure on food when incomes increase. A high strength of evidence indicates that private sector development has a positive impact on yields and productivity: <ul style="list-style-type: none"> In a PPP in Cote de Ivore, preliminary evidence from the pilot suggests that, with Yaanovel’s support, smallholder paddy and rice seed farmers can improve their productivity by up to 30% and 60%, respectively In Rungwe, annual green leaf production has increased fivefold from 3,774,912 kg (2000/01) to 15,285,451 kg (2004/05) 	Omotilewa, 2018; Tesfaye 2018; Dalberg and Grow Africa Report 2015; Ton, 2013; Usman, 2017

²¹ Multiplier varies according to the year job creation is considered from



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>Substantial evidence supports the hypothesis that household food security improves with private sector development and agricultural value chain strengthening in agriculture:</p> <ul style="list-style-type: none"> • In Uganda, a 21% increase in storage period for consumption was observed, which could have a significant impact on a household's ability to feed itself. • In Ethiopia the use of improved storage increased the probability of consuming a minimum acceptable diet by about 7 percentage points for user households. Use of improved storage technology lowered the probability of reporting food insecurity by 20 percentage points. • A high quality systematic review noted an increase in food security indicated by a rigorous household survey (without a counterfactual) resulting from a business plan support grant that increased value added activities conducted by farmers <p>There is little research studying this, but existing evidence supports the pathway to national food security:</p> <ul style="list-style-type: none"> • There is positive and statistically significant impact of both public and private R&D investments on food security globally. Private sector agricultural R&D investment has higher impact as compare to public agricultural R&D investment. <p>A medium strength of evidence supports reduced food wastage:</p> <ul style="list-style-type: none"> • In a food park in India, the wastage of agriculture produce has gone from 40% (earlier levels) to 10% (current levels) for fruits such as mango, guava and papaya. • In Project Nurture, post-harvest losses at the farmer level reduced from 46% to 15%, a significant drop in losses. However, given that production approximately doubled, halving the PHL percentage meant that actual tons of PHL remained unchanged. • Reducing PHL to a total of only 5% was a positive spillover benefit from a successful intervention where SHFs are included in anchor buyer supply chains. Outside of the Impala beer 	

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				ecosystem, however, losses still remain significant (~30%) and smallholders do not have sufficient access to markets.	

4. Reduced inequalities

To test this hypothesis, we examined 4 main research questions related to the hypothesis that investments in specific agricultural value chains or parts of the agricultural value chain are leading to reduced inequalities. We screened 54 studies, 30 were included; the geographical coverage is Sub-Saharan Africa, Latin America, South Asia, and South-East Asia (Indonesia and Philippines). The table below outlines the findings for each main research question as well as the conditionalities:

Exhibit 32: Inequality evidence gap findings

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
4a	Does agricultural value chain strengthening lead to reduced inequalities?			<p>There is mixed evidence for the impact of agricultural value chain strengthening measures on reducing gender inequalities but positive evidence for the impact on income inequality.</p> <p>Multiple studies have demonstrated that women subsistence farmers are disadvantaged by modern agricultural value chains, in the absence of gender-targeted solutions. A study in Mozambique showed mixed impact of a gender-neutral dairy value chain project. At the end of the program, both women and men participants had increased their income from dairy production. However, men controlled the majority of dairy income and they had come to own more and higher value assets than women. A GIZ report found that women tend to be less integrated in agricultural value chains than men. Their lack of access to markets, as well as social norms, impede their interaction with other agricultural value chain actors. Further, gender differences in literacy and education result in lower skilled roles in agricultural value chains for women.</p> <p>In general, multiple studies have demonstrated that agricultural value chain strengthening can boost rural incomes. For agricultural value chain investments to have maximum impact, ecosystem factors such as access to finance, land tenure security and market information systems are essential. E.g., a medium quality empirical study in Indonesia found that agricultural value chain strengthening programs in the cocoa agricultural value chain coupled with farmer extension stimulated economic activities in rural areas and increased community income. In a survey among traders in this study, it was found that 76% of traders increased their profits and 69% of their employees were benefitting from increased income. An increase in cocoa yield and quality also benefitted farmers.</p>	Farnworth et al, 2015, Padjung et al, 2018, Mehra et al, 2008

	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>Conditionalities: Gender-smart solutions in promoting female entrepreneurship through improved access to land, finance, training, business development services and technical support. Furthermore, beyond investments in parts of the agricultural value chain, ecosystem investments such as training and market linkages are essential to enable farmers take advantage of the agricultural value chain investments.</p>	
4b	Do investments in specific agricultural value chains or specific parts of the agricultural value chain lead to reduced inequalities?	↑	»»»	<p>The evidence demonstrates that investments in specific agricultural value chains or specific parts of the agricultural value chain can reduce inequalities, the agricultural value chains with high impact will vary from country to country. Investments in the agricultural value chain can lead to reduced inequalities by increasing income and reducing the poverty incidence. An empirical study that focused on the horticulture value chain in Senegal found that the Gini coefficient in the Senegal River Delta region decreased by 4.2% from 2006 to 2013 while the Gini coefficient in the rest of the country increased by 1.1% during the same period. At the same time, the incidence of poverty decreased by 19.2% in the treatment group and the incidence of extreme poverty by 6.7%. these improvements were primarily due to increase in the incomes of wage workers in the poorest half of the population by 30% and in the poorest 10% of the population by 53%.</p> <p>A key way to increase income and reduce inequality is by boosting market participation, this cuts across all parts of the agricultural value chain. An impact study among 800 smallholder farmers in Uganda found that the average annual income of sorghum-farming households supplying a private brewery which engaged in contract farming to be more than double that of a control group. (Sustainable Food Lab, 2017)</p> <p>A medium-quality qualitative study that focused on the cassava agricultural value chain found that investments led to improvement in household income for both male and female headed households (Ahmadu et al, 2017).</p> <p>Overall, women are more included in the production part of the agricultural value chain compared to the processing and marketing parts of the agricultural value chain. Due to other household chores that women are mostly involved, women are less likely to actively participate in processing. For example, a study</p>	Van de Broeck et al, 2016, Kolb et al, 2016 Ahmadu et al, 2014, Sustainable Food Lab, 2017



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>found that processing and marketing are dominated by men because the few processing units are allocated far away from their homestead which requires a long walk. In a village where the processing unit was 8 to 10km away from the homes, only 20% of the users were women, whereas in another village where the processing unit was 0-0.5km way from home, 70% of the users were women.</p> <p>Conditionalities - For agricultural value chain investment to benefit the rural poor, these investments need to complement other efforts that improve the policy environment, alleviate resource constraints, and build local capacity for responding to changing technological and economic challenges and opportunities. Educating farmers (with targeted attention at women farmers) on technologies and promoting of ownership of processing equipment are also important to reducing inequalities.</p>	
4c	Do investments that focus on women (in specific agricultural value chains and parts of the agricultural value chain) have an effect of productivity and profitability?	↑	»»	<p>There is evidence from case studies across multiple geographies that gender-specific agricultural value chain investments can improve women farmers' yields and productivity by 10-80% for different crops and, by extension, income.</p> <p>Studies indicate an increase in yields when women use similar inputs to male farmer levels resulting in an increase in profits. A medium-quality study demonstrated that by increasing women's land area and fertilizer usage to match male farmers' levels, yields could increase by 10.5% and 1.6% respectively. Similarly, in Kenya, a nationwide information campaign targeted at women as part of a national extension project, resulted in the yield of maize increasing by 28%, beans by 80% and potatoes by 84%. A low-quality review found that a program by Primark which employed only women farmers in the cotton agricultural value chain experienced benefits in the form of increased yields (12% per year) and a 200% increase in the average amount of profit compared to the time before the women enrolled in the programme.</p> <p>Conditionalities: Improving women's access to inputs and support services such as land, labor, technology, extension services and credit.</p>	SIDA, 2015, Kolb et al, 2016, Mehra et al, 2008, Croppenstedt et al, 2010
4d	Do investments in the agricultural value chain lead to greater	↑	»»»	<p>The evidence demonstrates that investments in the agricultural value chain can lead to macro-economic improvement, particularly in rural areas. A medium-quality empirical study in the horticulture value chain in Senegal found that poverty reduction is highest among households with employees in the</p>	Van de Broeck, 2016, Martens et al, 2017, AFDB, 2015



	Research question	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
	<p>macroeconomic improvements, particularly for the BoP and people in rural areas, than investments in other sectors, such as manufacturing and services?</p>			<p>horticultural export sector. The incidence of poverty and extreme poverty among these households reduced from 54% to 25% and from 30% to 15% respectively, resulting in significantly lower poverty rates than for self-employed households. The same study showed that employment increased by 12% and overall labor market participation increased by 17%.</p> <p>A high-quality quantitative study in Benin found that participation in contract-farming doubles rice income and increases total household income by 17%. The authors also find that participation in rice contract-farming results in positive technical and managerial spillover effects on non-farm activities and an improved ability of smallholder farmers to invest in other farm activities (Martens et al, 2017).</p> <p>A medium-quality study in Nigeria found that the efficient delivery of inputs to 6 million rice farmers combined with other interventions saw a sharp growth in rice production. Yields increased by over 150% and national paddy rice production rose by an additional 7 million MT during the three-year period. The nation reached 85% sufficiency in rice production and 1.7million jobs were created. (AFDB, 2015)</p> <p>Investments in the agri value chain also have the potential to create more jobs for the poorest relative to other manufacturing activities. In the case of Thailand, for the period 1990-2000 not only was the number of employees per value added (1,000 baht) for agro-processing at or above the mean for manufacturing overall, the number of poor employees per value added in the agro-processing industry was substantially greater. The figures for food products (and the smaller wood and wood products sector) were more than double those of the average of the manufacturing industry, “implying that the agro-processing industry, particularly the food industry, tends to hire a greater number of the poor than other manufacturing industries</p> <p>Conditionalities: Creating market linkages for subsistence farmers. Extension services and the provision of high-quality inputs. Public investment in infrastructure such as roads and power</p>	





5. Climate change mitigation and resilience

To test this hypothesis, we examined 4 main research questions related to the hypothesis that sustainable agricultural methods, reduced waste and forest conservation/restoration lead to climate change mitigation and resilience. We screened 76 studies and 41 were included. The geographical coverage includes Sub-Saharan Africa, South Asia (India and Nepal), Australia and South America (Brazil and Mexico). The table below outlines the findings for each main research question as well as the conditionalities:

Exhibit 33: Climate change evidence gap findings

	Research questions	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
5a	Do investments in sustainable agricultural methods and forest conservation lead to mitigation of adverse climate effects?			<p>The findings indicate that sustainable agricultural methods and forest conservation lead to the mitigation of adverse climate effects, through organic farming, yield improvement and agro-forestry.</p> <p>A wide range of evidence exists regarding the mitigation potential in the agriculture sector. This is partly a consequence of the diversity of sustainable agricultural methods such as organic farming, conservation agriculture, sustainable intensification and agro-forestry whose GHG emission profiles can vary. The literature covers 3 main avenues for GHG avoidance in agriculture: a) organic farming, b) yield improvement, c) agro-forestry. Organic farms have a lower carbon footprint than conventional agriculture. For example, a medium-quality empirical study in Australia found that, compared to organic farms, conventional farms use 56% more energy, 500% more water and also use more energy-intensive inputs, such as fertilizers and pesticides; on average, they emit 111% more GHG than organic farms do. Sustainable intensification strategies are backed by research that indicates that past investments in yield improvements have compared favorably with other mitigation strategies, by offsetting forest clearing. A medium-quality quantitative study found that the net effect of higher yields has avoided emissions of up to 161 gigatons of carbon (GtC) since 1961. For agroforestry, a medium quality study noted that Agroforestry offered the highest potential for carbon sequestration in non-Annex I countries and can play an essential role in mitigation – agroforestry systems contain 50–75 Mg C ha⁻¹ compared to row crops that contain <10 Mg C ha⁻¹. Thus converting row crops or pastures to agroforestry systems can greatly enhance the carbon stored in aboveground biomass.</p>	Wood et al, 2006, Smith et al, 2008, Tilman et al, 2011, Pretty et al, 2006, Dickie et al, 2014, Forstater et al, 2013.

	Research questions	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>While forest conservation can reduce absolute emissions, these investments are unlikely to have an impact on net emissions reduction unless incentive structures can offset the benefit gained from deforestation. A medium-quality report that focused on the effectiveness of reducing emissions from deforestation and degradation (REDD) found that REDD leads to climate change mitigation but the scale of the problem is so huge that even a USD1 billion investment was insufficient to shift incentives in a large economy such as Brazil, or offset revenues from activities that drive deforestation and degradation.</p> <p>Conditionalities: Sustainable agricultural methods, to have maximum intended climate impact, should go hand in hand with wider technology usage, adoption of adaptive management practices, insurance and credit access (and other economic incentives that increase farmer willingness and propensity to adopt), and extension services. Forest conservation investments could be sustainable with pay-for-performance schemes, low cost local management practices, and multi-stakeholder governance structures, but this has to be explored further.</p>	
5b	Do investments in sustainable agricultural methods and forest conservation lead to climate resilience?			<p>Many studies indicate that investment in sustainable agricultural methods and forestry can improve climate resilience through better moisture retention, drought resistant seeds/production methods, improved soil fertility and heat tolerance in diverse geographies in Sub-Saharan Africa and South Asia.</p> <p>Strong evidence supports the hypothesis that sustainable agroforestry leads to increased climate resilience. Two medium-quality studies in Kenya, and one medium-quality study in Vietnam concluded that agroforestry systems contributed to 25-40% higher water retention than regular crops, which increases climate resilience of smallholder farmers during periods of long droughts and flooding.</p> <p>The use of climate-resilient inputs by farmers can prevent the impact of climate hazards. A medium quality study in Uganda demonstrated that the use of climate-resilient varieties of rice seeds with improved heat tolerance, lower maturation times and drought resistance improved yields of smallholder farmers even in situations where climate hazards, and especially droughts, already negatively impacted actors along the rice value chain in the country.</p> <p>Studies comparing sustainable farming with conventional farming indicate that sustainable farming leads to increased climate resilience. Two medium-quality and one high-quality study in Sub-Saharan Africa compared the impact of sustainable</p>	Beyene et al, 2017, Nguyen et al, 2013, Palm et al, 2014, Mbow et al, 2014, Stevenson, 2014, Pound, 2018, Howden, 2007, Dekens et al, 2016.

	Research questions	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>agricultural methods such as organic farming and conservation agriculture with conventional farming. They concluded that sustainable methods preserved soil fertility and retained more water in the dry season, building climate resilience among smallholder farmers.</p> <p>Conditionalities – The provision of extension services to educate farmers on the importance and usage of improved varieties and new management practices, innovative financing mechanisms and economic incentives that ease the constraints of the worst off farmers, and technological support are necessary conditions to realizing climate resilience through sustainable agricultural practices.</p>	
5c	Do investments in specific parts of the agricultural value chain lead to more climate resilience?			<p>Climate vulnerability tends to be more concentrated at the production end of agricultural value chains. In Uganda, a medium-quality study that assessed the climate vulnerability of different actors along the coffee value chain, found that both farmers and processors were the most vulnerable to adverse climate shocks since they had limited diversification potential and weak organizational capacity. Farmers also had to bear the negative effects of climate hazards along the entire agricultural value chain in the form of lower prices (most actors along the chain pass on the losses incurred from climate hazards to farmers in the form of lower price).</p> <p>Overall, investments in parts of the agricultural value chain such as storage across all value chains will lead to climate resilience. E.g., a medium-quality study found that investments in storage and warehousing facilities could significantly reduce post-harvest losses and improve climate resilience and food security.</p> <p>Conditionalities: Support of the government and development partners in ensuring greater sensitization and awareness on climate risk management for all value chains and among the agricultural value chain actors contribute to increasing climate resilience for smallholder farmers and agricultural SMEs.</p>	Dekens et al, 2014, Cooper et al, 2008, Dekens et al, 2012, Kumar et al, 2017.
5d	Does less waste lead to increased income for farmers and agribusinesses leading to climate resilience?			<p>Lower post-harvest losses result in increased income due to the extra revenue earned from higher sales. However, the cost of incorporating post-harvesting practices that result in lower post-harvest loss can exceed the benefits of reduced post-harvest losses for small-scale farmers in SSA.</p> <p>The value of grains lost annually in SSA alone has been estimated at USD4 billion. This exceeds the value of total food aid in the region over the last decade. Thus, reducing food loss has been hailed as an important way to increase food security, increase</p>	Medeiros et al, 2012, Kumar et al, 2017, Lipinski et al, 2013, Chegere, 2018, Mills, 2017.

	Research questions	Direction of evidence	Strength of evidence	Summary of findings	Relevant literature
				<p>income streams for smallholder farmers and mitigate climate change. On the other hand, a medium quality study in SSA conducted a cost-benefit analysis of the adoption of post-harvesting practices. The study found that their adoption is economically beneficial to society by improving food security, increasing income and preserving resources used in production (land, energy and water). However, the study also found that the cost of adopting modern storage and handling practices at the farm-level can exceed the benefits of reduced waste for small holder farmers. The author presumes that this is primarily due to the majority of post-harvest losses occurring off-farm during the storage and transport of grains, thereby not necessarily supplementing farmer incomes.</p> <p>There is limited evidence showing that increased income leads to reduced vulnerability to shocks. Nevertheless, environmental management can be improved when the incomes of farmers are increased significantly. For example, a low-quality study found that when successful private sector enterprises that reduce food loss were successfully established in Ghana, the Philippines, and Central America, the incomes and skill sets of all the farmers involved with these enterprises increased markedly. Following this, the farmers' management practices were improved, ensuring that ecosystems supporting their farming ventures were sustainably managed.</p> <p>Conditionalities: Building resilience through the pathway of increased income is only possible when there are substantial on farm losses, and the benefits from their sale outweigh the cost of storage. Economic incentives also improve the adoption of storage. Extension improves the adoption and usage of storage.</p>	

ANNEX B: SUMMARY OF FINDINGS FROM THE AEF EVIDENCE MAPPING








The results of the AEF evidence mapping are relevant to IDF's energy investment theme. We summarize the findings here. For more detail, please see the AEF evidence mapping report.

The hypotheses used for the AEF evidence mapping are:

1. **Mini-grids:** An increase in the number/size of renewable energy mini-grids leads to improved access to energy for off-grid consumers and enables productive energy use by micro-enterprises, leading to economic benefits, better quality of life and reduced greenhouse gas (GHG) emissions
2. **Solar Home Systems (SHS):** Adoption of SHS by households and micro-enterprises leads to increased HH/MSME production (productive use), leading to economic benefits, better quality of life and reduced GHG emissions
3. **Transmission and distribution (T&D):** There is a strong role for the private sector to play in increasing transmission and distribution capacity and efficiency, leading to economic benefits, better quality of life and reduced GHG emissions
4. **Clean cookstoves:** Investments in cookstove producers/distributors lead to greater adoption of efficient cookstoves and LPG cookstoves and to fuel reaching the last mile consumer, leading to economic benefits, better quality of life and reduced GHG emissions
5. **Climate:** Renewable energy resources used to provide access to energy are replacing other dirtier/higher GHG forms of energy
6. **Economic growth:** Improved access to energy leads to increased economic growth and quality of life in the country

Reader guidance/legend: For each hypothesis, we scanned the literature to understand both the *strength of evidence* (how much good-quality evidence is available) and the *direction* of the evidence (supportive of the hypothesis, in contradiction or mixed). We summarized the evidence using symbols – these are explained in the exhibit below.

Exhibit 34: Legend for summary of findings

Direction of evidence		Strength of evidence	
	Positive		High
	Slightly positive		Medium
	Mixed		Low
	Negative		

Synthesis of findings

Hypothesis 1: Mini-grids

RE mini-grids can improve access to energy (and thereby quality of life, especially through more comfort and flexibility for women) in densely populated areas if they do not have to compete with subsidized fossil fuels; hydropower has contributed the most to connections and capacity, but solar is fast growing. However, business model viability is questionable and depends heavily on finding on anchor clients.

- A moderate amount of evidence indicates that RE mini-grids increase access to energy for unconnected households. The impact of RE mini-grids on access to energy is dependent on factors such as 1) the extent of diesel subsidies provided by governments; 2) population density- mini-grids are more viable in areas with high population density; 3) the type of power source- hydro, biomass or solar; and 4) affordability and the financial viability of the mini-grid, which can be improved by factors such as the presence of an anchor client.
- Substantial evidence indicates positive impact of access to energy through RE mini-grids on quality of life, especially in terms of women’s flexibility in managing household chores, and in terms of increased access to information and communication technologies
- While the contribution of mini-grids on business expansion and new business creation is uncertain, and limited at best, some evidence shows that in the limited instances where mini-grids contribute to business expansion and new business creation, they also marginally stimulate economic growth
- Substantial evidence indicates that RE mini-grids can reduce GHG emissions

Exhibit 35: RE Mini-grids: Summary of Findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
H1: Increase in number/size of renewable energy mini-grids leads to improved access to energy for off-grid consumers and enables productive energy use by micro-enterprises, leading to economic benefits, better quality of life and reduced GHG emissions.			
1a	Mini-grids have the potential to accelerate access to electricity through added capacity and new connections among unelectrified populations to a limited extent.	↑	»»
1b	Affordability of mini-grids for low income populations is uncertain despite being widely researched, and differs by population density and the source of energy.	→	»»»
1c	RE mini-grids are more reliable than existing sources of energy like diesel generators, Solar Home Systems, and kerosene. However, they are less reliable than a well-functioning grid.	↑	»»»
1d	RE mini-grids currently have low financial sustainability , with uncertainty on their future potential to generate returns, and a strong reliance on grants and subsidies.	↓	»»»
1e	There is an increase in energy usage among households connected to RE mini-grids.	↑	»»»
1f	There is uncertainty around whether RE mini-grids support the productivity and expansion of existing rural businesses . Energy source emerged as an important determinant of impact.	→	»»»
1g	RE mini-grids may contribute to new business creation , but there is no evidence to suggest that new business models are created.	↑	»»
1h	RE mini-grids replace dirtier forms of energy, thus, leading to lower GHG emissions . There is insufficient research to model the GHG impact of growing energy demand being met by mini-grids instead of traditional sources.	↑	»»
1i	RE mini-grids marginally stimulate economic growth through business expansion, job creation, and eventually, contribution to GDP.	↑	»»
1j	RE mini-grids lead to an overall improvement in the quality of life stemming from new connections.	↑	»»»
1k	There is not enough evidence to conclusively establish the impact of RE mini-grids on gender outcomes . Existing evidence shows positive comfort and flexibility outcomes, but mixed public safety outcomes.	→	»»

Hypothesis 2: Solar Home Systems

Solar Home Systems (SHS) positively impact access to energy and quality of life, and they support productivity increases in some settings; however, affordability for users remains a challenge. Economic impact may not be large enough to affect the country as a whole and has not been well studied. Gender impact outside of household flexibility is unclear.

- Access to SHS improves access to energy among rural, low income populations to some extent, with potential for further penetration. Substantial evidence shows that, compared to traditional sources (e.g.: kerosene lamps), SHS-supplied households use more hours of energy, and climb the energy ladder to higher tiers
- Similarly, it is evident that this access translates into improved quality of life, specifically through increased access to entertainment and better household safety outcomes
- Within households, substantial evidence shows that SHS can increase productive activity. However, while the cost of energy itself is lower with SHS than with traditional sources, the cost of the system is often prohibitive.
A small subset of microenterprises that depend primarily on lighting (e.g.: tea shops, grocery stores) can raise productivity and profits through the use of SHS.
- A key factor that determines the effect of SHS on productivity is the capacity of the device – larger capacity devices appear to produce the most significant effects
- Few studies track the impact of SHS on GDP, business creation, and induced jobs, with uncertainty around impact where they do. One exception is the clear potential of the SHS value chain to create jobs
- SHS replace dirtier/more polluting forms of energy
- Few studies link SHS to gender outcomes; and existing studies show mixed impact, with women’s flexibility increasing, but spending power potentially reducing

Exhibit 36: SHS: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
H2: Adoption of SHS by households and micro-enterprises leads to increased HH/MSME production (productive use), leading to economic benefits, better quality of life and reduced GHG emissions.			
2a	SHS improves access to energy among rural and low income populations to a limited extent, but this is growing.	↑	»»»
2b	SHS leads to an improvement in the quality of lighting, supports increased reliability of energy supply and increased productive activity for households . Larger capacity systems significantly increase productivity.	↑	»»»
2c	SHS leads to increased energy usage for rural businesses compared to kerosene and paraffin lamps. There is limited evidence of increased energy usage when compared to other sources of power.	↑	»»
2d	A small subset of microenterprises increase their productivity and profits through the use of SHS.	↑	»»»
2e	While the cost of energy itself is lower with SHS, the cost of the system is often prohibitive.	→	»»
2f	The impact of SHS on the creation of new rural businesses and business models is uncertain, and the extent of new business creation is limited or negligible where some impact is seen.	→	»»
2g	SHS replaces more polluting forms of energy, ie., similar energy needs are met with lower GHG emissions .	↑	»»»
2h	There is limited evidence, showing uncertain impact of SHS on economic growth either through on GDP, business creation or induced jobs. However, the SHS value chain has the potential to create direct jobs.	→	»»
2i	Access to energy through SHS has translated into improved quality of life , through increased access to entertainment and better household safety outcomes.	↑	»»
2j	There is not enough research to establish the effect of SHS on gender outcomes , and the existing research is inconclusive on the overall impact, as it supports increased flexibility for women, but indicates reduced purchasing power	→	»»

Hypothesis 3: Transmission and distribution

Private transmission and distribution investments can contribute to access to energy; they may contribute to better quality of life and economic impact; however, contributions to GHG reduction have not been clearly established.

- Substantial evidence supports the impact of improved T&D, through private investments, in increasing access to energy for households (especially through reliability and stability of electricity for those connected to the grid). Private sector investments can improve payment collection efficiency and operational efficiency of the utilities. However, the

presence of an independent regulator in assessing the performance of the private utilities is a critical supporting factor

- There is some evidence showing that improved T&D, through private investments, leads to better quality of life, through increased flexibility within the home
- A moderate evidence base indicates that improved transmission and distribution, through private investment, can stimulate economic growth. Beyond a loss in direct jobs due to increased labour productivity, little is known about the impact on economic activity, indicating a need for further research
- There is little evidence (and existing evidence is mixed) on the impact of improved T&D in reducing GHG emissions. The impact of expanding T&D and improving access to energy on GHG emissions is unknown, as existing studies focus on generation
- Little evidence addresses the specific case of connecting stranded RE generation assets

Exhibit 37: T&D: Summary of Findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
H3: There is a strong role for the private sector to play in increasing transmission and distribution capacity and efficiency, leading to economic benefits, better quality of life and reduced GHG emissions.			
3a	Private sector investments only lead to improved transmission of electricity if there are independent regulators.	→	»»
3b	Private sector investments lead to improved distribution of electricity – reduced power cuts, less dimming, and reduced distribution losses.	↑	»»»
3c	Privatization of transmission and distribution leads to increased access to energy for households and higher electrification rates.	↑	»»»
3d	There is insufficient evidence on the impact of privatization of transmission and distribution in reducing GHG emissions , and the existing evidence is inconclusive, indicating mixed outcomes	→	»
3e	Privatized transmission and distribution utilities stimulate economic growth through increased income generation and productivity. However, direct employment reduces as a result of increased efficiency.	↑	»»
3f	Private sector investments in transmission and distribution lead to better quality of life through improved health outcomes, more time flexibility and better income generating opportunities.	↑	»»

Hypothesis 4: Clean cookstoves

While clean cookstove (CCS) adoption clearly has high potential for positive health and climate impact, low affordability of CCS and fuel, especially in rural settings, constrains adoption. Research tends to focus on the demand side; the supply side is less well understood, especially for LPG cookstove and fuel distribution.

- At the macro level, significant evidence suggests that the adoption of CCS has the potential to avert deaths and disability-adjusted-life-years (DALYs) over the lifetime of stove usage. At the household level, there is uncertainty around individual improved health outcomes for women and children, despite being widely studied. This is partly because achieving quality of life outcomes depends on adopting CCS as at least the primary stove (even if not sole stove) used for cooking within a household over its lifetime
- Substantial evidence indicates that adoption of clean cookstoves does not reach the point of exclusivity, and in many cases, even that of primary usage in the long term. A significant barrier to adoption is low affordability of CCS by rural households, which can be reduced by easing liquidity constraints through subsidies or credit

- Specifically, for LPG cookstoves, there is little evidence on the extent and potential of private sector distribution networks, and consumer access to distribution points for stoves. Trends indicate that the high cost of LPG fuel is a bigger concern for rural consumers
- The use of cleaner fuels and CCS could contribute to GHG emissions reduction at the country level – these models however assume high rates of long-term stove adoption

Exhibit 38: Clean cookstoves: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
H4: Investments in cookstove producers/distributors lead to greater adoption of efficient cookstoves and LPG cookstoves and to fuel reaching the last mile consumer, leading to economic benefits, better quality of life and reduced GHG emissions.			
4a	Availability of clean cookstoves (CCS) does not always lead to exclusive adoption of CCS and in some cases not even primary usage in the long term.	→	»»»
4b	Private sector distributors have minimal effect on immediate adoption of CCS due to high upfront stove costs. However, this barrier of high upfront costs of CCS can be overcome with economic incentives.	→	»»»
4c	There is limited evidence on the effect of private sector distribution of LPG cookstoves on consumer access . Overall findings indicate that accessibility is low; studies highlight high costs of LPG fuel for rural consumers.	↓	»
4d	LPG fuel companies find it financially unsustainable to distribute LPG fuel in rural areas. Studies show that policy support from the government can help overcome this difficulty.	↓	»»»
4e	Adoption of CCS could contribute to GHG emissions reduction at the country level.	↑	»»»
4f	Adoption of CCS leads to improved quality of life outcomes (time savings and reduced DALYs) except in the case of health outcomes. However, achieving these outcomes depend on adopting CCS as at least the primary stove (even if not sole stove) used for cooking within a household over its lifetime. There is uncertainty around health outcomes as the link between reduced household air pollution and better health is unclear	→	»»»

Hypothesis 5: Climate

Renewable energy has high potential for climate mitigation (GHG avoidance), but technology cost limits large-scale deployment in developing countries.

- A substantial amount of evidence indicates that renewable energy has the potential to avert absolute amounts of GHG at its current scale of deployment
- There is also some evidence to indicate that, at the regional level, renewable energy (RE) deployment could reduce GHG emissions by more than 10% compared to a business as usual scenario
- A wealth of evidence speaks to the abundance of renewable energy resources in developing countries, but also indicates that affordable technology is yet to fully tap into this potential, limiting large scale deployment. One high quality global potential assessment study concluded that while RE could meet 16 times the primary energy demand, more investments into technology are required to take advantage of RE sources
- Little research has been published on the emissions reduction contribution of renewable energy in emerging markets, especially in Sub Saharan Africa, indicating the need for further research here, since policy contexts, project implementation efficiency, the largest sources of pollution, etc. would differ from developed countries

Exhibit 39: Climate: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
H5: Renewable energy resources used to provide access to energy are replacing other dirtier/higher GHG forms of energy.			
5a	RE deployment has the potential to reduce GHG emissions by more than 10% compared to traditional sources. However, most of the relevant studies are in developed countries; the case for developing economies is not established.	↑	»»»
5b	Affordable technology has not maximized the renewable energy potential in developing countries, limiting large scale deployment. The potential for scale up is dependent on the renewable energy source.	→	»»»
5c	Existing data and research do not establish that renewable energy has led to overall inclusive green growth in developing countries – the share of renewable energy has decreased.	→	»»»

Hypothesis 6: Economic growth

The link between access to energy and economic growth is clearly established, but its impacts on health and education require further exploration.

- Substantial evidence shows a positive relationship between energy access and GDP growth
- A wealth of evidence shows that reliable access to energy contributes to business expansion through increased productivity and improves ease of entry for new businesses
- Significant evidence indicates that women’s workforce participation increases with access to electricity. Outcomes tracking quality of life beyond improvements in household incomes and expenditures (e.g.: health, leisure time, etc.) require further study

Exhibit 40: Economic growth: Summary of findings

S.N	Summary of findings	Direction of evidence	Strength of evidence
H6: Improved access to energy leads to increased economic growth and quality of life in the country.			
6a	Reliable access to energy contributes to business expansion through increased productivity and improved ease of new business entry, thus, leading to economic benefits .	↑	»»»
6b	Electricity access improves quality of life overall. Studies also indicate increased labor force participation among women. Educational outcomes vary across studies.	↑	»»

Gender

Of all the hypotheses reviewed, the ones on mini-grids, SHS, CCS, and economic growth have implications on gender outcomes.

- Considerable evidence supports increased flexibility within the household and increased productive activity among women when households are connected to electricity (through mini-grids, SHS, or other sources).
- Village level electrification impacts women's employment positively
- Substantial evidence indicates increased time savings for women using CCS (compared to traditional stoves)
- The results for health and safety outcomes are more uncertain despite being studied extensively – while SHS, RE mini-grids, and CCS reduce Household Air Pollution (HAP), further testing is required to understand conditions that translate reduced HAP into better health outcomes
- Across SHS and mini-grids, there a moderate strength of mixed evidence on public safety – some studies record an improvement in the perception of safety with more lighting, others record an increase in assaults stemming from nightlife, or record no observed effects

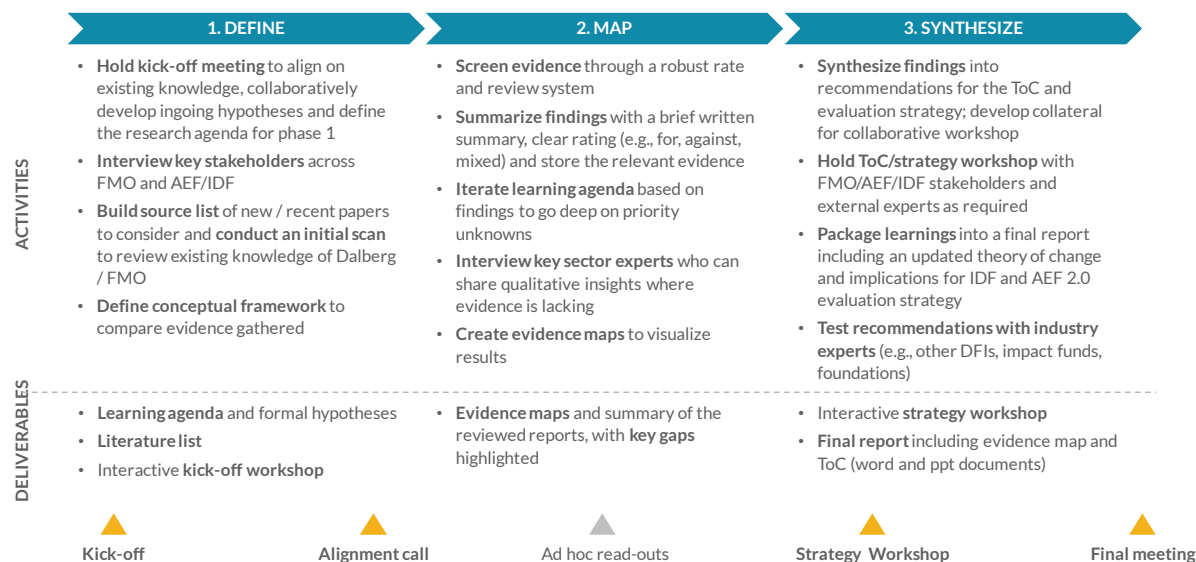
Few or no studies evaluate the impact of these interventions on women's decision making within the household, their access to information, or their access to and use of technology.

ANNEX C: METHODOLOGY

Our approach

Our overall approach spanned three key phases designed to develop a deep understanding of the evidence landscape for investments in access to energy, synthesize findings and develop recommendations.

Exhibit 41: Approach



1. Define

First, we interviewed key FMO experts and held a kick-off meeting in The Hague to prioritize causal links (and core assumptions) within the ToC. From this, we developed a set of initial hypotheses to test during research and thus set the research agenda. We built a preliminary source list of both foundational and recent papers to review, and we defined a conceptual framework to compare the validity and relevance of the evidence.

2. Map

We leveraged the defined research agenda to rapidly screen new evidence through a robust 'rate and review' system based on the screening questions developed in Phase 1. The questions were then translated into an evidence coding sheet to ensure the consistency and transparency of ratings. We then summarized findings with a brief written summary and clear rating (e.g., for, against, mixed, missing). At the end of each day, the team reviewed learnings and iterated the learning agenda accordingly to go deep on priority unknowns.

3. Synthesize

We synthesized findings from the evidence-mapping exercise into robust recommendations for IDF's theory of change and FMO's evaluation strategy. As part of this exercise, we will develop workshop collateral that effectively imparts findings to FMO's team (e.g., large posters, short presentations, worksheets etc.) and facilitates collaborative ideation for IDF's strategies (e.g., interactive exercises). We will also test recommendations with sector experts such as other DFIs, impact funds, foundations

etc., and then tweak the strategy based on feedback. For example, if other actors are already targeting a specific evidence gap, FMO can focus resources elsewhere.

Overview of Phase 1

In order to develop the hypotheses in Phase 1, we carried out a five-step approach:

- 1. Understand existing perspectives on agriculture investments in FMO:** Understand top priority areas for the agricultural value chain to gather initial views and perspectives of the team. This included reviewing previous IDF evaluations, agriculture and agribusiness sector reports, internal FMO documents on IDF and the gender and climate strategies.
- 2. In-person and phone discussions** to understand trends and discourse on current priority areas. These discussions helped to identify key impact pathways and investment priorities across the agricultural value chain. Over the course of three days, the following stakeholders provided relevant input for IDF:

Exhibit 42: Stakeholders engaged for IDF

S.No.	Name	Organization	Designation
1	Thelma Brenes	FMO	Evaluation Officer
2	Emilie Goodall	FMO	Manager, Development Impact and Sustainability, Strategy & Corporate Affairs Department
3	Stan Stavenuiter	FMO	Senior Evaluation Officer
4	Christiaan Broekman	FMO	Portfolio Analyst
4	Jacco Knotnerus	Independent Consultant	Advisor, IDF
5	Christopher Starmans	Ministry of Foreign Affairs	Policy Officer (outgoing)
6	Ivo Stoel	Ministry of Foreign Affairs	Policy Officer
7	Karen Maas	Erasmus Research Institute of Management	External evaluation panel member
8	Otto Genee	Ministry of Foreign Affairs	Senior evaluator; Evaluation panel member
9	Floor Van Oppen ²²	FMO	IDF Fund Manager

From our conversations with the different stakeholder groups, we gathered the priorities of these groups for the evaluation strategy:

Evaluation team: The evaluation team intends to use the evidence mapping for the following-

- Use the evidence mapping to answer some key questions such as, i) How to prioritize projects for evaluation; ii) Identify areas of rigorous research; and iii) Add to the body of knowledge (run full-scale evaluations to add to knowledge, rather than to collect evidence)
- Get more creative in types of evaluations, that is, move from impact evaluations and effectiveness studies to a broader range of methodologies

²² We engaged with Floor Van Oppen over the phone after our visit to The Hague.

- Test the links to the impact indicators such as socio-economic indicators and possibly to test FMO's model against evidence from the field
- Get clarity within FMO on what types of data can be used for what evaluation purpose – client data (usually costly and inefficient), model data, publicly available data

Fund management and investment team: The investment team intends to use the evidence mapping for the following-

- Test impact of investments in post-production activities across the agricultural value chain and forestry, given that going forward, the primary focus of IDF investments will move to agriculture investments
- Test the hypotheses around the development of local markets. While a lot is being produced, local value creation is often limited. Harnessing economic value within local economies through the development of integrated agricultural value chains which broadens activities from farming towards storage, processing and input distribution is important to the Ministry. Thus, gathering evidence on the agricultural value chain strengthening and the effect on local markets would be crucial for future IDF investments
- Integrate internally between the evaluation and the investment team by making the evaluation process a part of the investment cycle. The mapping will contribute to enabling the investment team to be onboarded with the ToC, define impact in investment proposals more clearly, and align with the evaluation team on the level of the ToC they are looking at (e.g.: output v outcome) while making investments

Ministry (DDE): For IDF, DDE has prioritized private sector-led local market strengthening, gender, and climate change as focus areas to gather evidence. The Ministry is primarily interested in the linkages from outcomes to impact. The evaluation strategy could also help inform what evaluation methods to deploy for government funds in the future.

3. **Workshop with investment teams** to understand anticipated investment trends, validate hypotheses, and map key priorities. The workshop was held with the core investment team as well as experts. In order to understand the future priority areas, we mapped out the current investments. Based on the type of agriculture of investments in the current IDF portfolio (by parts of the agricultural value chain), we asked the participants three main questions:
 - In what parts of the agricultural value chain do you see future investment opportunities?
 - Where do you see your investments creating impact?
 - What kind of impact do you think these investments would have across the impact metrics?

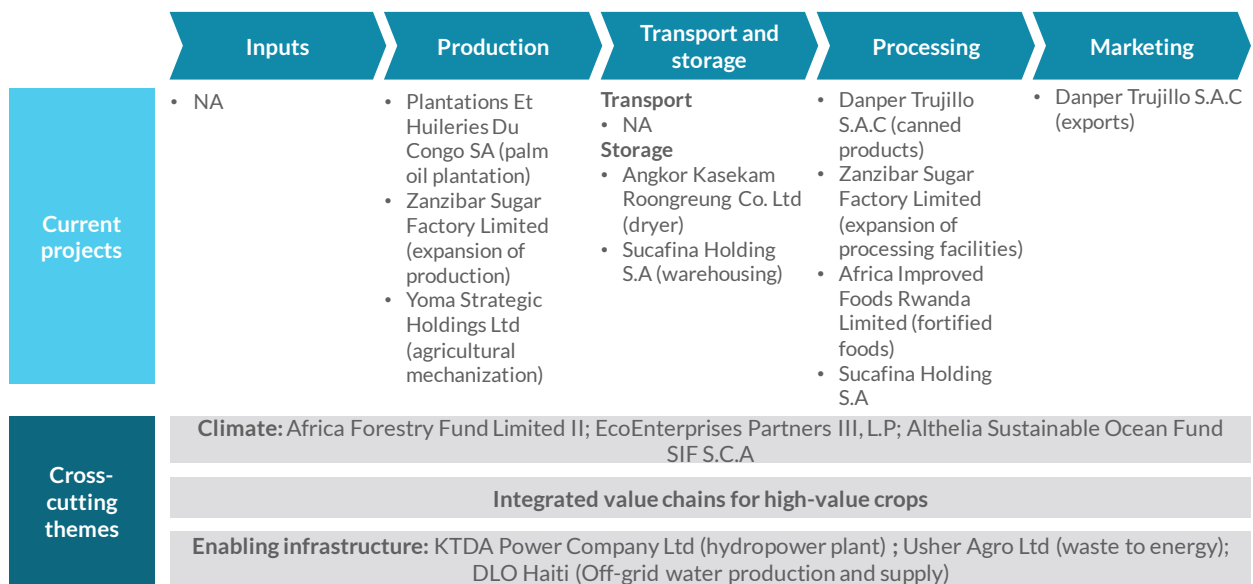
The workshop discussions indicated deep interests in strengthening the agricultural value chain and continued attention in sustainable forestry. Investments in agriculture will be aimed at plugging the gaps in the agricultural value chain particularly gaps in input distribution, storage and processing. Investments in agricultural production will be deprioritized except in situations where the company is vertically integrated and/or

closely interconnected with other companies operating in other parts of the agricultural value chain. The geographical focus will continue to be Africa, Asia and Latin America.

Furthermore, investments that have a strong climate and gender impact are of priority, given DDE’s focus on these issues. Thus, a consideration for climate and gender will be incorporated into the projects in which IDF invests. FMO has climate and gender strategies that serve as a framework for avoiding greenhouse gas emissions and for the pursuit of gender equality respectively.

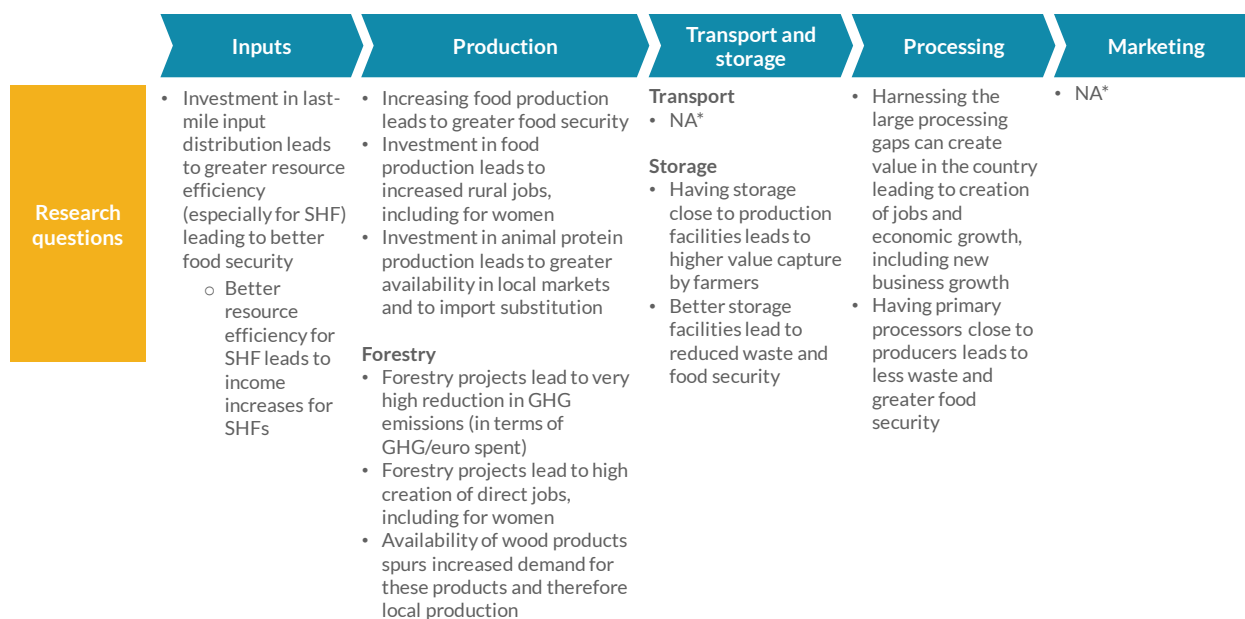
The figure below shows the current portfolio composition of IDF in the agri and forestry value chains.

Exhibit 43: Current portfolio composition for IDF



4. Develop preliminary hypotheses: Results of the workshop were used to identify key investment areas across the agricultural value chain and to develop focus areas and preliminary hypotheses for the different parts of the agricultural value chain from the perspective of expected impact and investment trends. This is illustrated in the figure below.

Exhibit 44: Focus areas and preliminary hypotheses across the agricultural value chain



The research questions were then further developed into hypotheses using conversations with the IDF fund manager, internal sector experts and linkages in the theory of change to arrive at the final list. These research questions were grouped according to the impact that IDF seeks to achieve through future investments.

5. **Structure and refine hypotheses** to ensure that priority assumptions underlying the Theory of Change are systematically and fully covered across the impact pathways. Steps 1 through 4 provided us with stakeholder priorities and anticipated investment trends, which we used to develop and prioritize preliminary hypotheses for the evidence map. Using these preliminary hypotheses and the ToC, we built the framework for our evidence map by ensuring that our complete set of hypotheses –

- Covers all levels of the ToC (e.g. many preliminary hypotheses addressed outputs and outcomes; in these cases, we created additional hypotheses to ensure that the link to impact is also covered)
- Has testable hypotheses (e.g. some complex preliminary hypotheses had to be broken down into individual sub-hypotheses to ensure that evidence for individual linkages can be separated)
- Includes key strategic themes (e.g. the gender impact of most IDF investment themes is not yet well understood; we have included gender as an element in the hypothesis on inequality and will structure the evidence search to surface gender-disaggregated evidence)

Coding Parameters

An Excel coding sheet was used to allow us to systematically compare the relevance, quantity and quality of the evidence. Studies had to meet minimum screening criteria (at least one positive relevance parameter) to be included for review. They were then rated on the full set of criteria. Please see the attached Excel sheet for details.

We used the following parameters to rate studies:

Relevance

- Geographic relevance (emerging economy, ideally sub-Saharan Africa, South Asia)
- Population match (e.g. rural, urban)
- Intervention match (e.g. solar mini-grid)
- Research question match (e.g. increase in productive use)

Quality of the publication²³

- Peer review
- Number of citations

Quality of the study method

- This assessment depends on the method applied and includes factors such as level of randomization for randomized controlled trials, sample size and frame for surveys

Demonstrated impact

- Causality or correlation?
- Generalizability of the study beyond the study context

²³ Our source list includes many publications that are neither academic journals, nor peer reviewed. Publication in an academic journal or peer review are not exclusion criteria.

ANNEX D: BIBLIOGRAPHY

Year	Lead author	Title	Journal/source
2006	Richard Wood	A comparative study of some environmental impacts of conventional and organic farming in Australia	Agricultural Systems
2014	Cheikh Mbow	Achieving mitigation and adaptation to climate change through sustainable agroforestry practices in Africa	Current Opinion in Environment Sustainability
2007	Mark S Howden	Adapting agriculture to climate change	Proceedings of the National Academy of Sciences of the United States of America
2012	Julie Dekens	Agro-Value Chain Finance and Climate Adaptation The role of the banking sector	International Institute for Sustainable Development
2009		Building climate resilience in the agricultural sector of Asia and the Pacific	Asian Development Bank
2004	R Lal	Carbon emissions from farm operations	Environment International
2018	Dhanej Thapa	Climate Adaptive Agricultural Innovation in Nepal: Prospects and Challenges	Climate Resilient Agriculture - Strategies and Perspectives
2007	Louis V. Verchot	Climate change: linking adaptation and mitigation through agroforestry	Mitigation and Adaptation Strategies for Global Change
2018	Hailemariam Teklewold	Climate change adaptation: a study of multiple climate-smart practices in the Nile Basin of Ethiopia	Climate and Development
2018	Martin Chegere	Climate Change and Post-Harvest Agriculture	Agricultural Adaption to Climate Change in Africa
2018	Barry Pound	Climate-Resilient Agriculture in South Asia: An analytical framework and insights from practice	Oxford Policy Management
2008	P.J. Cooper	Coping better with current climatic variability in the rain-fed farming systems of sub-Saharan Africa: An essential first step in adapting to future climate change?	Agriculture, Ecosystems & Environment

Year	Lead author	Title	Journal/source
2017	Abebe D. Beyene	Determinants of Adoption and Impacts of Sustainable Land Management and Climate Smart Agricultural Practices (SLM-CSA)	Environment for Development
2014	James R. Stevenson	Evaluating conservation agriculture for small-scale farmers in Sub-Saharan Africa and South Asia	Agriculture, Ecosystems & Environment
2011	Martin Whiteside	Evidence Base for Climate Resilient and Productive Agriculture in Southern Africa	DFID South Africa
2017	Anthony Mills	From Farm to Fork: Private Enterprise Can Reduce Food Loss Through Climate-Smart Agriculture	International Finance Corporation
2011	D. Tilman	Global food demand and the sustainable intensification of agriculture	Proceedings of the National Academy of Sciences
2008	Pete Smith	Greenhouse gas mitigation in agriculture	Philosophical Transactions of the Royal Society B: Biological Sciences
2016	Julie Dekens	How Small Businesses Can Support Climate-Resilient Value Chains: Lessons from Uganda	International Institute for Sustainable Development
2008	Niggli, U., Fließbach	LOW GREENHOUSE GAS AGRICULTURE: MITIGATION AND ADAPTATION POTENTIAL OF SUSTAINABLE FARMING SYSTEMS	FAO
2017	Ana Carolina Bastida	Mapping Financial Flows for REDD+ and Land Use in Brazil	Forest Trends
2010	Nadia El-Hage Scialabba	Organic agriculture and climate change	Renewable Agriculture and Food Systems
2014	Julie Dekens	Promoting an Integrated Approach to Climate Adaptation: Lessons from the coffee value chain in Uganda	International Institute for Sustainable Development
2013	Brian Lipinski	Reducing Food Loss and Waste	World Resources Institute
2017	Deepak Kumar	Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries	Foods

Year	Lead author	Title	Journal/source
2011	Brenda B. Lin	Resilience in Agriculture through Crop Diversification: Adaptive Management for Environmental Change	BioScience
2016	Jaideep Kumar Bisht	Resource Conservation Technologies (RCTs) for Climate-Resilient Agriculture in the Foothill of Northwest Himalayas	Conservation Agriculture
2006	J.N. Pretty	Resource-Conserving Agriculture Increases Yields in Developing Countries	Environmental Science & Technology
2009	C.S. Snyder	Review of greenhouse gas emissions from crop production systems and fertilizer management effects	Agriculture, Ecosystems & Environment
2009	Britaldo Soares-Filhoa	Role of Brazilian Amazon protected areas in climate change mitigation	Proceedings of the National Academy of Sciences of the United States of America
2011	Jonathan A Foley	Solutions for a cultivated planet	Nature
2011	Jules Pretty	Sustainable intensification in African agriculture	International Journal of Agricultural Sustainability
2008	Peter R. Hobbs	The role of conservation agriculture in sustainable agriculture	Philosophical Transactions of the Royal Society B: Biological Sciences
2014	Cheryl Palm	Conservation agriculture and ecosystem services: An overview	Agriculture, Ecosystems & Environment
2010	Jennifer A. Burney	Greenhouse gas mitigation by agricultural intensification	Proceedings of the National Academy of Sciences
2013	Maya Forstater	The effectiveness of climate finance: a review of the Amazon Fund	Overseas Development Institute
2016	Angie Daze	Enabling Climate Risk Management Along Agricultural Value Chains: Insights from the rice value chain in Uganda	International Institute for Sustainable Development
2012	Katia Medeiros DuBois	Incorporating climate change considerations into agricultural investment programmes	FAO

Year	Lead author	Title	Journal/source
2014	Amy Dickie	Strategies for Mitigating Climate Change in Agriculture	Climate Focus
2013	Quan Nguyen	Multipurpose agroforestry as a climate change resiliency option for farmers: an example of local adaptation in Vietnam	Climatic Change
2003	J.E. Lott	Water use in a Grevillea robusta–maize overstorey agroforestry system in semi-arid Kenya	Forest Ecology and Management
2010	Deborah Rubin	A GUIDE TO INTEGRATING GENDER INTO AGRICULTURAL VALUE CHAINS	Cultural Practice LLC
2010	Andre Croppenstedt	Agricultural value chain development: Threat or opportunity for women’s employment?	Food and Agriculture Organisation (FAO)
2009	Derek Byerlee	Agriculture for Development: Toward a New Paradigm	Annual Review of Resource Economics
2018	Dr. Steve Jennings	Case studies of business structures for a more equitable distribution of value in food supply chains	Oxfam
	Andrew Guinn	Changing Food Systems and Inequality: Implications for Food Security and Public Policy	
2017	Miet Martens	Contract-farming in Staple Food Chains: The Case of Rice in Benin	World Development
2017		ENABLING SMALLHOLDER FARMERS TO IMPROVE THEIR INCOMES	Sustainable Food Lab
2015		Feeding Africa: An Action Plan for African Agricultural Transformation	African Development Bank Group
2015	EMMANUEL HONGO MROTO	GENDER ANALYSIS IN THE SUNFLOWER VALUE CHAIN: A CASE OF MVOMERO DISTRICT, TANZANIA	
2013	Friederike Sorg	Gender and Value Chains	GIZ
2013	Johanna K. Silvander	Gender equality in global value chains and the role of Aid for Trade in promoting gender equality and women’s employment in developing countries	Ministry of Foreign Affairs, Finland

Year	Lead author	Title	Journal/source
2015	Cathy Farnworth	Gender integration in livestock and fisheries value chains: emerging good practices from analysis to action	International Journal of Agricultural Resources, Governance and Ecology
2014	Joyce Ahmadu	Gendered participation in cassava value chain in Nigeria	Merit Research Journal of Agricultural Science and Soil Sciences
2016	Goedele VAN DEN BROECK	Global Value Chains, Large-Scale Farming, and Poverty: Long-Term Effects in Senegal	Food Policy
2016	Diana Rutherford	Impact of an Agricultural Value Chain Project on Smallholder Farmers, Households, and Children in Liberia	World Development
2018	R Padjung	Improving agricultural commodity supply-chain to promote economic activities in rural area	Earth and Environmental Science
2016	Henriette Kolb	Investing in Women along Agribusiness Value Chains	International Finance Corporation
2017	Menale Kassie	Measuring Farm and Market Level Economic Impacts of Improved Maize Production Technologies in Ethiopia: Evidence from Panel Data	Journal of Agricultural Economics
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2011	Cheryl Doss	The role of women in agriculture	FAO
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Year	Lead author	Title	Journal/source
2014	Jairo Baquero Melo	Value Chains and Global Inequalities: Plantain, Contract Farming, and Vulnerability of the Small-Scale Farmers in Colombia	Munich Personal RePEc
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2008	Rekha Mehra	Women, Food Security and Agriculture in a Global Marketplace	International Center for Research on Women
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2011	Massa, Isabella	Impact of multilateral development finance institutions on economic growth	ODI Reports
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2013	Ton Giel	Effectiveness of innovation grants to smallholder agricultural producers: an explorative systematic review	
2017	Muhammad Usman	Agricultural Productivity and Food Security: Role of Public and Private Sector Investment in Research and Development	Journal of Environmental and Agricultural Sciences
2007	Elibariki Msuya	The Impact of Foreign Direct Investment on Agricultural Productivity and Poverty Reduction in Tanzania	MPRA
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2015	Raoul Herrmann	Impact of smallholder farmer horizontal and vertical linkages on access to prime markets and household welfare in Sub-Saharan Africa: The case of Tanzania	
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2009	Michio Watanabe	Is the development of the agro-processing industry pro-poor?: The case of Thailand	Journal of Asian Economics

Year	Lead author	Title	Journal/source
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2015	Michael L Walden	ECONOMIC CONTRIBUTION OF NORTH CAROLINA AGRICULTURE AND AGRIBUSINESS	NC State University papers
2017	Lily Odarno	ACCELERATING MINIGRID DEPLOYMENT IN SUB-SAHARAN AFRICA	World Resources Institute
2009	Charles Kirubi	Community-Based Electric Micro-Grids Can Contribute to Rural Development: Evidence from Kenya	World Development
2016	Sarah Best	Energising Local Economies	International Institute for Environment and Development
2011	S Dasappa	Potential of biomass energy for electricity generation in sub-Saharan Africa	Energy for Sustainable Development
2016	Simone Souza	Potential of Sugarcane in Modern Energy Development in Southern Africa	Frontiers in Energy Research
2017		POWERING AGRIFOOD VALUE CHAINS	Renewable Energy and Energy Efficiency Partnership
2018	Samuel Booth	PRODUCTIVE USE OF ENERGY IN AFRICAN MICRO-GRIDS: TECHNICAL AND BUSINESS CONSIDERATIONS	USAID-NREL

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2017	Mark DRAECK	RENEWABLE ENERGY-BASED MINI-GRIDS: THE UNIDO EXPERIENCE	UNIDO
2016	Christian Pirzer	Scaling Innovation at the Energy- Agriculture Nexus in East Africa	Energy-Agricultural Nexus
2003	Frank Rosillo-Calle	The role of biomass energy in rural development	Encontro de Energia no Meio Rural
2017		Understanding the Impact of Rural Electrification in Uttar Pradesh and Bihar, India: Evidence from The Rockefeller Foundation's Smart Power for Rural Development Initiative	The Rockefeller Foundation's Smart Power for Rural Development Initiative
2009	John Wilkinson	Agro-industry trends, patterns, and development impacts	
2015	Mark W Rosgrant	Food Security and Nutrition Assessment Paper	IFRI working paper
2016	Emiko Fukase	Agro-processing and Horticultural Exports from Africa	IFPRI Discussion Papers
2009	H Egbert,	Capacity Utilization of Enterprises in Tanzania	Tanzania Journal of Development Studies
2015	Nyamwanza Tonderai	Capacity utilization strategies in the milk processing industry in Zimbabwe	Journal of Management and Marketing Research
		Estimating Economy Wide Job Creation Effects	
2012	Yemane Gebrehiwet	Economci Profile of the Agro-processing industry in South Africa 1970-2010	
2018	Lalisa A Duguma	Community forestry frameworks in sub-Saharan Africa and the impact on sustainable development	Ecology and Society
1999	Simeon Ehui	Economy-Wide Impacts of Technological Change in the Agro-Food Production and Processing Sectors in Sub-Saharan Africa	IFPRI Discussion Papers
2016	Adia C Isinika	Growth of Agro-processing Firms and Labour Productivity in Tanzania: Opportunities and Limiting Factors	

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2013	Odoyo J Bittar	Impact of access to agro-processing technologies on growth of smallholder agro-processing industry in bureti district, Kenya	University of Nairobi Thesis Papers
2017	Technoserve	Solutions for African Food Enterprises	
2013	Bethelhem Berhane	The Effect of Improved Productivity of the Manufacturing Industries on the Ethiopian Economy: A Computable General Equilibrium (CGE) Analysis	Ethiopian Journal of Economics
	Thulani Mandiriza	THE IMPACT OF THE AGRO-PROCESSING COMPETITIVENESS FUND IN FACILITATING ENTRY INTO SELECTED AGRO-PROCESSING SECTORS	Competition Commission South Africa
2005	Corinna Hawkes	The role of foreign direct investment in the nutrition transition	Public Health Nutrition
2017	Didier Y Alia	Agricultural Input Intensification, Productivity Growth, and the Transformation of African Agriculture	University of Kentucky Libraries
2017	John W McArthur	Fertilizing growth: Agricultural inputs and their effects in economic development	Journal of Development Economics
2008	Esther Duflo	How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya	American Economic Review
2010	Geofrey Okoboi	OF WHAT MERIT IS IMPROVED INPUTS USE IN UGANDA'S MAIZE PRODUCTIVITY?	Joint 3rd African Association of Agricultural Economists (AAAE)
2018	Oluwatoba Omotilewa	Does improved storage technology promote modern input use and food security? Evidence from a randomized trial in Uganda	Journal of Development Economics
2012	Raushan Bokusheva	Factors determining the adoption and impact of a postharvest storage technology	Food Security
2018	Shilpa Aggarwal	Grain today, gain tomorrow: Evidence from a storage experiment with savings clubs in Kenya	Journal of Development Economics
2018	Ricker-Gilbert	Helping Smallholder Farmers Make the Most of Maize through Harvest Loans and Storage Technology: Insights from a Randomized Control Trial in Tanzania	

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2001	Eleni Gabre-Madhin	Impact Of Agricultural Market Reforms On Smallholder Farmers In Benin And Malawi	IFRI Report
2018	Marshall Burke,	Sell Low and Buy High: Arbitrage and Local Price Effects in Kenyan Markets	
2010	Bart Minten,	The Benefit of Cold Storages: Evidence from Bihar (India)	SSRN Electric Journal
2015	Michael Ndegwa,	Effectiveness and Economics of Hermetic Bags for Maize Storage: Results of a Randomized Controlled Trial in Kenya	Crop Protection
2014	Arvydas Lebedys,	Contribution of the Forestry Sector to National Economies, 1990-2011	FAO Working Papers
2018		The State of the World's forests	FAO Papers
2016		Investment Overview: ASFF 1	SIFEM Reports
2014	J Eisen	Rethinking community based forest management in the Congo basin	Rainforest Foundation UK Report
2012	Lorenzo Casaburi	Contract Farming and Agricultural Productivity in Western Kenya	
2004	Liesbeth Dries,	Foreign Direct Investment, Vertical Integration, and Local Suppliers: Evidence from the Polish Dairy Sector	World Development
2018	Ashok Mishra	Impact of contract farming on yield, costs and profitability in low-value crop: evidence from a low-income country	Australian Journal of Agricultural and Resource Economics
2014	John H Hanf	Processor driven integration of small-scale farmers into value chains in Eastern Europe and Central Asia	FAO
2018	Catherine Ragasa,	Limitations of Contract Farming as a Pro-poor Strategy: The Case of Maize Outgrower Schemes in Upper West Ghana	World Development
2014	Obasi Igweoscar	Effect of Contract Farming on Productivity and Welfare of Cassava- Based Farmers in South Eastern Nigeria.	European Journal of Business and Management

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2009	Sachiko	Impact of Contract Farming on Income: Linking Small Farmers, Packers, and Supermarkets in China	World Development

