An opportunity analysis for Indian MFIs to support climate-smart agriculture

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idh transforming markets | AGRI3 FUND | MSC MicroSave Consulting

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Executive summary

Climate change has a disproportionate impact on smallholder farmers. Extreme weather, heat stress, and pests decimate crop yields and increase costs. Climate-smart agriculture (CSA) offers a sustainable solution integrating resource-efficient technologies and resilience strategies. While the Indian government institutions have attempted to promote CSA, adoption remains slow due to financial and ecosystem barriers. At this juncture, microfinance institutions (MFIs) can emerge as a key player in financing CSA adoption with their extensive rural networks.

Recognizing MFIs' emerging role, the AGRI3 Fund and HSBC India launched a program to increase MFIs' lending capacity to marginalized rural farmers. This partnership seeks to help MFIs integrate CSA financing into their portfolios and create a path for smallholder farmers to build climate resilience and maintain agricultural productivity. IDH, as the AGRI3 Fund Technical Assistance Facility Manager, commissioned MSC (MicroSave Consulting) to conduct a CSA financing opportunity analysis study as part of this initiative. The study presented four significant findings.

- A supply-side analysis of CSA practices highlighted the increasing availability of CSA technologies and practices. A review of 100 such practices identified 12 priority solutions based on productivity, climate adaptation, and economic viability. These solutions included drip irrigation, solar pumps, no-till farming, and biodigesters.
- Qualitative demand assessment of CSA practices across Bihar, Tamil Nadu, and Uttar Pradesh revealed slow CSA adoption due to financial and ecosystem barriers, such as high upfront costs, limited access to technology, and counterproductive state policies.
- MFIs can help overcome financial barriers to CSA adoption by offering tailored financial products that address capital investment and working capital needs. Capital credit products include loans to buy seed drillers and drums, establish custom hiring centers, and set up drip- or solar-powered irrigation systems. Additionally, MFIs can finance livestock purchases, shed construction, household- or community-level biodigesters, and offer livestock insurance. On the other hand, working capital loans, such as crop loans for intercrops and agroforestry and financing for bio-input resource centers, ensure continuous support for sustainable agricultural activities.
- MFIs primarily focus on lending for small businesses or individual use, with agricultural loans typically restricted to short-term crop production. They rarely finance long-term investments, especially those required for CSA. Further, gaps in their product structures, internal processes, staff capacity, and IT systems limit their ability to support CSA financing opportunities effectively.

Based on these findings, MSC has identified product, process, and ecosystem-level recommendations to help MFIs facilitate CSA financing. At the product level, MFIs should tailor financial products to CSAs' unique needs, such as medium-term credit for solar equipment and working capital for bio-input centers. Partnerships with agri-tech firms, equipment manufacturers, and carbon credit programs can enhance credit delivery mechanisms. Additionally, MFIs must invest in staff training and technology integration to build robust internal systems. At the ecosystem level, concessional finance, credit guarantees, and insurance funds can lower risks. Finally, stakeholders, such as central and state departments (the Department of Agriculture, the Department of Fertilizers), policymakers, and regulators (NABARD, SIDBI, RBI), self-regulatory organizations (Sa-Dhan, MFIN), and CSA technology providers should address policy gaps, promote awareness, and encourage collaboration to accelerate CSA adoption.

Project background and methodology

Rising climate risks in agriculture

India's **120 million** smallholder farmers face heightened financial instability due to climate change, which leads to crop losses, postharvest damage, and rising production costs. As outlined in Figure 1, these challenges have cut farm incomes by **15-18%** and pose systemic risks.

The impact of climate change on farmers

Operational impact

- **Crop yield losses:** 80% of marginal farmers in India face losses due to climate change. 41% suffer from drought, 32% suffer from irregular rainfall, and 24% suffer from monsoon anomalies.
- **Postharvest losses:** Flooding and high humidity damage stored crops and increase spoilage, which affects marketable surplus and incomes.
- **Pest proliferation:** A rise in temperature has increased pest metabolism by 20%, leading to a rise in pesticide use.
- **Fertilizer dependency:** Climate stress has degraded 37% of India's land, increased erosion and salinity, and further driven reliance on fertilizer.
- **Asset damage:** Extreme weather damages homes, livestock, and assets, which worsens financial recovery.
- **Livestock mortality:** Climate change escalates livestock losses from droughts, floods, and diseases, such as Rift Valley fever.

Financial impact

- **Decreased annual income:** Farmers' incomes could decline by 15-18% on average. Due to extreme weather events, rainfed agriculture could see losses as high as 25%.
- **Increase in production costs:** Farmers have been experiencing increased expenses due to a greater reliance on groundwater for irrigation, driven by irregular rainfall and prolonged droughts. Additionally, pest and disease control costs have surged as changing ecosystems encourage pest growth. Farmers are now compelled to use more fertilizer to counter declining soil fertility, which further escalates overall production costs.

Figure 1: Impact of climate change on Indian farmers

Climate-smart agriculture (CSA) offers solutions through productivity gains, resilience-building, and emission reduction. CSA practices range from precision farming techniques that optimize resource use to crop diversification strategies that help mitigate crop loss risk. These practices help farmers reduce input costs for fertilizers, pesticides, and water and build long-term resilience to climate shocks. MFIs, with their deep rural networks, can drive CSA adoption by financing sustainable practices that benefit farmers. The Indian microfinance sector serves around **70** million borrowers and has a loan portfolio of **USD 40 billion**, **60%** of which is concentrated in the agriculture and allied sectors.

Recognizing this potential, AGRI3 Fund and HSBC India signed a partnership agreement in 2024 to catalyze a shift toward more climate-smart lending practices among Indian MFIs. Under this agreement, the AGRI3 Fund provides partial guarantees to HSBC for transactions that promote sustainable agriculture, rural livelihoods, and forest conservation. The first transaction under this partnership involved a partial guarantee from AGRI3 fund for a USD 50 million MFI lending facility. This facility enables HSBC to provide loans to MFIs, whose end borrowers will use the financing for agricultural and agri-allied activities. The program is complemented by a technical assistance initiative managed by IDH. It supports participating MFIs in identifying opportunities and developing products and services that enhance the environmental sustainability of their clients' agricultural activities by adopting CSA practices predominantly focused on women in rural areas.

Methodology

MSC employed a structured three-phase approach to identify relevant financing opportunities for MFIs and develop pathways to implement them effectively. The methodology is outlined below.

- A desk review was conducted to identify 100 relevant CSA practices. These practices were further screened through three levels based on predetermined criteria, resulting in a shortlist of 12 CSA practices
- A qualitative supply- and demand-side study was conducted to identify key enablers and barriers to CSA adoption. The findings were then synthesized to determine potential opportunities for MFIs in CSA financing.
- A stakeholder consultation workshop was hosted in December 2024 to validate the study's findings. Comprehensive recommendations and practical insights were also developed to help MFIs build a CSA financing portfolio based on the synthesis of secondary research, primary consultations, and workshop feedback.

Key findings from the study

Cost-benefit analysis of CSA practices

MSC evaluated 100 CSA practices based on relevance to India, suitability for smallholder farmers, impact on farm productivity, and potential for reducing GHG emissions. This evaluation resulted in an initial shortlist of 20 practices. These practices were further assessed for technical feasibility and economic viability, which narrowed the shortlist to 12 CSA practices. The selected solutions were categorized into four strategic clusters to offer a practical implementation framework: No-till farming, efficient irrigation systems, integrated nutrient and pest management, and integrated farming systems. Figure 2 summarizes the cost-benefit analysis of these CSA practices, the payback period, and additional relevant details.

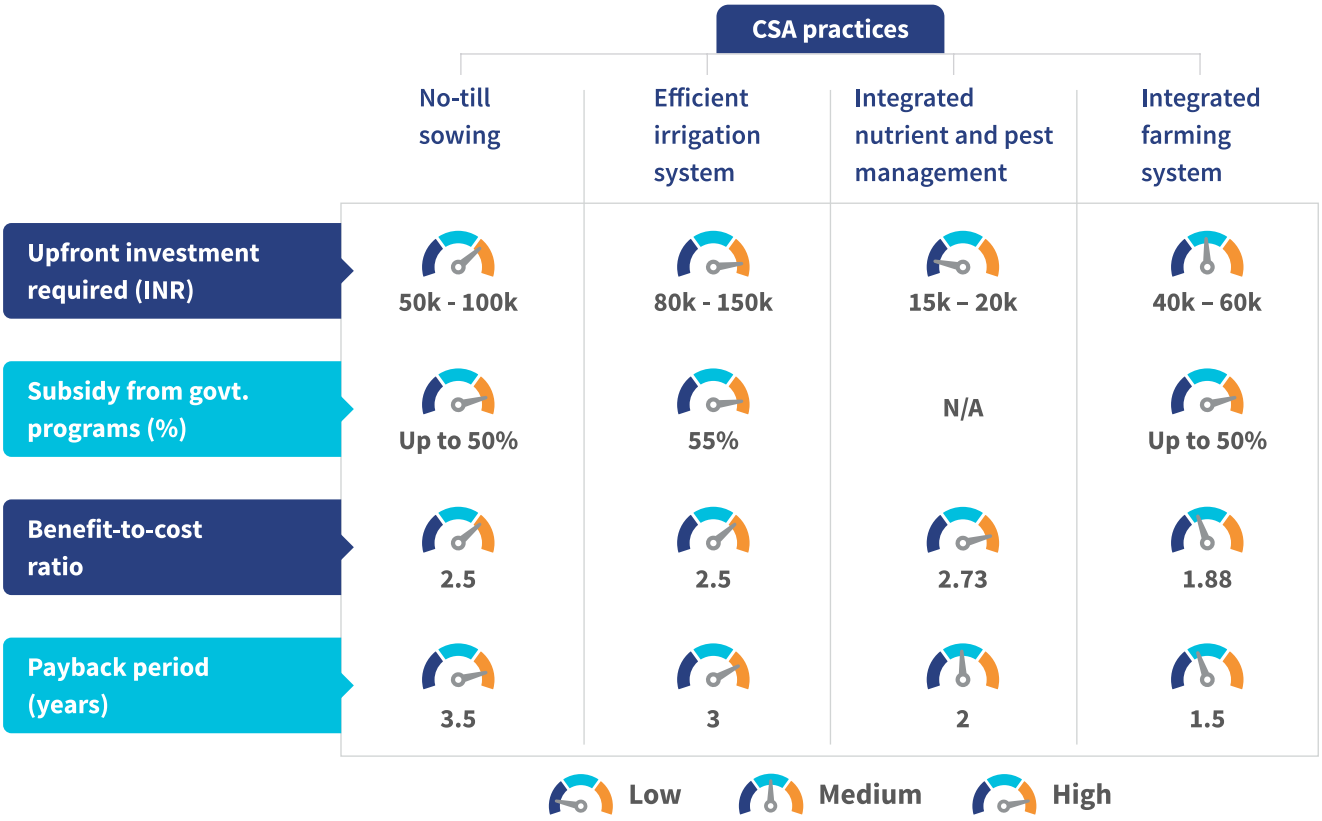

Figure 2: Analysis of shortlisted CSA practices: Investment, subsidies, benefits, and payback periods

No-till farming: This category includes direct-seeded rice (DSR) and zero-tillage through seed drums and drills. These practices offer numerous advantages, including soil conservation, improved moisture retention, and enhanced fertility. The preservation of soil structure and the reduction of erosion help maintain healthy, productive soil. These practices lower operational costs through minimized labor and fuel use, promotion of carbon sequestration, and reduced greenhouse gas emissions. No-till farming encourages biodiversity and supports beneficial soil organisms, which leads to better nutrient cycling. This method can face challenges, such as weed growth and high initial machinery costs. Yet, support programs, such as the National Food Security Mission (NFSM), help make no-till farming a viable and sustainable option for farmers.

Efficient irrigation systems: This includes irrigation practices, such as drip irrigation, solar-powered pumps, and new-age weather-based agro-advisory services. These practices are transformative for smallholder farmers. Drip irrigation delivers water and nutrients directly to the plant roots to reduce water use by up to 60% compared to traditional methods. It minimizes soil erosion and salinization and enables farmers in drought-prone areas to maintain productivity. Policies, such as the *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), which subsidize micro-irrigation systems, intend to make this technology more accessible.

Solar pumps provide reliable irrigation for water-intensive crops and reduce costs alongside greenhouse gas emissions. Farmers avoid fuel expenses and reduce their

carbon footprint through the use of solar energy instead of diesel or grid electricity. The ***Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM KUSUM)*** scheme partially offsets the costs to promote wider usage among smallholders. Weather-based agro-advisories integrate real-time weather data with agronomic expertise to offer location-specific recommendations. These advisories help farmers optimize planting, irrigation, pest management, and harvesting and reduce resource waste. Yet, poor smartphone penetration and language barriers in rural areas limit the effectiveness of these services. Moreover, the high upfront costs and technical complexities of irrigation system design, installation, and maintenance slow its adoption.

Integrated nutrient and pest management: Biopesticides and biofertilizers exemplify eco-friendly solutions for pest control and soil fertility enhancement. Biopesticides minimize risks to non-target organisms and reduce environmental contamination, while biofertilizers restore soil health by increasing organic matter. Both offer a renewable alternative to synthetic chemicals, yet slow action and limited market availability hinder their widespread use. Under the ***Paramparagat Krishi Vikas Yojana*** (PKVY), the central government of India provides financial assistance to promote these sustainable inputs and encourage their adoption among smallholders.

Integrated farming systems: An integrated farming system is a sustainable agricultural practice that combines multiple agrarian activities in a single farm. It integrates crops, cattle, and poultry to optimize resource use, enhance productivity, and improve sustainability. Biodigesters within these systems convert organic waste into biogas and nutrient-rich fertilizer, which improves energy efficiency and reduces greenhouse gas emissions. Mulching, another complementary practice, conserves soil moisture, regulates temperature, and suppresses weeds. Moreover, improved animal housing ensures healthier livestock and higher productivity, while crop diversification mitigates pests, diseases, or adverse weather risks. These practices promote resilience and sustainability but require knowledge dissemination and initial investments to gain traction among smallholders.

Financial and ecosystem barriers to CSA adoption

Despite the positive economic and environmental impact and policy drive, the uptake of these CSA practices has been slow due to financial and ecosystem barriers, as summarized in Figure 3.

Financial barriers

High investment requirement

CSA technologies, such as precision farming tools, seed tillers, and solar-powered irrigation systems, require substantial upfront investment, which many small-scale farmers cannot afford.

Higher cost of bio inputs

Eco-friendly inputs, such as organic fertilizers and pesticides, are more expensive than subsidized conventional inputs provided by primary agriculture cooperative credit societies (PACS*). This makes the transition to CSA financially challenging for farmers.

Insufficient de-risking mechanisms

Limited access to crop insurance, inadequate climate-resilient infrastructure, and a lack of early warning systems hinder smallholder farmers' ability to mitigate climate risks.

Ecosystem barriers

A lack of awareness and training

Farmers lack awareness of CSA practices and their long-term benefits due insufficient training programs, and limited access to technical assistance.

Limited institutional support

The absence of subsidies for CSA technologies and weak institutional frameworks prevent farmers' adoption of sustainable practices.

Counterproductive policies

Policies, such as free electricity for irrigation, reduce the appeal of solar pumps. Additionally, the high subsidies on urea make eco-friendly alternatives, such as biofertilizers and organic inputs, less attractive, which further hinders the shift toward sustainable farming practices.

*PACS are the grassroots-level arms of the short-term cooperative credit structure. PACS deals directly with rural agricultural borrowers. PACS gives them loans, collects repayments of loans, and also undertakes distribution and marketing functions.

Figure 3 : Barriers to CSA adoption

Opportunities for CSA financing for MFIs

Access to finance can help overcome financial barriers and enable the adoption of CSA technologies and practices. MFIs can empower farmers to implement sustainable agricultural solutions through timely finance tailored to CSA needs.

For instance, timely weather advisories and access to water are essential for the adoption of efficient irrigation systems. Key technologies to facilitate this include solar irrigation pumps and drip irrigation systems. However, the upfront cost of adopting these technologies is often more than USD 1,154 (INR 100,000), much higher than most smallholder farmers can afford. Financial interventions, such as special-purpose medium-term loans for solar irrigation pumps and drip irrigation systems, can significantly promote the adoption of these practices.

Similarly, limited access to quality inputs affects integrated nutrient management. Local bio-input resource centers can address this barrier to enable farmers to access critical resources and advisory support on best practices. The figure below summarizes the prevalent financing opportunities for MFIs to support CSA adoption.

	No-till farming	Efficient irrigation systems	Integrated nutrient and pest management	Integrated farming system
CSA practices	**Direct seeded rice** **Zero tillage sowing**	**Solar pumps** **Drip irrigation** **Weather advisory**	**Biofertilizers** **Biopesticides**	**Livestock, backyard, poultry, and goat farming** **Mulching** | **Crop diversification** **Shade management** | **Biodigester**
Enablers for adoption by farmers	Access to farm machinery, such as seed tillers and seed drum rollers, via individual or SHG ownership	Access to solar pumps, drip irrigation systems, and smartphones	Access quality biopesticides, seeds, and fertilizers through bio-input resource centers (BRC)	Financial assistance to buy cattle or birds, access to sheds for animals and birds, credit and risk transfer mechanisms to encourage crop diversification and biodigesters
Cost (INR)	Seed drillers: **125k- 150k** Drum rollers: **45k–50k**	Solar pumps (5 HP): **180k- 200k** Drip irrigation systems: **80k-85k**	BRC setup cost: **70k-85k** WC requirement: **40k-50k** Soil testing kits: **45k-50k**	• Crop loans: **30k-45k** • Purchase of cattle, poultry, or goats: **50k-70k** • Cost of setting up shed: **15k-20k** • Small-scale biodigester: **15k-17k** • Medium-scale biodigester: **30k-40k**
Financing opportunity	• Farm equipment loans for seeds tillers and drum rollers • Credit to set up custom hiring centers for seed tillers, tractors, and other equipment	• Special purpose medium-term loans for solar irrigation pumps and drip irrigation systems • Small loans for smartphones	• Entrepreneur loans to set up BRCs • Working capital loans for BRCs • Small business loans to purchase biofertilizers, pesticides, and tolerant seeds	• Crop loans for intercrops and agroforestry • Loans to buy goats and poultry • Loans to establish sheds • Loan for household-level biodigesters • Group loans to set up community biodigesters at the SHG level • Livestock insurance

Figure 4: CSA financing opportunities

MFIs' readiness and capacity to realize CSA financing opportunities

MFIs are well-positioned to finance CSA adoption, with **41%** of income-generating loans directed to agriculture and **19%** to animal husbandry. The current loan trends align with CSA needs, with mid-term tenures (**18–24 months**), monthly repayment, and high-ticket loans (**USD 926–1,157**). However, as seen in Figure 5, MFIs must refine delivery mechanisms, upgrade IT systems, and enhance capacity-building to establish a robust CSA financing portfolio.

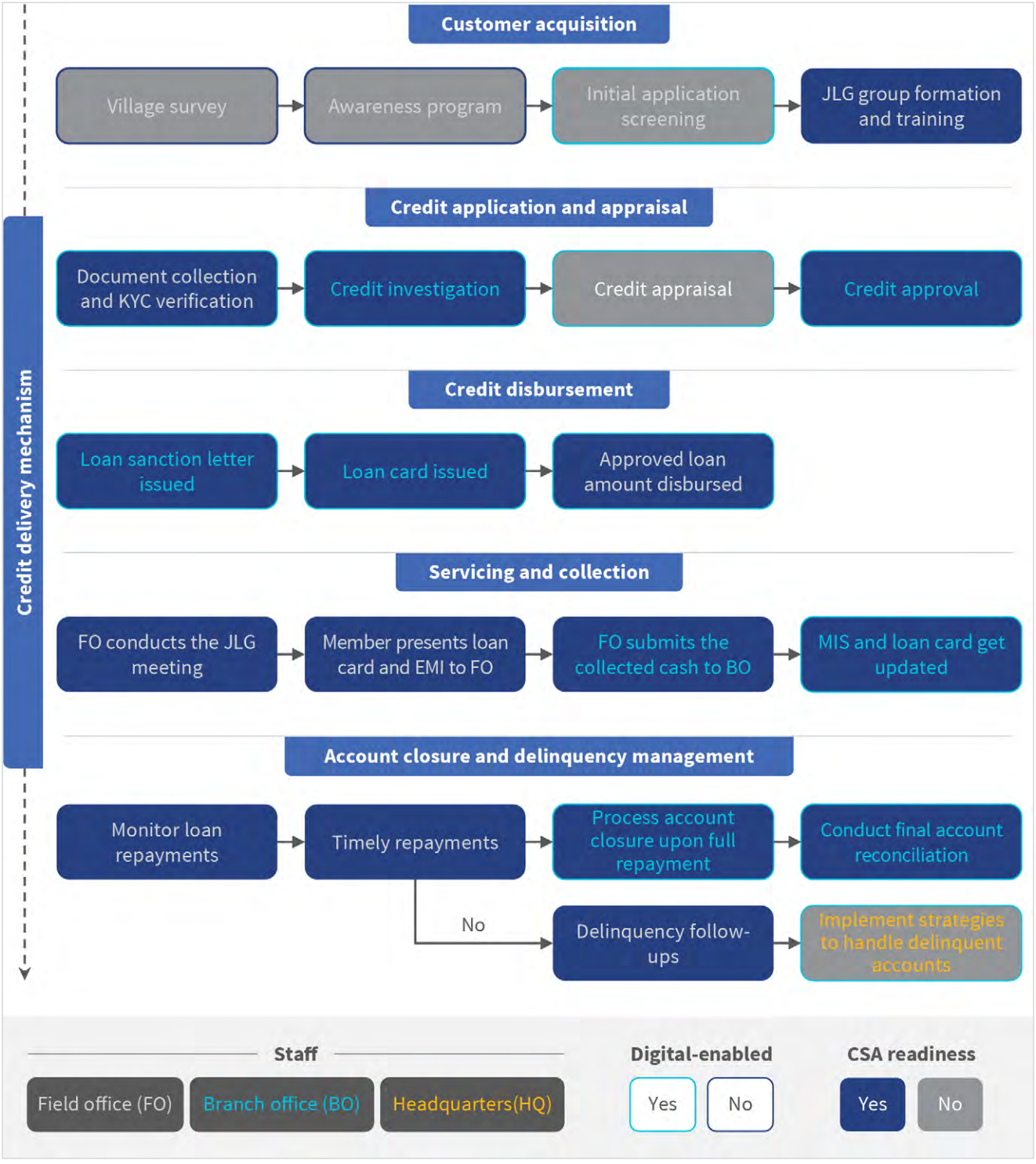

Figure 5: Internal process readiness assessment of MFIs

MFI lending for CSA faces barriers at operational, ecosystem, and financial levels, which include the following:

- **Reliance on joint liability groups (JLGs) and lack of technology adoption:** JLG loans currently comprise 78% of MFI portfolios. Due to this, MFI operations rely heavily on high-touch, in-person interactions, while technology interventions are confined mainly to the credit disbursement stage.
- **Misaligned credit delivery mechanisms:** MFI loan repayment structures often misalign with agricultural cash flows and lack tailored interest moratoriums for short-term inputs and long-term equipment financing.
- **Insufficient internal capacity:** Workforce limitations hinder loan evaluation and innovation, including inadequate training in CSA risk assessment and high customer-to-staff ratios. Existing IT systems are not geared to support CSA loans as they lack flexible repayment options and risk assessment tools
- **Lack of taxonomy:** Ambiguity in the definition of eligible projects complicates impact measurement and heightens risk perceptions. It hinders financial product development and complicates regulatory compliance.
- **Insufficient data for risk assessment:** Fragmented data on climate vulnerability, CSA practices, technology providers, and cost-benefit information limit MFIs' access to essential information. Decentralization complicates risk assessment and underwriting, which hurts effective resource allocation, decision-making, and monitoring of CSA initiatives.
- **Nascent technologies and limited regional replicability:** CSA technologies in India remain primarily at an early stage, with most restricted to small-scale pilots in specific regions. Proven, scalable models that can be adapted across diverse agro-climatic zones are absent. Even mature solutions, such as drip irrigation, are not well-suited to India's smallholder farming patterns.
- **High cost of capital:** Investors perceive higher risks in financing CSA. This perception is due to long gestation periods and the lack of evidence on the demand and success of such products. This results in higher funding costs.
- **Limited risk transfer mechanisms:** Meso-level risk transfer mechanisms, such as parametric insurance and credit guarantees for CSA financing, are nascent. Only 13% of global agri-insurance is deployed at the meso level. While NABARD has started efforts to extend credit guarantees for CSA financing to NBFCs, MFIs have yet to receive similar support.
- **Regulatory constraints:** MFIs must maintain **75%** of their total assets as **qualifying assets**, which restricts asset-backed financing for CSA technologies, such as solar pumps, biodigesters, and solar dryers.
- **Limited use of ESG-linked capital:** Despite their contributions to social and environmental impact, MFIs struggle to raise ESG-linked capital. The few MFIs that have issued ESG or sustainability-linked instruments face significant challenges due to the high effort needed to secure these funding sources.

Recommendations for CSA financing

MFIs must adopt a strategic approach to bridge the existing gaps in CSA financing. This approach must emphasize product- and process-driven initiatives. MFIs should also collaborate with other stakeholders to support these initiatives and create an ecosystem that promotes CSA.

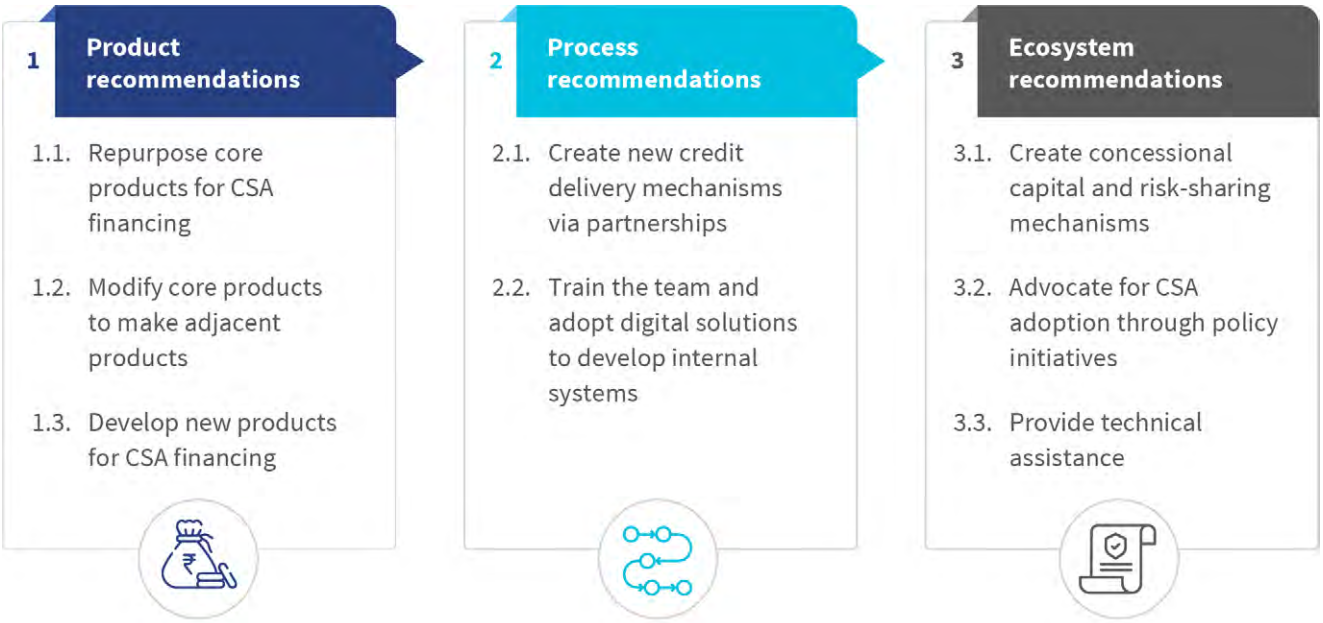

Figure 6: Summary of recommendations

Product recommendations

MFIs can enhance their product offerings through a three-step approach.

1. They can repurpose existing financial products, such as income generation loans, individual loans, and working capital loans, to better suit CSA's specific needs.
2. Simultaneously, MFIs must modify existing products to deepen their reach into current and adjacent markets. For instance, they can redesign consumer durable loans to facilitate incremental changes, such as smartphone loans to access digital agriculture services. Other loans of this type could include working capital loans that target pro-CSA businesses, such as bio-input centers and custom hiring centers for seed tillers.
3. Additionally, MFIs can introduce transformational products to address the unique and emerging requirements of CSA. These could include green loans for integrated farming systems (IFS), crop loans for contingent crops, and carbon financing mechanisms that promote climate-resilient farming practices.

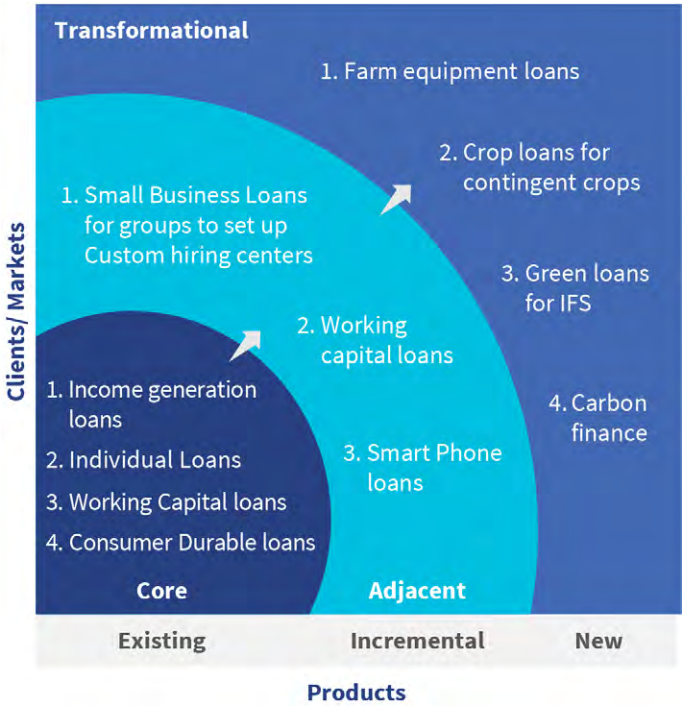

Figure 7: Product recommendations

Process recommendations

MFIs can strengthen their processes through external partnerships to deliver credit and develop robust internal systems.

Strengthen credit delivery mechanisms

MFIs can partner with ecosystem players to bolster credit delivery mechanisms. Such potential partners would include original equipment manufacturers (OEMs), social enterprises, government programs, agri-tech startups, and carbon credit programs. As summarized in Table 1, these partnerships will play distinct yet complementary roles throughout the credit cycle's critical stages.

Process	Original equipment manufacturers (OEMs)	Social enterprises and government programs	Agri-tech startups	Carbon credit programs
Customer acquisition	OEMs can provide MFIs with a network of farmers who intend to invest in CSA technologies.	Social enterprises and government programs have a strong grassroots presence. They can mobilize farmer groups, cooperatives, and self-help groups through awareness campaigns on the benefits of CSA practices and facilitate bulk financing through the integration of finance into other programs.	Agri-tech startups provide advisory services to farmers and have access to their past data on agricultural activities. MFIs can use this data to generate leads and connect potential borrowers.	Carbon credit programs have an existing network of farmers and technology providers for sustainable practices. MFIs can evaluate the network's credit needs and support them.
Credit application and appraisal		They help farmers with loan documentation, application preparation, and the use of government subsidies or guarantees to reduce risks for MFIs.	They provide farm-level data to enhance MFIs' credit risk assessment processes. This data may include soil health, crop productivity, and weather risks.	They highlight potential revenue streams from carbon credits to strengthen the financial case for CSA loans.
Credit disbursement			They enable digital payment systems to ensure fast and secure disbursement to farmers.	
Servicing, collection, and monitoring	They provide maintenance services and warranties for CSA technologies, which ensure functionality and reduce the risks of default.	They facilitate financial literacy training, group repayment systems, and loan rescheduling for distressed borrowers.	They use Internet of Things (IoT) sensors, satellite imagery, and advisory platforms to monitor correct CSA adoption and track MFI outcomes.	They monitor adherence to sustainable farming practices to ensure eligibility for future carbon credits.
Account closure and delinquency management	They offer asset recovery options, such as equipment buybacks, to recover funds in case of default.			

Table 1: Roles of various partners to strengthen credit delivery systems

Build internal processes and systems

Robust internal systems are essential for effective CSA financing. A comprehensive strategy should focus on capacity building and technology integration. Based on the analysis, headquarters staff must develop expertise in CSA technology, financing trends, risk mitigation, product design, governance, and stakeholder partnerships. Branch staff require loan performance analysis, risk assessment, and compliance monitoring skills. Meanwhile, field staff will need practical knowledge of CSA practices, farmer engagement, and digital data collection and loan processing tools.

All MFIs should conduct a thorough training needs analysis before implementation. A phased approach to capacity building should include the creation of a centralized knowledge repository, onboarding of experts, and development of tailored training programs. The training delivery should incorporate collaborative methods, such as workshops, peer-learning sessions, and exposure visits, to enhance knowledge sharing and best practices.

Additionally, MFIs should dedicate efforts to collect and report data on climate change's impact on their portfolios, particularly in terms of losses incurred. Furthermore, they need to establish mechanisms to track and report ongoing financing activities that fall under the scope of CSA financing.

Technology integration is equally crucial to optimize CSA financing. MFIs should strengthen core technologies, such as digital payments, API platforms, and MIS dashboards. They can then adopt emerging risk and demand assessment tools, such as geotagging and machine learning. Future advancements, such as AI chatbots for customer service and voice-enabled media technology, can be explored for further innovation.

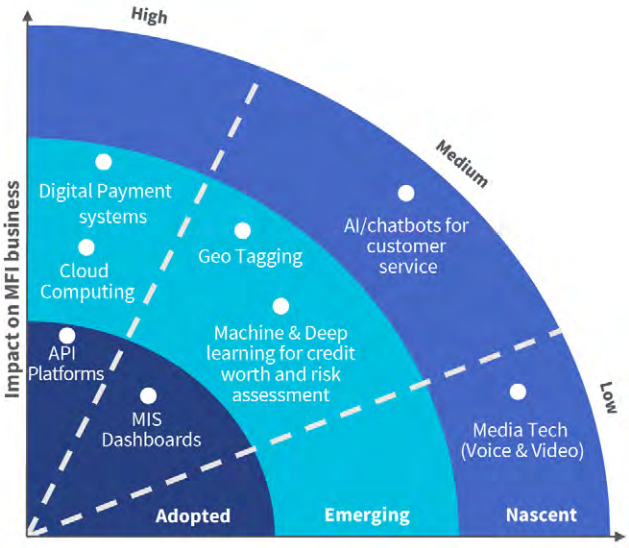

Figure 8: Phased approach to technology integration

Ecosystem-level recommendations

The implementation of interventions that support both the demand and supply sides of CSA financing is crucial for an enabling ecosystem to emerge. Ecosystem players in this context include relevant central and state departments (the Department of Agriculture, the Department of Fertilizers), policymakers, regulators (NABARD, SIDBI, RBI), self-regulatory organizations (Sa-Dhan, MFIN), and CSA technology providers.

CSA technology providers play a vital part to enable and scale CSA financing by bridging the gap between climate-resilient practices and investable opportunities. Their effectiveness is measured through product quality, delivery, after-sales service, and overall reliability, which directly influences the bankability and financing potential of CSA technologies. The ecosystem of CSA technology providers is diverse and evolving, with players at different stages of maturity. Some are well-established, while others are still in early development. Further research is needed to support and integrate these technologies into financing mechanisms. This research would also map the landscape of providers and help understand the specific constraints and challenges they face when they attempt to scale their solutions and meet the needs of varied agricultural contexts.

Provide access to concessional finance

Philanthropic organizations, development finance institutions (DFIs), and impact investors should focus on providing **catalytic financing** to strengthen both the demand and supply sides of CSA.

On the demand side, the creation of green bonds can provide long-term funding for MFIs, improve liquidity in the sector, and support CSA initiatives. Additionally, concessional debt refinancing mechanisms that offer

MFIs lower interest rates and extended repayment terms would enable them to provide more accessible loans for CSA projects. The allocation of dedicated funds for interest subvention can also bridge the gap between regular and subsidized interest rates, which would allow MFIs to offer farmers lower-interest loans for CSA financing.

On the supply side, engagement with CSA technology providers through blended finance models is vital. These models can support the growth of CSA solutions and prevent promising innovations from failing at an early stage, often referred to as the "valley of death."

Implement support mechanisms for risk mitigation

Risk-sharing mechanisms, such as guarantee funds, are essential to reduce the risks involved in CSA financing. These funds can create social impact guarantees, partial credit guarantees (PCGs), and first-loss default guarantees (FLDGs) to help lower MFIs' perceived risks. Catalytic funders could design a social impact guarantee to meet specific CSA-related performance metrics that involve various stakeholders, such as MFIs, impact investors, and independent evaluators. A PCG can cover MFIs' losses if the borrower defaults on high-value loans. This will encourage investment in CSA projects that are otherwise considered too risky. Meanwhile, an FLDG provides a derisking mechanism for investors in MFIs. Thus, it can reduce the cost of capital and make CSA financing more attractive.

Additionally, the establishment of a dedicated insurance fund for CSA loan portfolios can protect MFIs from climate-related defaults. This fund can be capitalized through contributions from governments, donors, and private investors focused on climate resilience. MFIs can also buy index insurance to protect their CSA loan portfolios from credit and counterparty risks. This insurance would provide payouts that they could use to reschedule loans for farmers who struggle to repay the loan amount.

Enforce policy advocacy

A policy gap analysis is critical to identify deficiencies in current government support programs. Based on the findings from the policy gap analysis, financial institutions, regulators, and ecosystem players, such as CSA technology providers, can recommend policy changes to expand financial support for CSA. MFIs and CSA technology providers can also create regulatory sandboxes to test CSA innovations within a controlled environment.

Such sandboxes can promote experimentation and adaptation of global best practices. Farmer awareness programs can also help educate farmers on CSA's benefits and ways to implement these practices effectively. Workshops and seminars can further facilitate discussions between CSA technology providers, government agencies, and other stakeholders to explore integration opportunities and develop standards and protocols that align with public infrastructure needs.

Sectorial alignment on data and taxonomy

MFIs often struggle due to limited access to high-quality data, which hinders innovation and decision-making. The development of digital data-sharing platforms and the promotion of open innovation will bridge gaps and build stakeholder collaboration. The creation of standardized taxonomies for CSA technologies and financing products will also ensure consistency and comparability across the sector. Clear key performance indicators (KPIs) must be designed to track the performance and impact of CSA financing effectively. These indicators would measure outcomes across financial, environmental, and social dimensions.

The way forward

The guarantee-backed on-lending to MFIs, supported by technical assistance, has sparked interest among private players in CSA financing. Further, this opportunity analysis study has laid a strong foundation developing tailored CSA financial products and piloting them in select states. Building on these insights, Agri3 and IDH will make efforts to scale pilots, strengthen institutional capacity, and foster ecosystem-level collaboration to ensure sustained momentum and long-term adoption of climate-smart agriculture.

About the organizations

Agri3 Fund

The Agri3 Fund was developed as a joint endeavor of Rabobank and the United Nations Environment Programme (UNEP), with support from the Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden ("FMO") and IDH. The fund is a blended-finance vehicle to catalyze private financial resources for forest protection and sustainable agriculture and improve rural livelihoods. In the process, the fund intends to unlock at least USD 1 billion in finance toward deforestation-free, sustainable agriculture and land use.

The Fund provides guarantees to commercial banks and other financial institutions, known as "partner financial institutions (PFIs), to derisk and catalyze debt finance for capital mobilization. The Fund's ultimate beneficiaries are businesses that operate in the forestry, food, and agriculture sectors and SMEs that operate in the development assistance countries' food and agriculture value chain. These beneficiaries will be reached through their relationship with the PFIs that Agri3 will engage with. The PFIs will provide beneficiaries with a loan that the Fund will guarantee.

The Agri3 Fund has a three-step approach to mobilize capital and bridge the gap in financing through its 1) deep technical sector expertise, 2) ability to absorb and transfer financial risk, and 3) technical assistance, managed by IDH, for impact implementation. IDH brings businesses, governments, investors, and communities together to accelerate and scale up sustainable agricultural trade. IDH convenes, cocreates, and cofinancess programs worldwide to transform markets for the benefit of people, plants, and progress.

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HSBC India

The Hong Kong and Shanghai Banking Corporation Limited in India offers a full range of banking and financial services through 26 branches across 14 cities. HSBC is one of India's leading financial services groups, with around 42,000 employees in its banking, investment banking and capital markets, asset management, insurance, software development, and global resourcing operations in the country. The bank is at the forefront of arranging deals for Indian companies that invest overseas and foreign investments into the country.

MSC (MicroSave Consulting)

MicroSave Consulting (MSC) is an international advisory firm with more than 25 years of experience in driving financial, social, and economic inclusion. With a team of 300+ professionals across 68 countries, MSC provides strategic advice, technical assistance, and consultancy to governments, multilateral institutions, financial entities, and impact investors.

MSC's **Climate Change and Sustainability (CC&S)** practice uses expertise in agriculture, energy systems, MSMEs, health, and more to deliver solutions that promote resilience and low-carbon development. Known for its comprehensive services in strategy, climate finance, and capacity building, MSC works to drive meaningful climate action and sustainable development through locally-led approaches and digital solutions.

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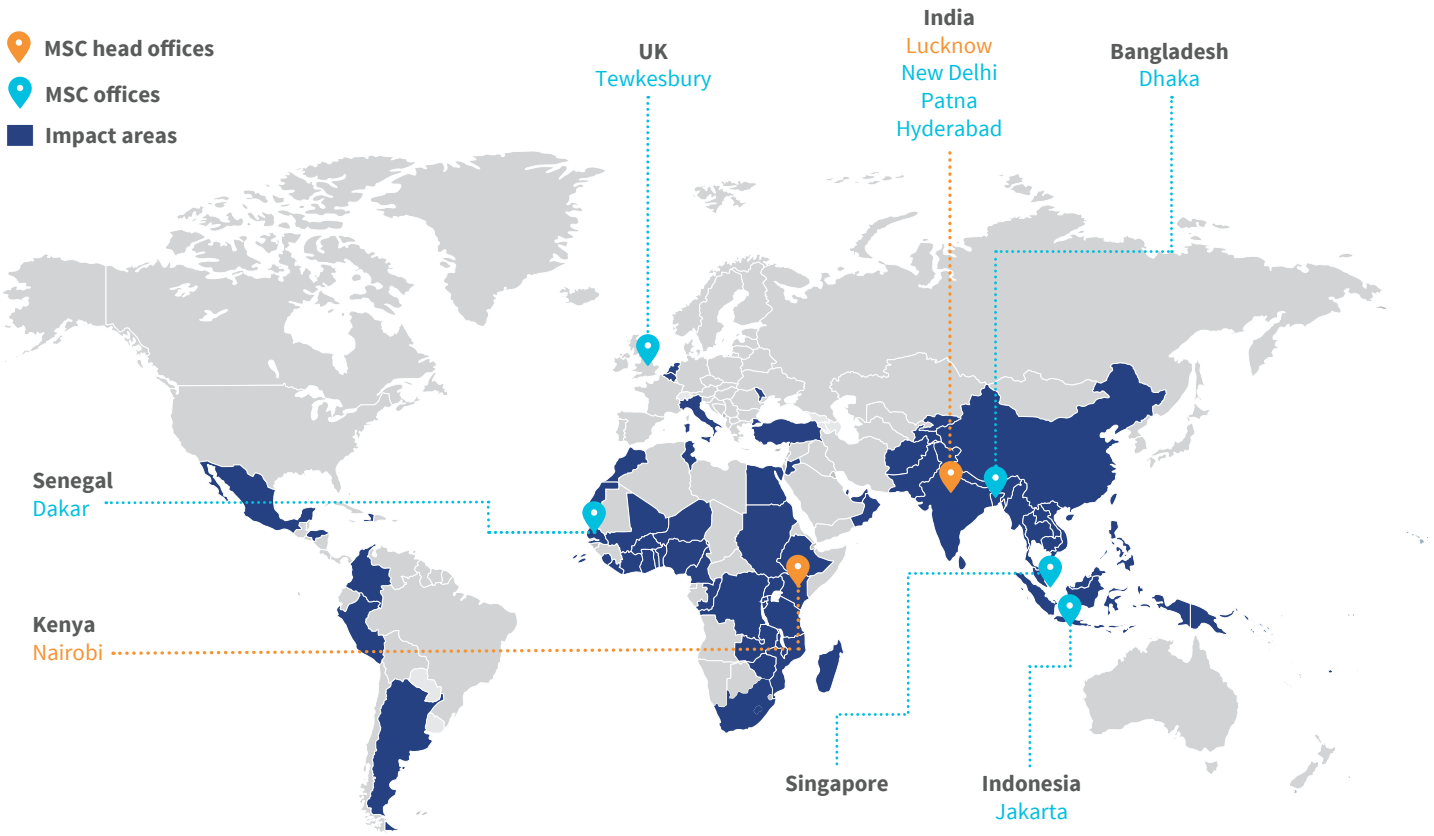
MSC
MicroSave Consulting



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