



Making Agriculture Climate-Smart

**A BUSINESS PERSPECTIVE FROM
SOUTH ASIA**

About IFC

International Finance Corporation, a member of the World Bank Group, is the largest global development institution focused exclusively on leveraging the power of the private sector to tackle the world's most pressing development challenges. Working with private enterprises in more than 100 countries, IFC uses its capital, expertise, and influence to help eliminate extreme poverty and promote shared prosperity.

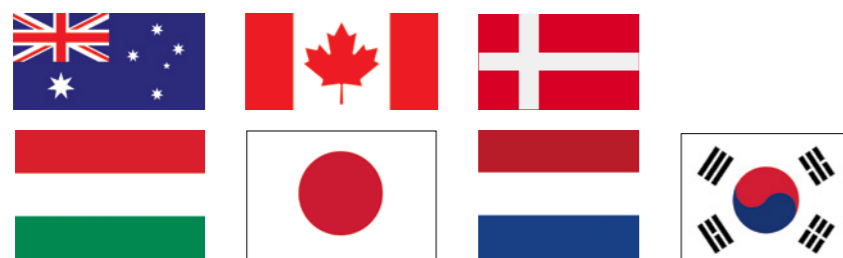
IFC's Manufacturing, Agribusiness, and Services (MAS) Department covers sectors that address basic human needs, such as food, shelter, jobs, and health and education. Clients in these sectors play a critical role in providing goods and services to consumers, creating jobs, contributing to government revenue, and stimulating growth through small-to-medium enterprises.

IFC has made agribusiness a priority because of its potential for broad developmental impacts that play a strong role in poverty reduction. IFC combines investment and advisory services to help the sector address higher demands and escalating food prices in an environmentally sustainable and socially inclusive way. In FY 2017, our investments in agribusiness and forestry totaled more than \$1.7 billion, including funds mobilized from other investors. Our investments in climate-smart agriculture totaled more than \$800 million. Our clients created opportunities for more than three million farmers.

For more information, visit www.ifc.org

Acknowledgements

In partnership with:



This publication would not be possible without the support of our development partners: Australia, Canada, Denmark, Hungary, Japan, the Netherlands, and Republic of Korea. We are also grateful to the Pilot Program for Climate Resilience (PPCR) and the Global Agriculture and Food Security Program (GAFSP) whose work in climate-smart agriculture has been critically important.

In addition, we express our deepest gratitude to our valued clients and teams at bigbasket.com, DCM Shriram Limited, Golchha Organization, Hindustan Coca-Cola Beverages Private Limited, Jain Irrigation Systems Limited, JK Paper Limited, Mountain Hazelnuts Group Limited, Olam International Limited, and Supreme Seed Company Limited for providing valuable content that made it possible for us to write the case studies.

Countries represented on the cover (clockwise from top left): Bangladesh, Nepal, India, and India. All photos from iStockphoto.com

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Foreword

South Asia is one of the fastest-growing regions in the world. While rapid economic growth has lifted millions out of poverty, the challenges of high inequality in many rural and urban areas, infrastructure bottlenecks, food security concerns, and unemployment remain. Furthermore, it is evident from persistent food and water crises in the region that climate change will constrain future growth.



While South Asia, particularly India, has made significant strides in climate change mitigation (through the reduction of greenhouse emissions), much remains to be accomplished on the adaptation front. IFC believes that demonstrating the business case for emerging climate-smart practices and technologies will allow the private sector to scale up adaptation and build resilience faster.

The agriculture sector in South Asia provides livelihood to millions of smallholders, and it is under severe threat from temperature increases, erratic rainfall patterns, sea water incursion and floods due to climate change. By 2030, the demand for all primary food commodities in South Asia may outstrip supply. Thus, there is a need for concerted efforts to increase farm yields while adapting to climate change. The private sector in South Asia is already rising to this challenge through the promotion of climate-smart agriculture. IFC is proud to have catalyzed that action, made possible thanks to support and commitment from our strategic development partners - Australia, Canada, Denmark, Hungary, Japan, the Netherlands, and Republic of Korea.

Similarly, water continues to be a significant challenge for South Asia. As per estimates by the 2030 Water Resources Group, India will suffer dramatic shortfalls in water and have less than 50 percent availability against its demand by 2030. There are water quality issues, particularly in parts of India and Bangladesh, where pollution and seawater incursion are responsible for its deterioration. Through corporate stewardship, the private sector can play a significant role in the conservation and efficient utilization of water.

South Asia is a region of priority for IFC – both for investment and advisory services. We are eager to explore new opportunities with our clients and donor partners to achieve development impact through the private sector. Agribusiness is a key priority given the complexities of the supply chain, the dominance of smallholders, and the imminent challenges due to climate change.

There are many technological innovations and business models emerging worldwide that can transform agriculture in a climate-smart manner. These innovations and models deserve support to enable rollout on a commercial scale. IFC believes that much can be accomplished through knowledge sharing and collaboration between private entrepreneurs, policymakers, civil society, farmer organizations, and research institutions. This publication is an attempt to facilitate that knowledge sharing among key stakeholders by profiling successful private sector companies in South Asia and their business-linked climate-smart initiatives.

Adjustment to climate change and building resilience is no longer a choice; it is an imperative for the sustenance and growth of all businesses. IFC will continue to support our clients on this journey, and we welcome new insights, comments, and feedback on this publication.

Sincerely,

Tania Lozansky
Global Head, Advisory Services
Manufacturing, Agribusiness, and Services Department

Introduction to Climate-Smart Agriculture



The agricultural sector drives many economies but must evolve to meet growing food demands. It must also reduce its environmental footprint and adapt to a changing climate. Agriculture contributes to – and is affected by – climate change. Agriculture and forestry account for up to 30 percent of global greenhouse emissions.

At the same time, farmers across the globe are experiencing more droughts, floods, and heat waves that are increasing production variability and pushing already vulnerable populations into poverty and potential migration, as farmers seek new sources of income. Climate change also increases food market volatility, which drives up food prices and increases the risk of food insecurity.

The World Bank Group describes climate-smart agriculture as an integrated approach to managing food-producing landscapes – cropland, livestock, forests, and fisheries – that addresses the interconnected challenges of food security and climate change. Climate-smart agriculture promotes a set of practices and business models that can help reduce emissions and build resilience. It aims to address both food insecurity and climate change by improving resistance to climate impacts, reducing greenhouse emissions, and increasing farm productivity. IFC provides investments and advice that contribute to the three pillars of climate-smart agriculture.

Countries and companies are making climate-related commitments and investments. Ninety-four percent of the Intended Nationally Determined Contributions submitted at the Paris Conference of the Parties (COP) included obligations and "asks" around agriculture, forestry, and land use. Our clients are stepping up to be part of the solution to protect their brands, enhance competitiveness, and reduce risks in their supply chains. The private sector is increasingly investing in climate-smart practices and new business models.

IFC has defined three strategic focus areas. The first involves helping companies raise their productivity in livestock farming – generating more meat and milk per animal – through a combination of genetics, feed substitutes and supplements, and improved farm operations. The second focus area assists farmers in growing more food with fewer inputs through innovative practices such as precision agriculture, efficient irrigation, and reducing the amount of fertilizer used. The third focus area promotes advising clients on ways to reduce post-harvest crop losses, improve food security, and boost incomes by investing in enhanced warehouses and silos, cold storage facilities, better logistics and distribution, and consumer education programs.

Accelerating investment in climate-smart agriculture requires governments to create supportive environments, the private sector to commit to greener supply chains, for farmers to adopt more sustainable agronomic practices, and for financial institutions to offer innovative financing models. IFC, through its investment and advisory services, is committed to being a trusted partner and helping clients achieve the results that they desire.

Nina Zegger
Global Head, Climate Business
Manufacturing, Agribusiness, and Services Department

Smallholder Productivity



“ We at DSCL Sugar are committed to agricultural sustainability linked to food security. The inclusive approach of the Meetha Sona program, with its climate-smart sustainable sugarcane cultivation, enhanced yields, smart land and water use, rural entrepreneurship, and mechanization, complements DSCL’s sustainability vision.”

- ROSHAN LAL TAMAK, EXECUTIVE DIRECTOR

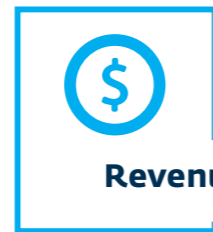


CORPORATE OVERVIEW: DCM SHRIRAM LIMITED



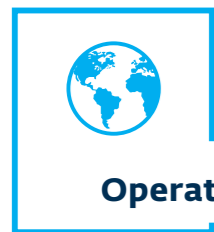
Company Profile

A business conglomerate with interests in agribusiness (sugar, fertilizers, farm-solutions, and hybrid seeds), chemicals (caustic soda and PVC compounds), power, and cement



Revenue

Approximately \$1 billion (2016-2017)



Operational Reach

Headquartered in New Delhi, India with operations in South Asia and Southeast Asia spanning Indonesia, Thailand, and the Philippines



Relationship with IFC

Investment client since 2005 with cumulative investments of \$160 million approximately to date; advisory client since 2009

www.dcmshriram.com

PROGRAM OVERVIEW: FARM YIELD IMPROVEMENT (SUGARCANE)

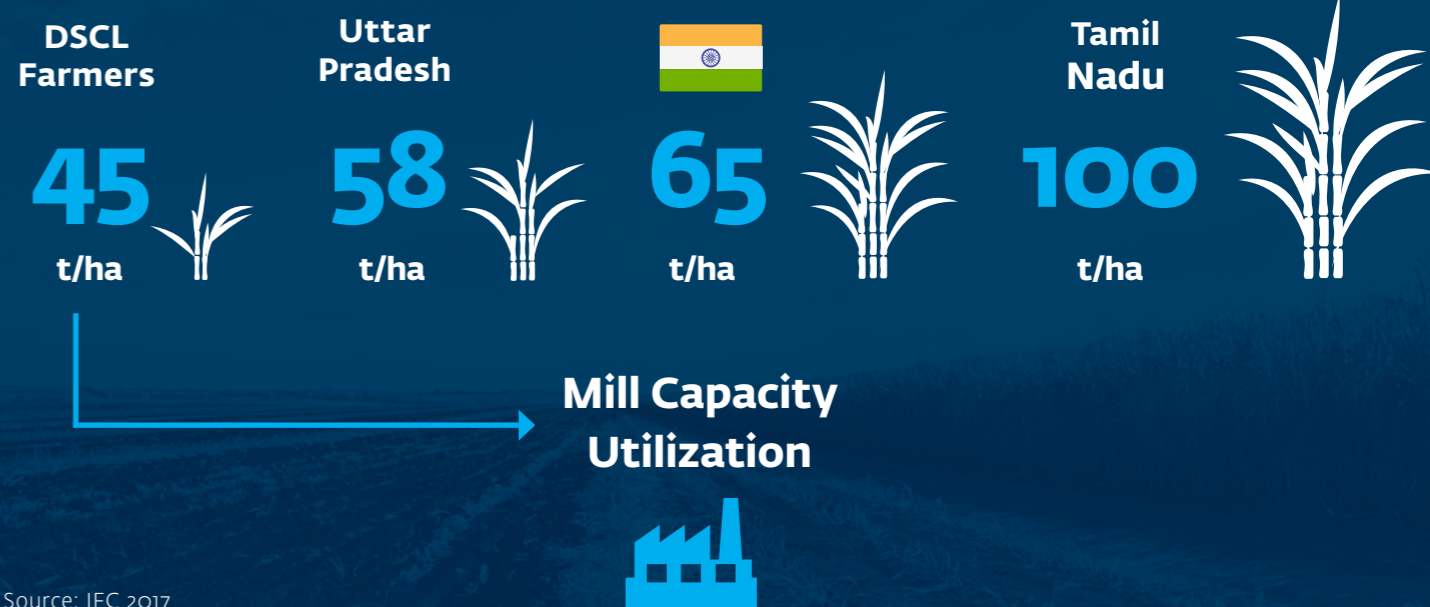
DCM Shriram Limited (the “company”) started its sugar business in the central Indian state of Uttar Pradesh in 1997 and now operates four sugar mills with a total installed capacity of 33,000 tons crushed per day, crushing four million tons sourced from 150,000 smallholder farmers. The sugar production facilities also have cogeneration power plants with installed capacity of 115 MW supplying energy to the national grid and meeting the company’s captive power requirements.

THE CHALLENGE

Sugar mills need to run for at least 120-140 days in a year for optimal efficiency. Smallholder farmers in the company’s sugarcane procurement area have low farm yields compared with sugarcane farmers in other parts of the state and the country. For instance, while the average sugarcane yield for Uttar Pradesh is 58 metric tons per hectare, for farmers in the company’s sugarcane procurement area, the yield is 45 metric tons per hectare. The average sugarcane yield for India is 65 metric tons per hectare, while the highest sugarcane yields in India are recorded in the state of Tamil Nadu at 100 metric tons per hectare. The low farm yields in the company’s sugarcane procurement area increases the opportunity cost for cultivating sugarcane, leading to several farmers shifting to other commercial crops. For the company, this means a reduction in sugarcane available for sourcing, leading to a reduction in the number of days for mill crushing and, therefore, reduced plant capacity utilization.

There were several reasons for low and stagnant farm yields in the company’s sugarcane procurement area. One of the prime reasons was low capacity and technical know-how of the smallholders cultivating sugarcane. Most farmers were practicing low-tech agriculture with unsustainable input usage, such as over-application of fertilizers and water (leading to an increase in the cost of cultivation without any commensurate increase in yields) and non-climate-smart practices such as burning of crop residue and over-irrigation.

FIGURE 1: BELOW-AVERAGE YIELDS LEADING TO REDUCED MILL CAPACITY UTILIZATION



Source: IFC 2017

THE SOLUTION

In 2009, the company and IFC developed a systematic program for farmer training and capacity building for sustainable yield improvements through adoption of a climate-smart sugarcane agronomy package of practices (PoP) named the 'Meetha Sona' program, which translates to 'sweet gold.' Starting with 2,000 smallholders, the company introduced several training and capacity building measures for the extension workers and farmers. These included establishing demonstration farms for climate-smart sugarcane cultivation practices, such as new climate-resilient, high-yielding varieties; soil health improvement; water-use efficient practices and technologies such as mulching, furrow irrigation, land levelling, and drip irrigation systems; and an integrated pest management program. With IFC's support, the company adopted an eight-step approach following the '3 S' principle of suitability, sustainability, and scalability, as depicted below.

FIGURE 2: 8-STEP APPROACH FOR SUSTAINABLE YIELD IMPROVEMENT

1. Need Assessment

- Identifying gaps/opportunities
- Baseline

3. Training Manual

- Good agronomy
- Extension support
- Improved varieties
- Farmer engagement criteria
- Do's / Don'ts

5. Lead Farmers

- Technology demonstration and exposure visits
- Farmer groups, mentorship
- Micro-entrepreneurship for mechanization

7. Monitoring & Evaluation

- Field performance with crop cutting
- Farmer KABP survey
- Cost-benefit analysis

2. Custom PoP

- Locally appropriate PoP including water-use efficiency

4. Capacity Building

- Training the trainer approach
- Classroom and on-field training & feedback

6. Farmer Training & Demonstrations

- Farmer training by extension workers
- In-field expert advisory
- Technology demonstration

8. Scale Up/Replication

- Development results
- Best practices/lessons

Source: IFC 2017




RESULTS

After 3 years of implementation, an independent, third-party assessment for the demonstration program showed a 69 percent yield differential for the program farmers vis-à-vis the control group farmers. The company thereafter scaled up the initiative to cover 80,000 farmers, including 15,000 women farmers, and laborers surrounding its four sugar mills. As a result, there has been an increase of over 70 percent in the area under mulching where smallholders have shifted from stubble burning, thereby reducing greenhouse emissions from the farms while also improving soil water moisture and reducing demand for irrigation. Over 50 percent of Indian farmers grow sugarcane during autumn planting (September to October) along with pulses, oilseeds, green gram, and potatoes, a practice which not only promotes smart land use but also supplements farm incomes. Thirty-eight billion liters of water-use has been avoided on sugarcane farms due to smallholders adopting water use efficiency practices, such as mulching, land leveling, and furrow irrigation, a figure independently verified by EY.

With IFC's support, the company has partnered with several other interested institutions such as Solidaridad Asia Limited and Hindustan Unilever Foundation to bolster its efforts to scale up. Today, the company is in Phase IV of the Meetha Sona program with support from an additional partner, Coca-Cola India Private Limited, with the aim of further increasing farm yields by an additional 25 to 30 percent through 2020.

The company also benefited from the Meetha Sona program. With increased availability of sugarcane in the area, the company was able to increase its procurement volume. From a baseline of 90-day milling operations in 2010, it has boosted productivity to 120 days of milling operations in a season, thereby improving its plant capacity utilization. There has also been a marked improvement in the quality of sugarcane, with sugar recovery improving over the last few years. From an average recovery of 9.27 percent in 2014-2015, sugar recovery has improved to over 10.01 percent in 2016-2017, which has in turn improved the company's top and bottom-line performance. Furthermore, sugar recovery is poised to increase to 10.50 percent in 2017-2018 due to acceleration in adoption of improved agronomy practices by farmers and improvements in the 'cut-to-crush' time due to the streamlining of harvesting systems and processes.

Figure 3: Climate-Smart Agriculture Impact Summary

Type	Description	Impact to Date	Expected Impact by 2020
 Smart land use	Increased output per unit of land (allowing land to be used for other crops); balanced land-use through inter-cropping; improved farmer income	Average 20 percent increase in yields and farmer income	15 percent yield increase
 Water-use efficiency	Optimal use of water as per crop requirement; reduction in irrigation water requirement due to efficient practices and technologies	~55 billion liters of water use avoided on farms	20 billion liters of water use to be avoided
 Greenhouse emission reductions	Reduced diesel pump usage (due to reduction in irrigation water demand); reduced stubble burning due to mulching	70 percent increase in area under mulching	100 percent of procurement from farms with no stubble burning

Source: IFC 2017

“Golchha Organization believes in sustainable value innovation both in terms of economics and the environment. Through the PPCR project with IFC in Eastern Sugar Mills, we have added a new dimension of climate resilience to our work.”

– HITESH GOLCHHA, MANAGING DIRECTOR

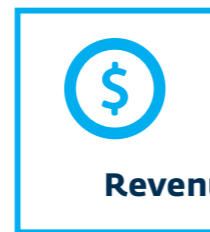


CORPORATE OVERVIEW: GOLCHHA ORGANIZATION



Company Profile

Golchha Organization is a business conglomerate involved in a wide range of sectors, including pulp and paper, steel and wires, food grain processing and oils, sugar, biscuits and confectioneries, plastic and tin packaging, particle boards, jute, aluminum, TV and electronic assembling, furniture, knitwear, vehicles, and agricultural tools and equipment. Eastern Sugar Mills Limited is a subsidiary of Golchha Organization.



Revenue

Approximately \$700 million (2016-2017)



Operational Reach

Across Nepal



Relationship with IFC

Advisory client since 2013

PROGRAM OVERVIEW: SUSTAINABLE AND RESILIENT SUGARCANE FARMING

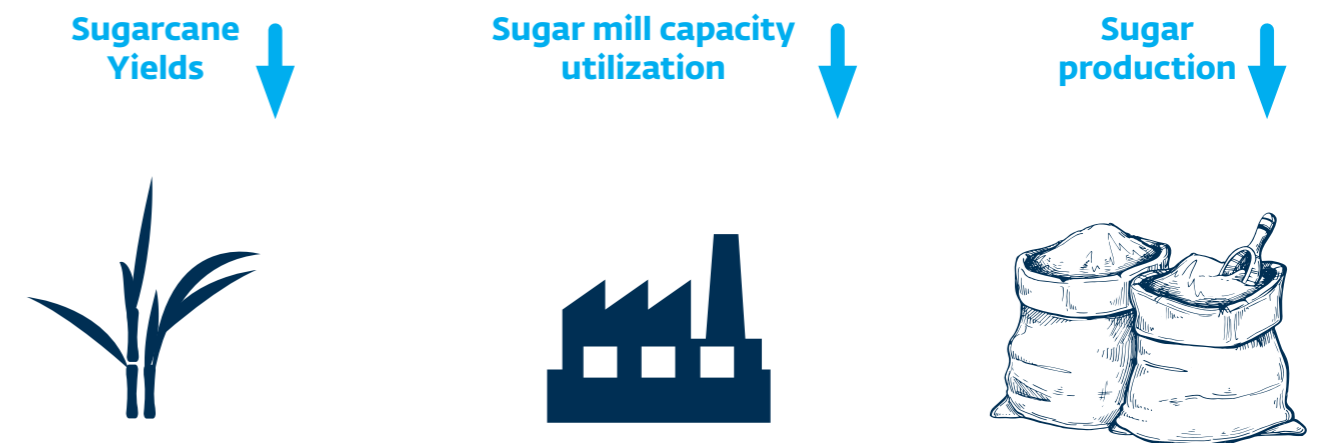
Golchha Organization (the “company”) is one of the largest business groups in Nepal. Its two sugar mills are also among the largest sugar manufacturing companies, namely, Eastern Sugar Mills Limited (ESML) and Shriram Sugar Mills Limited (SSML).

THE CHALLENGE

Nepal is one of the most climate-vulnerable countries in the world due to its harsh geography, largely poor and resource-dependent population, and weak institutional capacity to manage the climate challenges that it faces. With time, the effects of climate change are expected to further intensify extreme weather events requiring proactive measures to increase adaptation and resilience.

The plains of Terai are the agricultural hub of Nepal. This region is greatly affected by high temperatures, decreased rainfall, and increased occurrence of droughts and floods. Sugarcane is one of the major commercial crops grown in Terai. The current yield of sugarcane is around 50 metric tons per hectare and is expected to shrink by 10 to 12 percent by 2030 due to climate change. Both of the sugar mills owned by the company currently run below capacity (70 percent) due to the lack of availability of sugarcane for processing.

FIGURE 4: SHRINKING SUGARCANE YIELDS LEADING TO REDUCED MILL CAPACITY UTILIZATION



Source: IFC 2017

THE SOLUTION

The company partnered with IFC in 2013 to implement a project with its sugarcane farmers to increase resilience to climate change. The project was funded by the Pilot Program for Climate Resilience (PPCR), a funding window of the Climate Investment Fund (CIF).

The plains of Terai have high humidity, long dry spells between rains, and flash floods. Several practices were promoted to farmers to help them manage climate risks, such as mulching for soil moisture retention, planting stress-tolerant sugarcane seeds, and integrated pest management.

FIGURE 5: PROMOTING CLIMATE-SMART CULTIVATION PRACTICES TO SMALLHOLDER FARMERS TO STRENGTHEN SUPPLY CHAIN

6,000 Farmers
2,400 Women Farmers

- Farmer training**
- Technical & resilience skills**
- Demonstration farms**
- Mulching for soil retention**
- Planting stress-tolerant seeds**
- Integrated pest management**



Source: IFC 2017

RESULTS

Through the IFC-Golchha project, technical skills and resilience practices have been taught to over 6,000 farmers, including 2,400 women farmers, with the aim of increasing farm yield and sugarcane quality, and improving farmer relationships. Training farmers on climate change adaptation practices ensures the improved quality and quantity of sugarcane. On the demonstration farms, the yield has almost doubled from 50 metric tons per hectare to 96 metric tons due to the sustained adoption of recommended agronomy practices. For farmers, seeing is believing. In the case of ESML, smallholders had live demonstration fields to witness the impact on yields due to the adoption of recommended practices.

While the smallholders benefited from increased yields, the company benefited due to an increase in sugar recovery. The highest sugar recovery was recorded at ESML in Nepal with 9.6 percent versus the baseline figure of 8.2 percent.



Currently, 90 percent of farmers have reported the adoption of promoted practices. Sixty lead farmers play a key role in the promotion and adoption of project-promoted practices.

By the end of the project, over 6,500 farmers will have received training with an expected target of a 20 percent increase in productivity and income.

The company continues to identify new opportunities to support its farmers. With these encouraging results, it is important to mention that the company is taking initiatives for scaling up and replicating climate-smart practices in its business. For instance:

- The company has invested \$6.5 million in the second mill, and has a new partner on board to improve the overall efficiency and amount of support that farmers receive for productivity improvements.
- The company is planning for cogeneration through the sugar mills to promote clean energy and improve their overall financial health.
- The company is in discussions about a farmer exchange program with DCM Shriram in India for institutionalizing learning and knowledge sharing.

Figure 6: Climate-Smart Agriculture Impact Summary

Type	Description	Impact to Date
 Smart land use	Increased farm yields; soil health improvements; intercropping; integrated pest management	50 percent increase in yields as reported on demonstration farms Increase in sugar recovery by 1.4 percent
 Smart water and energy use	Water-use efficiency practices such as mulching, furrow irrigation and soil moisture retention; reduction in usage of diesel pump sets for irrigation resulting in greenhouse emission reductions	Estimated 20-25 percent reduction in irrigation water demand

Source: IFC 2017

“Hindustan Coca-Cola is focused on creating “shared value” in three critical areas: water, women and community well-being. We have something more valuable than just monetary resources to offer for the good of the public. It is our expertise, our know-how which is our unique and specific strength.”

– CHRISTINA RUGGIERO, CHIEF EXECUTIVE OFFICER



CORPORATE OVERVIEW: HINDUSTAN COCA-COLA BEVERAGES PRIVATE LIMITED



Company Profile

Hindustan Coca-Cola Beverages Private Limited (HCCB) is a part of the Bottling Investments Group of The Coca-Cola Company, Atlanta, the United States.



Revenue

Approximately \$1 billion (2016-2017)



Operational Reach

Headquartered in Gurgaon, Haryana, India



Relationship with IFC

Advisory client since 2016

www.hindustancoca-cola.com

PROGRAM OVERVIEW: FRUIT-CIRCULAR ECONOMY

Hindustan Coca-Cola Beverages Private Limited (the "company") is one of the largest institutional buyers of processed fruits, especially mango, for the flagship mango beverage brand Maaza.

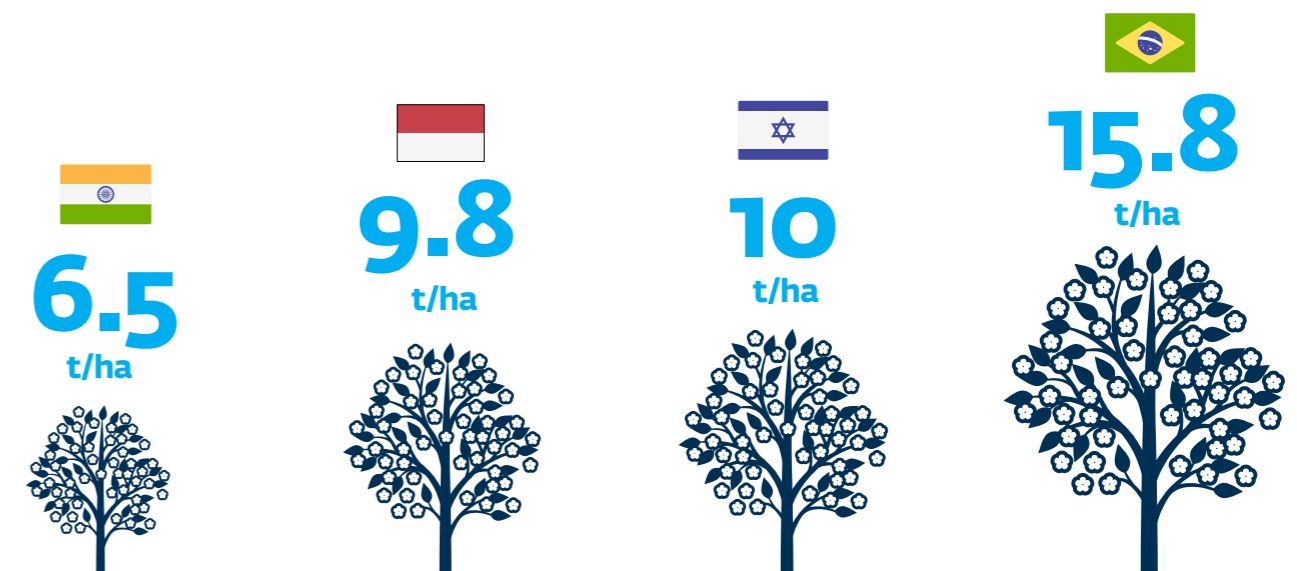
THE CHALLENGE

India is one of the world’s largest producers of mangoes, with one of the lowest farm yields for that crop. It is estimated that mango orchards cover over 1.5 million hectares of land in India with a total annual production of around 10 million metric tons. This translates to an average farm yield of around 6.5 metric tons per hectare, one of the lowest in the world when compared with other mango growing countries such as Brazil (15.83 metric tons per hectare), Israel (10 metric tons per hectare), and Indonesia (9.78 metric tons per hectare). This is further compounded by increasing water shortages in the major mango-growing belts of India due to changing weather patterns, which adversely affect ground and surface water availability. As a result, the yield of mango orchards has not kept pace with India’s increasing demand for them, which has seen a 20 percent annual growth rate over the last ten years for fresh and processed mangoes. This demand is primarily for the Totapuri variety of mangoes which are predominantly used in beverages and grown only in South India. This has created a demand-supply mismatch for Totapuri mangoes and has put pressure on the company to consistently source these mangoes in the right quantity and quality for its beverage business.

There are several challenges that plague Totapuri mango cultivation:

- Smallholder farmers with mango orchards utilizing outdated cultivation practices
- Limited access to timely information of new technologies and practices
- Limited access to quality inputs (saplings, fertilizers, credit)
- Limited access to markets with a heavy dependence on intermediaries, such as traders, reducing the effect on farmers on further improvements up the supply chain

FIGURE 7: BELOW-AVERAGE MANGO YIELDS NOT KEEPING PACE WITH INCREASING DEMAND



Demand ↑ 20%

THE SOLUTION

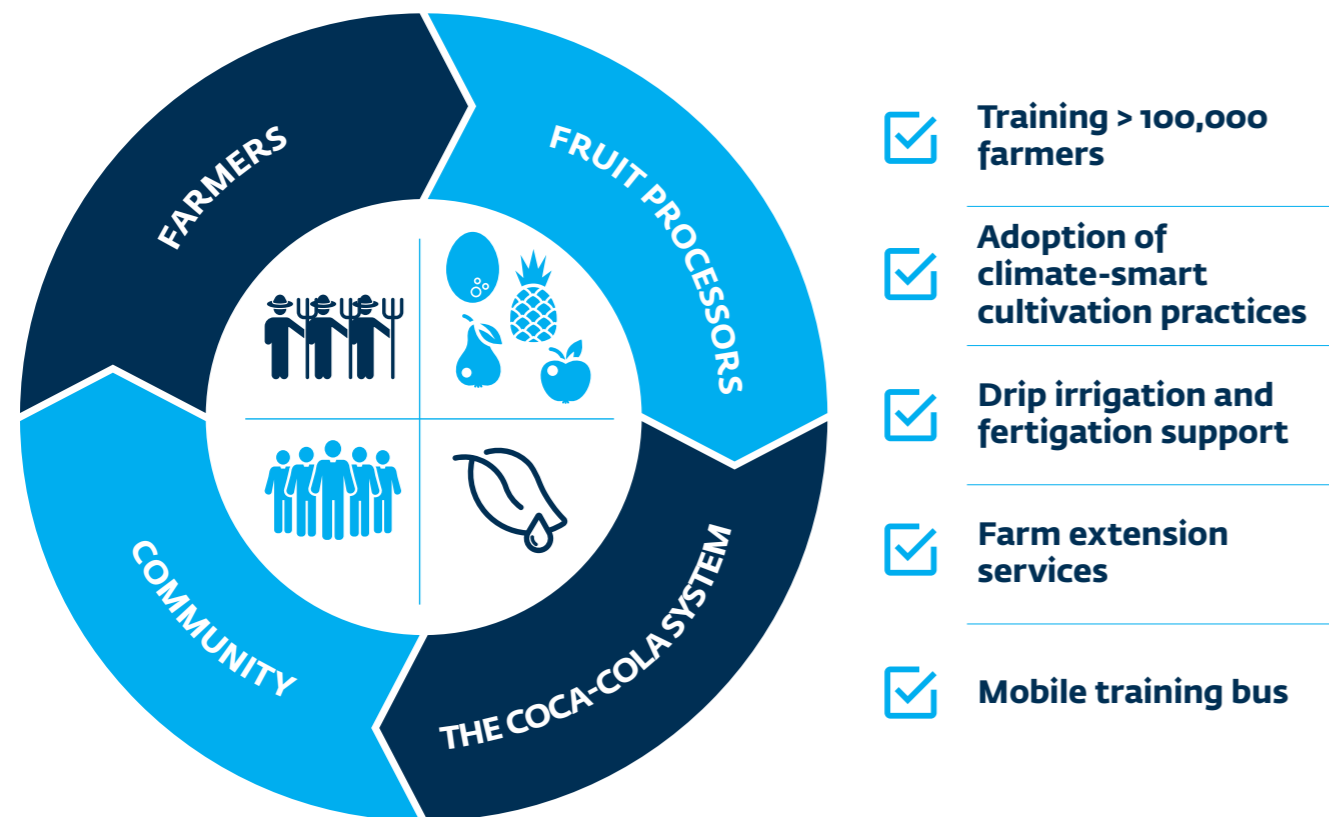
Project Unnati was designed in collaboration with Jain Farm Fresh Foods Limited and implemented in collaboration with IFC in transforming the mango value chain and the lives of farmers. This project represents a ten year, \$10 million investment to promote modern mango production on 25,000 acres with 12,500 farmers, including 3,000 women farmers, through modern planting techniques.

Furthermore, this project intends to train over 100,000 mango farmers on the rejuvenation of old mango orchards through a climate-smart sustainable PoP. The project aims to provide long-term, holistic farm solutions to smallholders, including mango seedling plantings, drip irrigation and fertigation support, and farm extension services to improve the transfer and adoption of technology. A mobile training bus, equipped with modern training facilities, was created to bring cutting-edge training programs to the doorsteps of farmers in their villages.

In addition, to minimize market risks for farmers undertaking necessary investments, the company will provide a 100 percent 'buy back guarantee' for all of the mangoes grown by the farmers supported by this project.

IFC is supporting the implementation of Project Unnati by providing expertise through smallholder farmer training on the adoption of climate-smart cultivation practices, hydrology assessment, and water modeling for the areas proposed for the project. This allows the farmers to develop water sustainability strategies and action plans.

FIGURE 8: 'FRUIT CIRCULAR ECONOMY' TRANSFORMS MANGO VALUE CHAIN AND IMPROVES LIVELIHOODS OF FARMERS



Source: IFC 2017

RESULTS

- Over 2,200 farmers have been trained in Andhra Pradesh and Karnataka to date. An additional 1,700 farmers have been trained to rejuvenate old mango orchards through climate-smart practices.
- 1,000 acres of land have shifted to modern production.
- An ultra high-density demonstration farm and nursery have been established for smallholder demonstrations.
- All farmers are provided free of charge extension support to implement Jain G.A.P. standards for compliance to quality standards, traceability, and environmental protections.

Project farms are expected to have double the yields of conventional mango orchards. Over time, it is expected that the bulk of the company's mango procurement requirements for Maaza will be met through engagement with farmers supported under Project Unnati.



This project systematically addresses the challenges in mango cultivation in these ways:

- Increases the capacity of smallholder farms through climate-smart mango cultivation practices and technologies
- Provides access to timely information and support for smallholder mango farmers in their adoption of new practices and technologies through trained extension workers and field coordinators
- Provides access to quality and timely inputs
- Provides access to markets for the sale of mangoes with a 100 percent purchase guarantee from the company
- Trains smallholders on the adoption of water-use efficient mango cultivation practices and technologies while keeping in mind the increasing water shortages in mango growing areas

In 2016, the company signed an agreement with the government of Maharashtra and Jain Farm Fresh Foods Limited for Project Orange Unnati to set up a citrus juice manufacturing facility in the Vidarbha region of Maharashtra in India. Orange Unnati is expected to benefit farmers across 10,000 acres of land with an average holding of two acres.

IFC and HCCB are discussing collaboration on Project Orange Unnati to support smallholder efforts, water sustainability measures, and impact assessments.

Figure 9: Climate-Smart Agriculture Impact Summary

Type	Description	Expected Impact by 2022
Smart land use 	Improved farm yields per unit of land through modern agri-techniques like ultra high-density fruit (mango, citrus) cultivation; intercropping for food security; soil health improvement; integrated pest management	Two-fold increase in yields Doubling of farm incomes
Smart water and energy use 	Increase in water-use efficiency, soil moisture management through adoption of efficient water-use technologies such as drip irrigation systems; reduced energy usage due to reduced diesel pump irrigation	20 to 25 percent increased water-use efficiency 10 to 15 percent reduction in farm energy use

Source: IFC 2017

Smart Land & Water Use



“ Our agribusiness model is designed on the concept of 'resource to roots,' which not only addresses the water, energy, and food security, but especially helps smallholder farmers improve their incomes significantly.”

- ANIL JAIN, CHIEF EXECUTIVE OFFICER

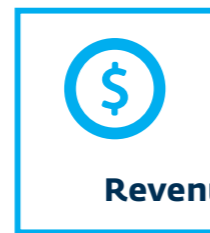


CORPORATE OVERVIEW: JAIN IRRIGATION SYSTEMS LIMITED



Company Profile

Jain Irrigation Systems Limited is a business conglomerate with interests in micro-irrigation systems, food processing, PVC sheets and pipes, solar energy appliances, and non-banking financial services. Jain Farm Fresh Foods Limited is a subsidiary of Jain Irrigation Systems Limited.



Revenue

Approximately \$1 billion (2016-2017)



Operational Reach

Headquartered in Jalgaon, Maharashtra, India, the company has a business presence in over 120 countries.



Relationship with IFC

Investment client since 2007 with cumulative investments of approximately \$150 million to date; advisory client since 2008

www.jains.com

PROGRAM OVERVIEW: WATER FOOTPRINT REDUCTION THROUGH DRIP IRRIGATION

Jain Irrigation Systems Limited (the "company") is one of the world's largest manufacturers of micro-irrigation systems (for example, drip sprinklers). Through its subsidiary Jain Farm Fresh Foods Limited, the company has business interests in food processing and has one of the largest industrial establishments in India for processing dehydrated produce, such as mangoes and onions.

THE CHALLENGE

Vegetable and fruit farming in India is predominantly done by smallholders, especially women farmers. In large parts of the country, particularly South India, there are increasing water shortages due to erratic rains caused by climate change and unsustainable groundwater usage in order to meet agricultural, industrial, and domestic water demands. The limited availability of water constrains smallholders' ability to produce and supply buyers such as Jain Farm Fresh Foods Limited.

INCREASING WATER STRESS PUTS PRESSURE ON SMALLHOLDERS, LIMITS YIELDS

Growing demand for water requires innovative solutions.

Source: IFC 2017

THE SOLUTION

The company has worked tirelessly to promote its 'more crop per drop' vision of irrigation. Through a detailed study of the interrelationship between soil, water, crops, terrain, and related agro-climatic conditions, it has designed a viable system to deliver measured quantities of water at the roots of plants at regular intervals. This ensures that the plants do not suffer from under- or over-irrigation. The company ensures that farmers are able to manage its micro-irrigation systems and it provides requisite after-sale services.

In collaboration with IFC, the company initiated India's first corporate water interest in the agribusiness sector when they tested growing dehydrated onions with and without drip irrigation in the Tapi River basin in North Central Maharashtra.

Using drip irrigation in onion cultivation has resulted in 1,200 liters of water saved per kilogram of dehydrated onions per year compared with onion cultivation using conventional irrigation. Since the bulk of dehydrated onions are exported, there is a reduction in virtual water trade of another 18 million cubic meters annually.

The benefits of drip irrigation in reducing water usage are also visible in the onion supply chain (farm-level) as shown in the table below. Compared to flood irrigation, the blue water footprint of onion cultivation under drip irrigation is less than one-third (500 liters per kilogram) of dehydrated onions under drip versus 1,796 liters per kilogram without drip. The results are equally noticeable for the gray water footprint at 13 liters per kilogram of dehydrated onions versus 286 liters per kilogram without drip.

FIGURE 10.1: 'MORE CROP PER DROP' IRRIGATION REDUCES WATER FOOTPRINT WHILE IMPROVING YIELDS

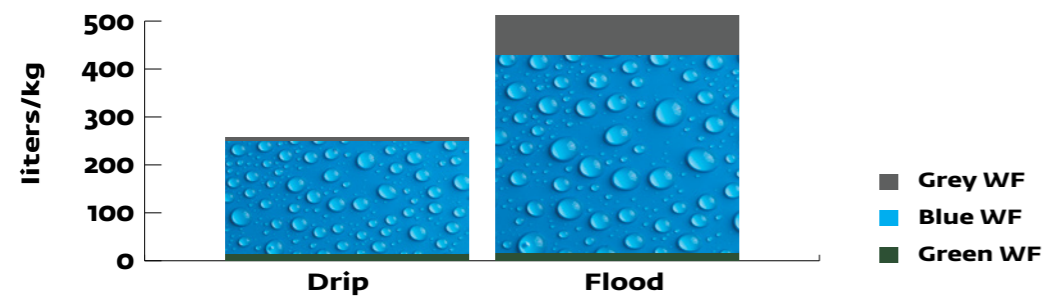


FIGURE 10.2: FARMERS COVERED UNDER MICRO-IRRIGATION

Year	White Onion			Mango			Banana		
	No. of Farmers	Areas Covered (Acres)	Crop Yield	No. of Farmers	Areas Covered (Acres)	Crop Yield	No. of Farmers	Areas Covered (Acres)	Crop Yield
2013-2014	2,445	4,977	36,726	-	-	-	420	2,682	-
2014-2015	2,452	4,679	38,054	148	209	6,931	599	3,600	15,047
2015-2016	2,489	5,400	47,171	582	3,948	5,613	658	4,011	28,356
2016-2017	2,489	5,056	43,206	453	3,172	6,210	476	2,599	10,414
2017-2018 (Proposed)	5,200	10,000	-	453	3,172	-	500	2,700	-

RESULTS




There have been other on-farm benefits as well from the use of micro-irrigation systems. For instance, the efficiency of fertilizer use has increased by 30 percent due to fertigation through drip irrigation systems. This has also had a positive bearing on crop yields, which in most cases have increased by over 50 to 100 percent when the crop was well-tended. Given the positive on-farm results from the use of micro-irrigation systems, the company has been able to convert 500,000 farmers, including 50,000 women farmers, to drip irrigation, making it the dominant player in the Indian micro-irrigation market.

Furthermore, while working with smallholders, the company realized that the cost of compliance with international supply chain standards such as GLOBALG.A.P. was very high. In collaboration with IFC, the company developed a simpler version of GLOBALG.A.P. referred to as Jain G.A.P. To implement Jain G.A.P., smallholders have been provided with assistance on soil water management to reduce input usage, technical agronomy extension support for cultivating improved varieties for higher yields, containers for safe storage of pesticides, first-aid kits on farms, personal protective equipment, requisite training for use of such equipment, and a manual for data keeping.

The company has mainstreamed Jain G.A.P. as an intermediate standard to improve farm yield, adopt climate-smart agriculture practices, and increase hygiene and sanitation on farms. The company has also had a positive effect on food safety, worker welfare, and wildlife and biodiversity conservation. In 2017-2018, the company intends to increase the area Jain G.A.P. by 10,000 acres of white onions, 3,000 acres of mangoes, and 2,700 acres of bananas.

The company has sourced over 165,000 metric tons of Jain G.A.P.-certified white onions, 53,000 metric tons of bananas, and 17,000 metric tons of mangoes to process and sell globally to institutional buyers, resulting in up to a 70 percent reduction in irrigation water requirements due to micro-irrigation systems and bringing irrigated agriculture to additional land.

Figure 11: Climate-Smart Agriculture Impact Summary

Type	Description	Impact to Date
 Water-use efficiency	Reduced irrigation water demand; reduced farm water losses	50 percent reduction in irrigation water demand 500,000 farmers adopted micro-irrigation systems
 Smart land use	Improved farm output per unit	15 to 20 percent increase in yields and farmer incomes
 Enhanced resilience to droughts, pests, and diseases	Adaptation of CSA practices under Jain G.A.P.; scalability/outreach to more smallholders	30,000 hectares of land certified in last 5 years 15,000 farmers trained

“ A passion for action is at the core of our existence at JK Paper, informing our business performance, competitiveness, and sustainability.”

– HARSH PATI SINGHANIA, VICE CHAIRMAN AND MANAGING DIRECTOR



CORPORATE OVERVIEW: JK PAPER LIMITED



Company Profile

JK Paper Limited is a part of the JK Organization, founded 100 years ago, and has business interests in paper, cement, automobile tires, power transmissions systems, agribusiness (dairy and seeds), defense electronics, health, and education.



Revenue

Approximately \$500 million (JK Paper), \$4 billion (JK Organization)



Operational Reach

Business presence in over 100 countries



Relationship with IFC

Investment client since 2006 with cumulative investments of approximately \$80 million to date; advisory client since 2008

www.jkpaper.com

PROGRAM OVERVIEW: SMART LAND USE THROUGH SOCIAL FARM FORESTRY

Part of the 100-year-old JK Organization, JK Paper Limited (the “company”) is one of India’s leading paper manufacturers. It has two large integrated paper manufacturing units in Rayagada in Odisha and Songadh in Gujarat with a combined capacity of 455,000 metric tons per year. It is the market leader in India in the branded copier paper segment and among the top two players in the country in coated paper and high end packaging boards.

India is one of the world’s largest and fastest growing paper markets. Currently, India sits at an attractive point in the consumption curve, with a national consumption rate of 11.5 kilograms per capita, still below the corresponding global per capita consumption average of 58 kilograms. Although India accounts for nearly 17 percent of the global population, it accounts for a mere four percent of the world’s paper consumption. This gap is narrowing due to several factors, including an increase in disposable income for millions of Indian households, an increase in literacy rates from 65 percent in the 2001 census to over 75 percent in the 2011 census, and the growing middle-class demand for paper for packaging and other services. This increase in the demand for paper has put pressure on pulp and paper companies to expand their capacity, and in turn, identify additional supplies of wood pulp, the key raw material.

THE CHALLENGE

While there is growing demand for paper and paper products in India, there is a severe shortfall in the supply of wood pulp. Unlike other major paper manufacturing countries where paper companies own large tracts of designated forest lands to meet their wood pulp requirements, India does not allow paper companies to own tree plantations. Thus, paper companies depend on outgrowers to plant trees. Given most farmers' reluctance to grow trees due to the relatively long gestation period from planting to harvest, many paper companies end up with wood supplies from a long distance away (sometimes as much as 600 kilometers from the manufacturing units). The business of paper manufacturing is critically influenced by logistics, as the most competitive companies are able to bring in wood pulp from closer locations, thereby keeping their transportation costs low.

To stay competitive and to ensure a stable and consistent supply of plantation wood, the company decided to source all its wood requirements from less than 200 kilometers from its manufacturing units. However, both of its paper manufacturing units are in locations that are water-stressed, have degraded lands with stagnant agriculture, and resource-poor farmers. This difficult situation is further exacerbated due to climate change, as evident from the increased frequency of fluctuating weather conditions, recurring droughts, and a growing incidence of pests.

THE SOLUTION

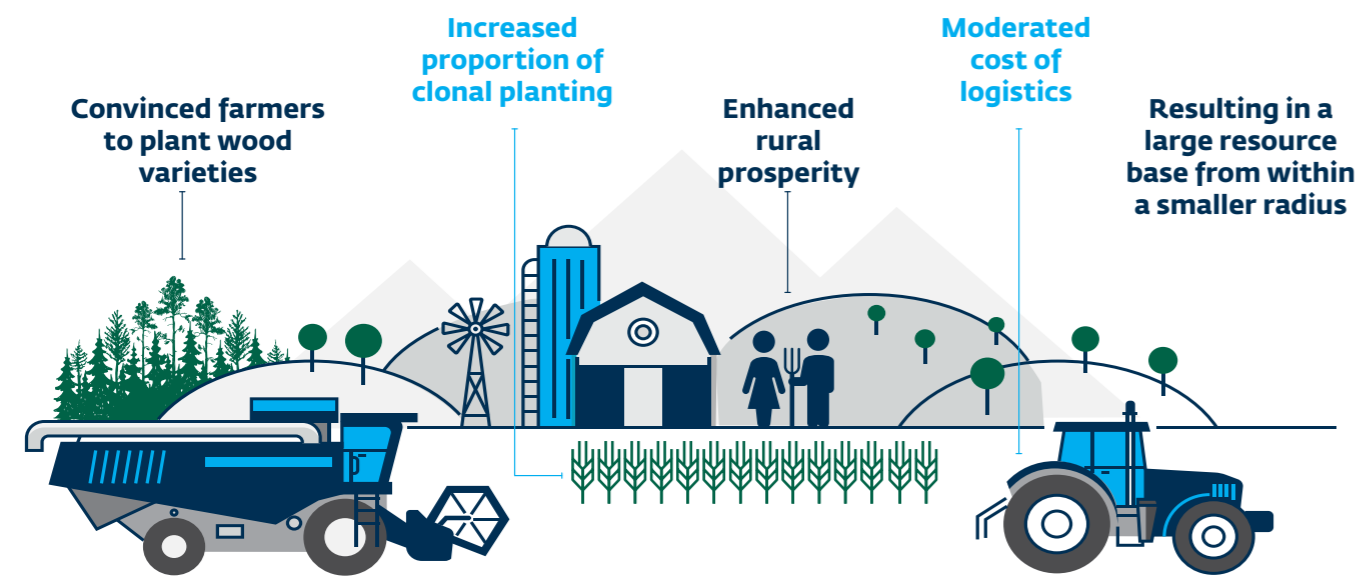
The company has initiated an ambitious program, called the Social Farm Forestry Program, for promoting climate-smart land use for outgrowers within 200 kilometers of its paper manufacturing plants. It works with outgrowers in proximity to its manufacturing units to grow the desired plantation wood (subabul). This was considered an audacious move by most industry experts, as it is difficult to convince farmers to change their traditional crop-growing patterns. Fears were that farmers would never plant long gestation crops, they would be apprehensive about buyers, and that they would not shift from commercial crops, such as sugarcane and cotton.

Under the Social Farm Forestry Program, the company undertook several measures to educate and convince the farmers to shift from crops with a high environmental footprint (sugarcane, cotton) to trees (such as subabul). In the process, the company did the following:

- Set up world-class research and development facilities at its paper manufacturing units to develop fast-growing clonal subabul varieties to reduce the time between planting and harvest
- Developed a cadre of trained extension employees to work with farmers and educate them on the benefits of shifting to tree plantations. This included educating them on farm economics. A number of farmers were organized in small farmer groups/cooperatives to work together to grow trees on a relatively larger scale as a unit
- Developed farms to demonstrate intercropping high-value, symbiotic crops with subabul so that farmers could improve their land use and supplement their incomes
- Provided a buy-back guarantee to all farmers growing clonal varieties of subabul to mitigate any marketing risks

The company collaborated with IFC in 2008 to professionalize its Social Farm Forestry Program, focusing attention on farmer training and capacity building, extension worker training, developing robust farm economics with trees and intercrops as appropriate for farmers, and facilitating access to financing for farmer cooperatives for tree plantations.

FIGURE 12: SOCIAL FARM FORESTRY PROGRAM BALANCES ECOLOGICAL FOOTPRINT AND FARMERS' INCOME SECURITY



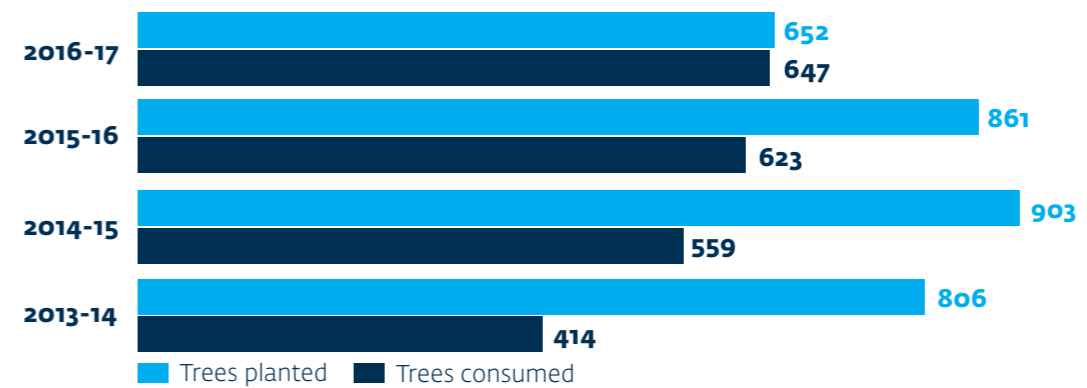
Source: IFC 2017

RESULTS

What started as a trickle several years ago has now attracted more than 45,000 farmers across both corporate locations, and the extent of coverage has increased from nil to an aggregate of over 150,000 hectares. The company has become a wood-positive company as it plants more trees than it consumes.

Just when it looked like a local commercial agriculture solution would not take off, persuasion and persistence triggered a plantation revolution. The proportion of raw material procured locally by the Odisha facility increased from 25 percent to an estimated 60 percent. The sourcing radius has declined, and the bulk of the sourcing is now conducted within 200 kilometers from the manufacturing plant, easing up logistics and reducing operating costs (including fuel consumption). Improved raw material quality (clonal variety trees) has translated into increased manufacturing efficiency.

FIGURE 13: TREES PLANTED VS. CONSUMED (LAKH)*



Source: JK Paper Limited

There have been several ecological and environmental benefits from the plantations under the Social Farm Forestry Program:

- Greening of wastelands and an increase in tree cover on degraded marginal lands. The company has encouraged an addition of 15,000 hectares annually to its plantation through the distribution of more than 60 million saplings to farmers, out of which 20 million saplings are produced in self-owned, high-tech, advanced clonal nurseries.
- Improved micro-climate, lowering soil temperature, and a reduction in moisture evaporation through shading and mulching. Eradication of surface run-off, nutrient and soil erosion, and improvements in soil structure through the constant addition of organic matter.
- Up to a 25 percent increase in farm incomes due to intercropping with clonal varieties of subabul.
- An Emission Reduction Purchase Agreement (ERPA) was signed, covering 1,608 hectares, mainly owned by small and marginal farmers associated with the company's Social Farm Forestry Program, providing additional income to participating farmers while shrinking their carbon footprint.

Figure 14: Climate-Smart Agriculture Impact Summary

Type	Description	Impact to Date
Smart land use 	Conversion of wasteland and degraded lands to green cover; intercropping with trees provides enhanced income to farmers and fixes nutrients like nitrogen in the soil	15,000 hectares planted annually for the last 5 years 20-25 percent increase in farmer incomes
Enhance soil water availability 	Trees enhance soil carbon content which in turn increases the soil moisture holding capacity and prevents water run-off	Water holding capacity increased by 10-15 percent for agro-forestry farms
Greenhouse emission reductions 	Increases carbon sequestration on land, and trees reduce greenhouse emissions on the farm	60 million saplings planted leading to a reduction in greenhouse emissions

Source: IFC 2017

*1 lakh = 100,000 units

“The looming Himalayas and their unique natural and cultural ecosystems are surprisingly vulnerable to climate change. By planting 10 million productive trees on degraded slopes, Mountain Hazelnuts provides long-term sustainability to these endangered treasures.”

- DANIEL SPITZER, CHAIRMAN & CHIEF EXECUTIVE OFFICER



CORPORATE OVERVIEW: MOUNTAIN HAZELNUTS GROUP LIMITED



Company Profile

Bhutan's first-ever 100 percent foreign direct investment; established in 2010 to produce hazelnuts; modeled to deliver "triple bottom line" (3BL) returns as a for-profit, for-purpose, and environmentally sustainable enterprise



Operational Reach

Bhutan



Relationship with IFC

Investment client since 2014 with cumulative investments of \$9 million to date (including GAFSP)

www.mountainhazelnuts.com

PROGRAM OVERVIEW: SMALLHOLDER HAZELNUT PRODUCTION

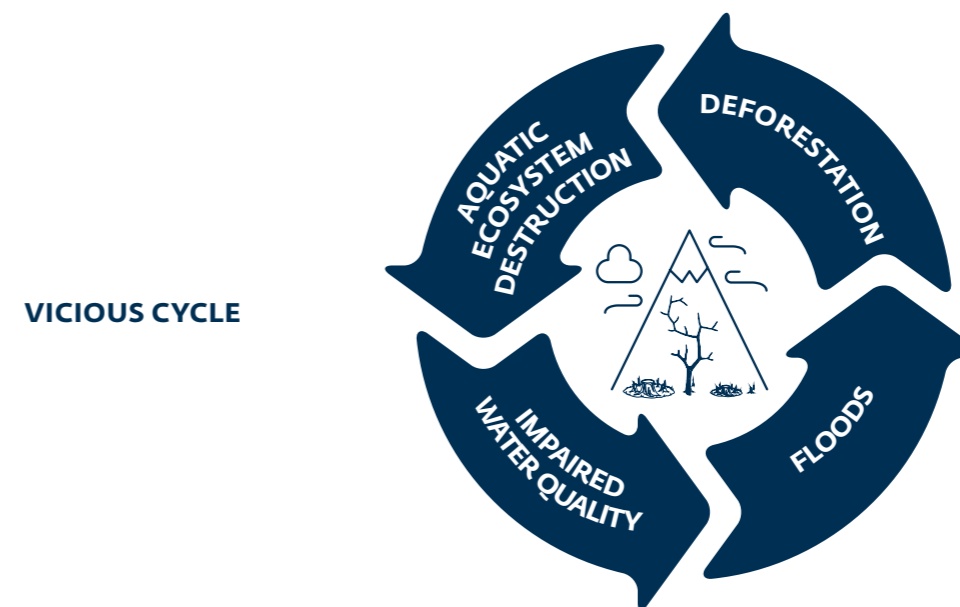
Bhutan's first-ever 100 percent foreign direct investment, Mountain Hazelnuts Group Limited was established in 2010. It was designed to deliver "triple bottom line" (3BL) returns: financial, social, and environmental. The company ventured into commercial hazelnut production in the Kingdom of Bhutan with the goal that its optimal agro-climate and soils would support a business capable of bringing prosperity to 15 percent of the country's overall population.

THE CHALLENGE

Traditional farming in many Bhutanese villages is subsistence-based, and consequently, farmers struggle to meet the "requirements of the market." This hurdle is exacerbated by long distances between farms and markets, which create challenging logistics for small farmer groups, especially when handling fresh vegetables and fruits. Few viable cash crops have been identified, and each of these has associated problems. These challenges are the largest for smallholder farmers living at higher altitudes, who have even fewer options to grow income-generating crops.

Deforestation, combined with fuelwood scavenging, cattle overgrazing, and "slash-and-burn" cultivation, has exposed vast Bhutanese mountainsides to the direct impact of the elements and led to a vicious spiral of land degradation. During the dry winter, the remaining scrub vegetation dies off and the ground hardens. When monsoons hit the slopes in the spring, there is not enough biomass to retain the soil, which then washes away. In subsequent years, the soil deteriorates even further, leaving it less hospitable for plants. Over time, hillside hydrology and flora fluctuate seasonally between dry periods, punctuated by flooding that is both ecologically damaging and dangerous, leading to reduced soil fertility, slope instability, stream sedimentation, impaired water quality, increased flooding risks, and aquatic ecosystem destruction.

FIGURE 15: DEFORESTATION LEADING TO A VICIOUS SPIRAL OF LAND DEGRADATION AND ECOSYSTEM DESTRUCTION



VICIOUS CYCLE

Source: IFC 2017

THE SOLUTION

The Mountain Hazelnuts model addresses each of these social and environmental concerns and exemplifies climate-smart agriculture on several dimensions by: providing a sustainable solution to increase farm incomes without displacing crops; improving mountainside communities' resilience to extreme weather, soil deterioration, and slope instability; restoring healthy watersheds; and filtering significant volumes of carbon dioxide.

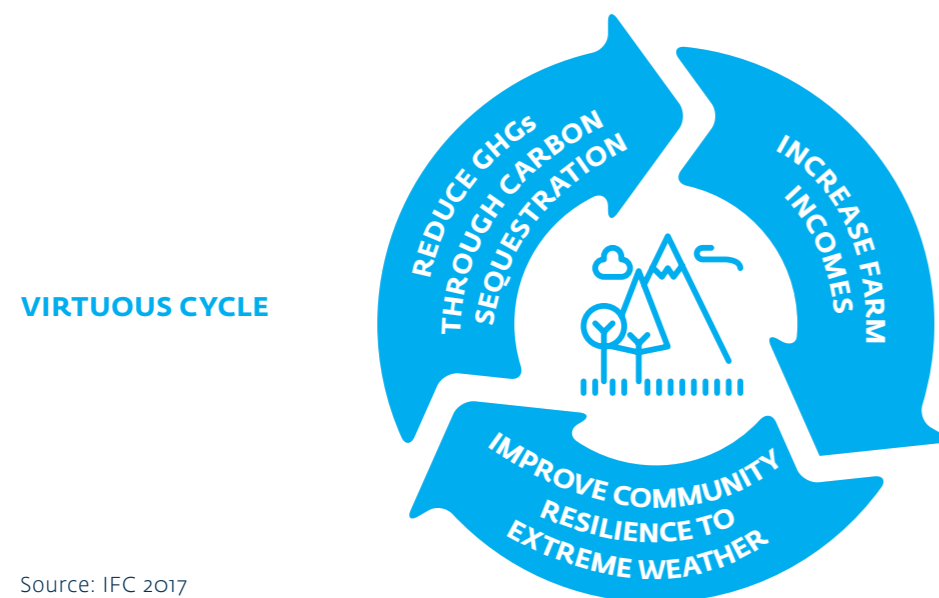
Increase farm incomes. The company targets land between 1,700 to 3,000 meters in altitude, which is an ideal agro-climate for hazelnuts and where farmers have been largely excluded from earning meaningful agricultural income. The company has partnered with farmers and local communities to exclusively repurpose fallow or degraded land for hazelnut orchards. Because hazelnut trees are only planted on fallow, mountainous land which farmers currently cannot use, this complements and increases their income. Hazelnuts will not displace current food crops or traditional farming activities, and food security will not be affected.

The company's model assures that farmers can share in the company's success, addressing the systemic barriers that keep them trapped in a poverty cycle, including supporting access to credit and savings through the company's partnerships with local financial institutions, the provision of critical collection and transport services, and the guaranteed purchase of market-quality hazelnuts. Lastly, significant economic and cultural benefits will positively affect the rural communities where the company works. Participating farmer households are expected to more than double their income through hazelnut growing.

Improve community resilience to extreme weather. The company helps redress the environmental challenges of reduced soil fertility, slope instability, stream sedimentation, and ecosystem destruction by providing the trees to plant in degraded areas, training its growers in hillside conservation technology, and creating economic incentives for farmers to carefully tend the trees. As an entirely rain-fed and resilient tree crop well-suited for Himalayan agro-climatic conditions, hazelnuts have few resource demands. By restoring tree cover, hazelnuts also help support more consistent rainfall during the dry season, maintain optimal moisture and humidity levels, reduce wildfire risks, improve crop growth, and support the hydrology of neighboring natural ecosystems. Furthermore, stabilizing slopes protects watersheds downstream from debris and siltation that can threaten aquatic ecology.

Reduce greenhouse emissions through carbon sequestration. The company's hazelnut orchards stabilize eroding mountain soils and will filter out an estimated 1.5 million tons of carbon dioxide, equivalent to 3.5 million barrels of oil. Pruned hazelnut stems provide a sustainable source of wood fuel, alleviating deforestation pressures and balancing energy requirements.

FIGURE 16: COMMERCIAL HAZELNUT PRODUCTION DELIVERS "TRIPLE BOTTOM LINE" (3BL) RETURNS



Source: IFC 2017



RESULTS

Within a short amount of time, the company has planted over 6 million hazelnut saplings exclusively on 25,000 acres of degraded or fallow land contributing to climate change mitigation and adaptation.

The company has established close collaborative relationships with local communities, having provided trees, training, and support programs to more than 9,000 farming households, which included 50 percent women farmers. Through a partnership with the Ministry of Agriculture and Forests, the company provides farmer training and outreach, support in developing local cooperatives, and transportation from remote villages to international markets. The company acts as a strong partner for smallholder farmers who do not have the finances to invest in saplings. It works with them from the initial planting of saplings to the purchase of harvested nuts.

Though still in its early days, there are already significant operational efficiencies because of the climate-smart initiatives undertaken with smallholders in Bhutan. At maturity, which is still a few years away, the company expects a total annual production of up to 40,000 metric tons of hazelnuts in Bhutan. The hazelnuts will be exported to lucrative international markets, becoming one of Bhutan's most important sources of foreign exchange earnings.

Figure 17: Climate-Smart Agriculture Impact Summary

Type	Description	Expected Impact by 2020
Smart land use 	Additional fallow and degraded land under agro-produce, thereby providing income security to smallholders; reduced soil runoff/deterioration; increased green cover; reduced impact of floods and runoff on mountain slopes.	Additional 25,000 acres of land to be brought under forest cover
Greenhouse emission reductions 	Increased tree cover mitigates greenhouse emissions from agriculture, ensures soil-water balance.	1.5 million tons of CO2 reductions

Source: IFC 2017

Climate Resilience



“ We at bigbasket believe that the natural way of farming is the best way for our farmers, as well as the environment. From day one, we have been passionately engaged in promoting organic products.”

- HARI MENON, CHIEF EXECUTIVE OFFICER



CORPORATE OVERVIEW: BIGBASKET.COM



Company Profile

Established in 2011, bigbasket.com (Supermarket Grocery Supplies Private Limited) is India's largest online food and grocery store with over 18,000 products and 1,000 brands in their product catalog, including fruits and vegetables, rice and lentils, spices and seasonings, packaged products, beverages, personal care products, meat, and other processed foods



Revenue

Approximately \$220 million (2016-2017)



Operational Reach

Headquartered in Bangalore, Karnataka, India with distribution across the country



Relationship with IFC

Investment client since 2015 with a cumulative investment of \$25 million in equity; advisory client since 2017

www.bigbasket.com

PROGRAM OVERVIEW: CONNECTING PEOPLE WITH FARMERS FOR THE PURCHASE OF SUSTAINABLE FRUITS AND VEGETABLES

bigbasket.com (the "company") is India's leading online grocery store. In a short span of six years, the company has expanded its business to over 25 cities in India with seven million registered customers placing over 1.5 million online orders monthly.

The company operates in four key segments: 1) a full-service platform primarily designed to cater to the monthly grocery demands of customers in Tier-I cities; 2) express specialty delivery to cater to the need for items with limited shelf life; 3) partnerships with specialty stores to supply perishable items such as meat and meat products; 4) a business-to-business model that provides inventory management services for smaller stores and hotels.

Fruits and vegetables are one of the key categories at bigbasket.com, consisting of over 18 percent of its total sales revenue. Currently, the company sources its fruit and vegetable requirements from 1,500 farmers through 20 collection centers in key sourcing regions.

THE CHALLENGE

Information asymmetry at farms is widespread in agriculture in most developing countries where farmers do not have timely information about the market and the weather. In the face of climate change, this information asymmetry can have far-reaching impacts, as farmers may not have relevant information in time to take remedial measures. This results in crop loss, loss in quality of produce, and financial burdens on the farmers. The company faces the challenge of inconsistent quantity and quality of vegetable sourcing due to the lack of information systems that can track the farm output and provide weather and related agronomy information to farmers in real-time.

Fruit and vegetable production is affected by climate change. Changing weather patterns such as rising temperatures, prolonged summers, shortened winters, and erratic rain have altered agricultural systems for fruits and vegetables, resulting in stagnant or declining farm yields, increased pests and diseases, reduction in quality, and crop failures. The bulk of the vegetable farming in India is carried out by smallholders, particularly women. Stagnant or declining farm productivity in vegetable farming due to climate change is adversely affecting the livelihood of these poor and vulnerable farmers. For instance, the potato is highly sensitive to temperature fluctuations and sunlight. Due to rising temperatures and related pests and diseases, potato yields are expected to decline in almost all potato-growing states in India by 16 to 20 percent by 2030.

FIGURE 18: FRUITS AND VEGETABLES UNABLE TO ATTRACT COMPETITIVE PRICES DUE TO INTERMEDIARIES IN THE VALUE CHAIN, INCREASED INCIDENCE OF PESTS AND DISEASES



Rising temperatures

Pests and diseases

Crop failures

Stagnant or declining yields

Decrease in quality

Poor appearance

Source: IFC 2017

THE SOLUTION

In collaboration with CropIn, a mobile phone-based farmer information services platform provider, the company has launched an ambitious program called 'Farmer Connect' with the goal of bridging the information gap at the farmer's end by providing timely crop advisories related to weather and market conditions. CropIn's artificial intelligence uses satellite data to gather weather and field conditions and provides customized crop advisories for the company's farmers. This is then provided to farmers either through their field agronomists, directly through SMS, or via an application. The company also uses this platform to support farmers in planning their farm operations, records the application of inputs, particularly the use of pesticides and fertilizers, and assesses expected yields. This enables the company to forecast expected outputs (and in turn, supplies) and plan its inventory accordingly in its warehouses to minimize crop wastage and meet customer demands.

FIGURE 19: FARMERS USE SMART TECH-DRIVEN SOLUTIONS AND FARM ADVISORY TO GET UPDATES ON WEATHER AND MARKET CONDITIONS

Localized advisories to farmers via SMS and Farmer Connect App



Source: IFC 2017



RESULTS

Through the Farmer Connect program, the company can directly reach out to all of its 1,500 smallholders and provide crop advisory services, as well as procure fruits and vegetables. Over 72 percent of all fruits and vegetables sold on the company's online platform are sourced directly from the farmers. This has enabled the company to not only eliminate intermediaries from the supply chain and improve efficiencies, but also provide a mechanism for ensuring quality and traceability throughout its supply chain.

The company and its farmers have received the following benefits from the Farmer Connect Program:

- Through this process of disintermediation, the company has managed to improve supply chain efficiencies by 30 percent, resulting in improved margins for the company, higher prices for the farmers, and lower prices to consumers.
- Farmers linked to the company's supply chain have reported reduced usage of farm supplies, especially pesticides and fertilizers, due to timely crop advisories, resulting in improved input-use efficiency which reduced the cost of cultivation.
- Encouraged by the success of the Farmer Connect program, the company plans to double its farmer base to 3,000, including 1,500 women farmers, by 2018. Using the mobile phone-based farmer information platform, the company plans to introduce farmer capacity building initiatives linked to global supply chain quality standards such as GLOBALG.A.P. The company intends to retain its position in India as the leading online retailer of fruits and vegetables by connecting with farmers to provide extension support, climate advisories, and food safety measures. In this regard, the company and IFC are exploring collaboration opportunities related to building smallholder capacity on food safety.

Figure 20: Climate-Smart Agriculture Impact Summary

Type	Description	Expected Impact by 2019
Smart land use 	Improved output per unit of farm land; improved input-use efficiency (especially fertilizers and irrigation) due to timely crop information; intercropping	20 percent increase in farm yields 25 to 30 percent increase in supply chain efficiency
Climate resilience 	Climate-appropriate input usage due to relevant weather information; reduction in crop loss due to timely preventive measures	15 to 20 percent increase in farmer incomes due to reduction in crop losses

Source: IFC 2017

“ Our endeavor at Olam will improve the livelihoods of farmers and communities through various initiatives designed to enhance productivity and returns, environmental stewardship, and promotion of climate-resilient agriculture by unlocking mutual value with all our partners through collaboration.”

– SANJAY SACHETI, COUNTRY DIRECTOR, INDIA



CORPORATE OVERVIEW: OLAM INTERNATIONAL LIMITED



Company Profile

A global agribusiness company supplying food and raw industrial materials to over 23,000 institutional customers around the world and a market leader in the trade of several agro-commodities, such as edible nuts, cocoa, spices, coffee, cotton, and rice



Revenue

Approximately \$15 billion (2016-2017)



Operational Reach

Operations in 70 countries, headquartered in Singapore



Relationship with IFC

Investment client since 2003 with cumulative investments of approximately \$330 million to date; advisory client since 2012

www.olamgroup.com

PROGRAM OVERVIEW: SUSTAINABLE WATER DEMAND MANAGEMENT FOR SUGARCANE FARMING

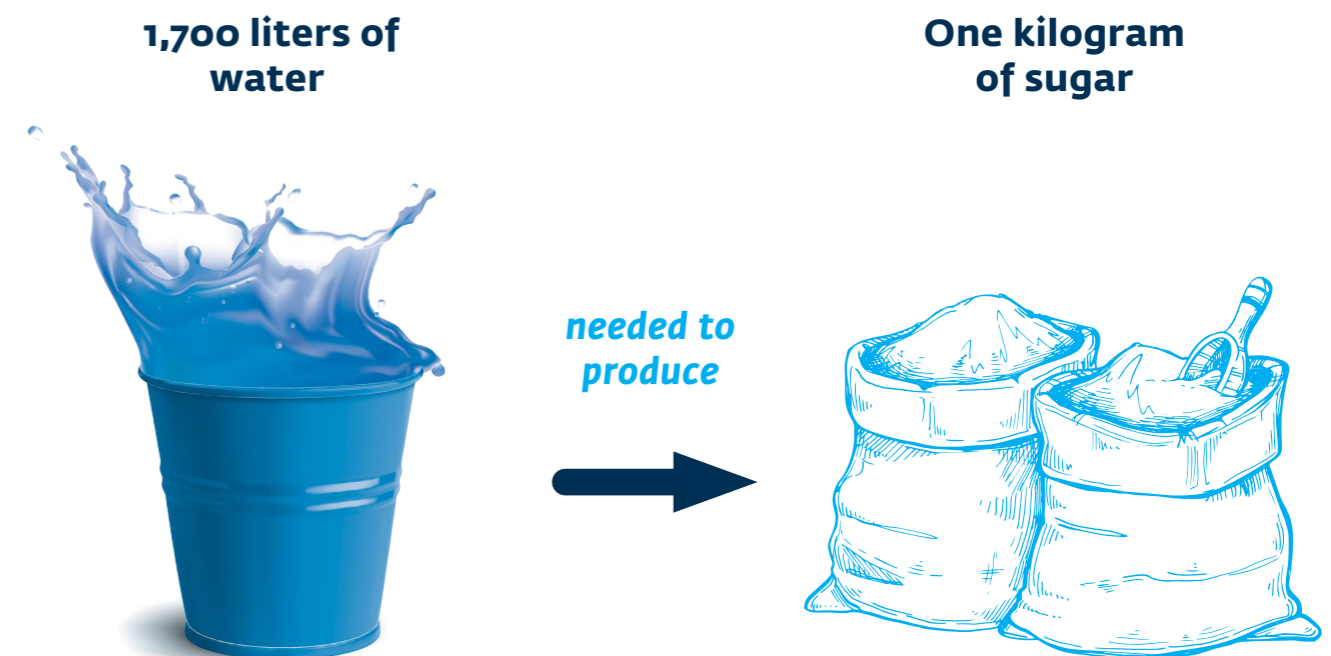
Olam International (the “company”) has a vast buying network as it directly sources crops such as cocoa, coffee, sugarcane, and spices directly from farmers in developing countries who face interrelated challenges including low yields and low incomes that are now further exacerbated by climate change.

The company is guided by the comprehensive Olam Livelihood Charter, which identifies holistic factors that affect farm productivity both within and beyond the farm, including climate-related risks. Its eight principles tackle economic, environmental, and social challenges like building farm resilience to climate change through suitable adaptation practices.

THE CHALLENGE

The company owns and operates two sugar mills in India: Barwani (Madhya Pradesh) and Rajgoli (Maharashtra). While sugarcane farm productivity is relatively good in both states, Madhya Pradesh produces an average of 65 metric tons, and Maharashtra produces 70 metric tons, versus the national average of 60 metric tons. There is an acute water shortage in both of these states. Sugarcane is one of the most water-intensive crops with over 1,700 liters of water required to produce one kilogram of sugar, as per estimates by the Indian Sugar Mills Association (ISMA) (2013). The increasingly low amount of available water in the sugarcane-growing areas in India due to unsustainable water use and climate change has increased the business risk to the company’s sugar manufacturing operations. Its effects are a reduction in available sugarcane leading to a reduction in the number of days for crushing by the mills (due to the unavailability of sugarcane) and lower mill capacity utilization.

FIGURE 21: ACUTE WATER SHORTAGE LEADING TO LOWER MILL CAPACITY UTILIZATION



Source: IFC 2017

THE SOLUTION

In 2012, in collaboration with IFC, the company launched a climate-smart sugarcane farmer support program, referred to as “Madhu Shree”, for a period of three years. The program was implemented in both sugar units in collaboration with Solidaridad Asia Limited, covering over 18,000 smallholders, including 3,000 women farmers.

Under the Madhu Shree program, the company designed and implemented initiatives for the extension workers and farmers to motivate them to adopt climate-smart sugarcane agronomy practices. An emphasis was placed on the promotion of efficient water-use practices and technologies, such as drip irrigation systems (surface and sub-surface), mulching, furrow irrigation, green manuring to increase soil organic carbon and boost soil moisture, and laser land leveling. The company facilitated access to financing for smallholders to purchase the products and technologies recommended for water-use efficiency and sustainable sugarcane crop husbandry. Throughout the engagement with smallholders, the focus was solely on articulating the business case for the adoption of sustainable, climate-smart, water-efficient practices and technologies, including improvements in farm yields and a reduction in the cost of cultivation.

Over 1,000 demonstration farms were set up all through the company’s sugarcane sourcing areas to demonstrate the specifics of the company’s recommended climate-smart practices.

FIGURE 22: SUGARCANE FARMER SUPPORT PROGRAM IMPROVES YIELDS AND REDUCES CULTIVATION COSTS

Olam Charter Principles	2016 Key Facts
1 Finance	<ul style="list-style-type: none"> \$707,263 in financing
2 Improve yield	<ul style="list-style-type: none"> 13,421 farmers trained in good agricultural practices 15% increase in overall productivity since 2013 70 demonstration plots and 1,000 model farms for a practical, 'hands on' approach to training
3 Labor practices	<ul style="list-style-type: none"> 13,421 farmers trained in good labor practices
4 Market access	<ul style="list-style-type: none"> 1.05 million tons procured from 23,931 hectares
5 Quality	<ul style="list-style-type: none"> First global metric standard for sugarcane
6 Traceability	<ul style="list-style-type: none"> 100% tonnage is traceable
7 Social and infrastructure investment	<ul style="list-style-type: none"> \$76,327 was invested in economic infrastructure, including drip irrigation systems and farming equipment
8 Environmental impact	<ul style="list-style-type: none"> 3,584 farmers managing 9,111 hectares received training in water stewardship, including drip irrigation 2,978 farmers received training on soil fertility, including trash mulching, to increase organic levels of carbon in the soil 2,937 farmers received training on Integrated pest management to minimize negative impacts of chemicals on the environment and help farmers manage costs Improving water and fertilizer efficiency not only reduces environmental impact, but reduces costs and discourages the growth of weeds.

Source: Olam International Limited

RESULTS




In 2016, the impact assessment for the Madhu Shree program showed impressive results. Smallholders noted a 15 percent average increase in sugarcane farm yields. At the same time, over 61 billion liters of water was saved on smallholder farms due to the adoption of efficient irrigation practices and technologies, as independently verified by EY.

Sugarcane sourcing volume almost doubled for one of the company mills due to an increase in farm yields through judicious use of water for irrigation. This led to improved plant usage and greater operating efficiency. A second Olam mill recorded the country’s highest sugar recovery (greater than 13.5 percent), adding to the company’s top-line and bottom-line performance, thus improving its financial health.

In 2017, the company and IFC launched Phase II of the Madhu Shree program with Solidaridad Asia as the co-implementation partner. This phase will focus on strengthening climate resilience among smallholder farmers with an enhanced focus on improving soil health, integrating pest management, and demonstrating the use of solar pumps in conjunction with micro-irrigation systems.

In this phase, further emphasis will be put on mainstreaming climate-smart agriculture practices in the company’s capacity building and extension programs with the overall aim of strengthening farmer loyalty to Olam as the sugarcane buyer of choice.

Figure 23: Climate-Smart Agriculture Impact Summary

Type	Description	Impact to Date
 Smart land use	Improved farm yields providing more output from less land to meet company requirements	15 percent increase in farm yields leading to increased income for 15,000 smallholders 15,000 hectares of land converted to climate-smart practices Sugar recovery: 13.5 percent for Rajgoli Mills
 Water-use efficiency	More output per unit of water; increased soil moisture due to increase in soil carbon; reduced pressure on limited water resources;	61 billion liters of water use avoided at farm level
 Greenhouse emission reductions	Reduced usage of diesel pump sets for irrigation due to water-use efficiency practices; shift from stubble burning to mulching	10-15 percent reduction in farm energy consumption; 50 percent reduction in greenhouse emissions on farm due to less burning

Source: IFC 2017

“Supreme Seed Company Limited (SSCL) is committed to serving farmers by providing high quality, climate-resilient seeds that improve crop yields for smallholders.”

- A.H.M. HUMAYUN KABIR, MANAGING DIRECTOR



CORPORATE OVERVIEW: SUPREME SEED COMPANY LIMITED



Company Profile

Founded in 1978, Supreme Seed Company Limited is a subsidiary of the Surovi group, a diversified business with investments in the agriculture, logistics, distribution, real estate, motors, and hospitality industries. It is a leading seed enterprise in Bangladesh specializing in production, processing, marketing, and breeding of field crops and vegetable seeds.



Revenue

Surovi Group: \$25 million;
Supreme Seed Company Limited: approximately \$10.8 million



Operational Reach

Operates across 11 regional offices in Bangladesh



Relationship with IFC

Advisory client since 2007

www.supremeseed.net

PROGRAM OVERVIEW: YIELD INCREASE IN SALINITY-STRESSED AREAS

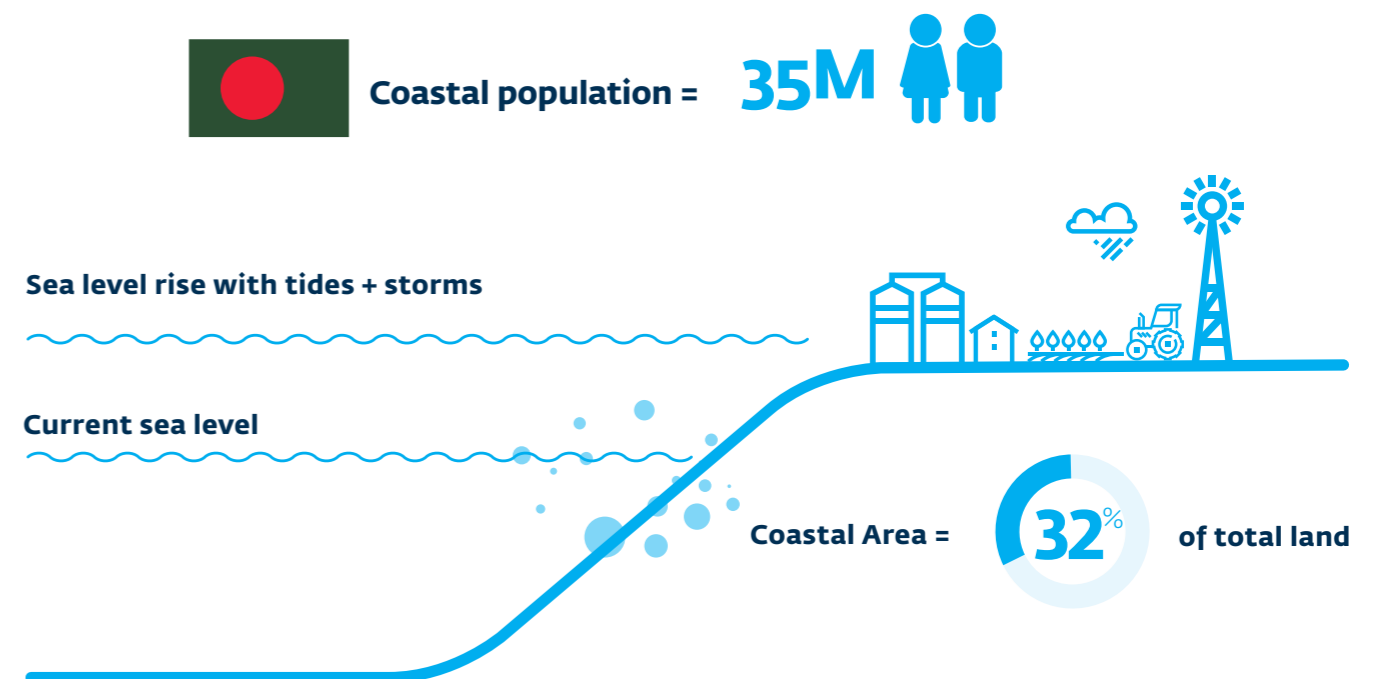
Founded in 1978, Supreme Seed Company Limited (the “company”) is now one of the leading and most innovative seed production companies in Bangladesh. The company works on genetic improvements in plant breeding. Today, the company offers more than 150 different varieties of cereals, vegetables, maize, potatoes, and cotton seeds.

THE CHALLENGE

Bangladesh is one of the most climate-vulnerable countries in the world. Frequent and severe natural disasters as well as floods, torrential rains, erosion, cyclonic storms, tidal surges, and a rise in sea level pose constant threats. Nearly one-third of the country is susceptible to tidal inundation. In the face of climate change, Bangladesh’s agriculture sector faces the threat of losing arable land each year at a faster rate than its population growth of 1.5 percent. The coastal area of Bangladesh represents over 32 percent of its total land at 47,000 square kilometers, with a population of 35 million residing in this area. As a low lying delta country, every year thousands of hectares of arable land are affected by saltwater intrusion in the southern polder regions of Bangladesh. The consequent rising salinity levels are adversely affecting agriculture farm productivity, thereby affecting the livelihoods of millions.

While a range of climate-smart salinity-tolerant seeds are now available in Bangladesh, not many have been tried out in real-test situations in the polder regions. Companies are also unaware of how to build a supply-chain with farmers in the polder regions to introduce climate-resilient seeds that are conducive to grow in the region. Farmers are often cheated by spurious local seed manufacturers leading to erosion of trust between farmers and seed suppliers.

FIGURE 24: RISING SALINITY LEVELS AFFECTING FARM PRODUCTIVITY WITH LIVELIHOOD OF MILLIONS IMPACTED



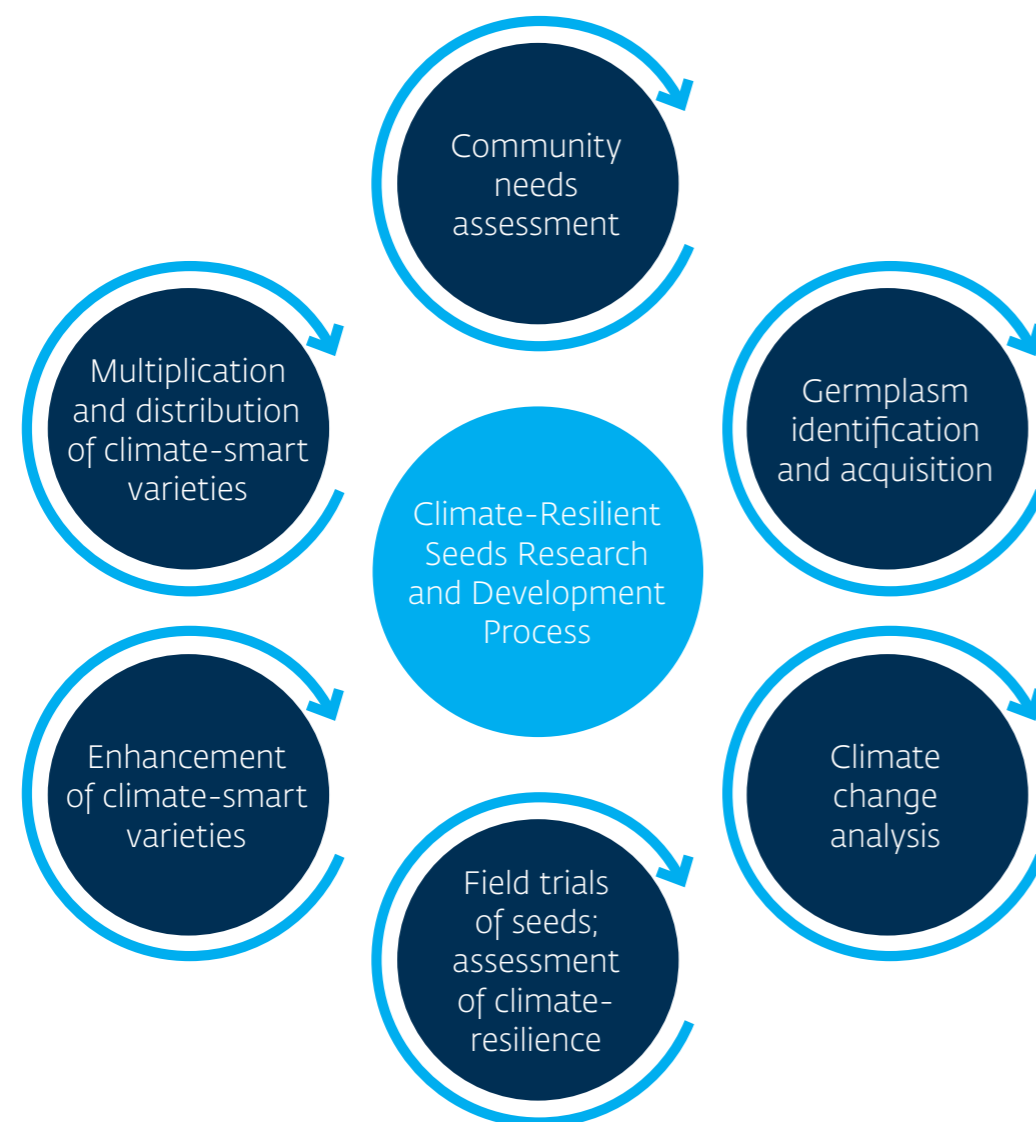
Source: IFC 2017

THE SOLUTION

With climate change a reality, the emphasis is on adaptation with private sector participation. The company is a leader among private sector firms in developing value-added business propositions through innovation, research, and development in order to develop stress-tolerant rice and vegetable seed varieties that can withstand prolonged periods of submergence, high levels of salinity, and drought conditions.

In 2007, the company began working with IFC to promote climate-resilient agriculture practices in Bangladesh and is currently focusing on the seven polder regions in the southern regions. Through the collaboration, it developed a business case for promoting stress-tolerant seeds with smallholders and set up demonstration farms in climate change-affected areas to expose seed growers, dealers, and retailers to new seed varieties and their production process. This effort received an additional boost in 2015 when it collaborated with IFC under the PPCR.

FIGURE 25: DEVELOPMENT AND PROPAGATION OF STRESS-TOLERANT SEEDS HAVE POTENTIAL TO INCREASE YIELDS AND INCOME



Source: IFC 2017

RESULTS


With support from IFC, the company has brought awareness of stress-tolerant seeds and new climate-resilient technologies and practices to over 100,000 smallholders in Bangladesh. Some of the key results achieved by the company through the farmer support programs are:

- Improved business performance, e.g., an increase in farm yields in high salinity conditions by 15 percent compared with conventional seed varieties
- Over 45,000 farmers trained by the company on the benefits of using stress-tolerant seeds
- In the salinity-affected areas of southern Bangladesh, over 600 dealers and retailers gained a better understanding of the business potential, use, and production of stress-tolerant seeds

Given the success in the development and propagation of stress-tolerant seeds by the company, the government of Bangladesh introduced eight new stress-tolerant seeds, all on its approved list of seeds to be sold to farmers.

The company is further expanding its presence in the vulnerable regions in Bangladesh and plans to cover an additional 40,000 farmers, including 5,000 women farmers, by 2020. It expects to increase revenues by 10 to 15 percent through the sale of stress-tolerant seeds. The new seed varieties being developed and deployed have the potential to increase farm yields by up to 20 percent, resulting in a 15 percent increase in net farm incomes for the smallholders.

Figure 26: Climate-Smart Agriculture Impact Summary

Type	Description	Impact to Date	Expected Impact by 2020
Enhanced yields in salinity-affected areas 	Research and development to develop stress-tolerant seeds for areas affected by floods and fluctuating weather, thus ensuring food security and farmer livelihoods	15 percent yield increase in high salinity areas (reported on demonstration farms); ~45,000 farmers covered	20 percent yield increase 10-15 percent revenue increase

Source: IFC 2017

REFERENCES

Foreword

Charting Our Water Future: Economic Frameworks to Inform Decision-Making, 2009. Access at <https://www.2030wrg.org/portfolio-item/charting-our-water-future/>

Introduction to Climate-Smart Agriculture

CGIAR website, "Food Emissions." Access at <https://ccaafs.cgiar.org/bigfacts/#theme=food-emissions>

DCM Shriram Limited

Indian Institute of Sugarcane Research (IISR), Lucknow, Uttar Pradesh, India website. Access at: www.iisr.nic.in

Solidaridad Network website for South and Southeast Asia. Access at: <https://www.solidaridadnetwork.org/regions/south-south-east-asia>

Journey Staff at Coca-Cola India (2017). 'Meetha Sona' Hoping to Sweeten Agriculture for Cane Farmers in Uttar Pradesh. Access at: http://www.coca-colaindia.com/stories/community/agriculture/_meetha-sona_-hoping-to-sweeten-agriculture-for-cane-farmers-in-

Golchha Organization

Climate Investment Funds website. Access at: <https://www.climateinvestmentfunds.org/fund/pilot-program-climate-resilience>

Chiara Trabacchi and Martin Stadelmann (2013). Making Adaptation a Private Sector Business: Insights from the Pilot Program for Climate Resilience in Nepal. Access at: <https://climatepolicyinitiative.org/wp-content/uploads/2013/12/SGG-Case-Study-Pilot-Program-for-Climate-Resilience-in-Nepal.pdf>

IFC Climate Business, Stories of Impact. IFC Advisory Helps Farmers Adapt to Climate Change. Access at: http://www.ifc.org/wps/wcm/connect/0255112b-9133-49f9-acd3-e237a8fe0298/12StoriesOfImpact-ClimateResilience_Nepal.pdf?MOD=AJPERES

PriceWaterhouseCoopers (PwC) and Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED). 2012. Scoping Study on Climate Resilient Agriculture and Food Security – PPCR-Nepal. May 2012.

Hindustan Coca-Cola Beverages Private Limited

Sustainability Update 2016/17. Access at: <http://www.coca-colaindia.com/sustainability-report-2016>

Unnati: A Joint Sustainable Agricultural Initiative by Jain Farm Fresh Foods Limited and Hindustan Coca-Cola Beverages Private Limited. Jain Farm Fresh website. Access at: www.jainfarmfresh.com/unnati

L.N. Revathy (2017, July 07). Jain Farms to take ultra-high-density mango planting to TN, Karnataka. The Hindu Business Line. Retrieved from <http://www.thehindubusinessline.com/economy/agri-business/jain-farms-to-take-ultrahighdensity-mango-planting-to-tn-karnataka/article9754321.ece>

Jain Irrigation Systems Limited

Water Footprint Assessments Jain Irrigation Systems Ltd. Dehydrated Onion Products Micro-Irrigation Systems (http://waterfootprint.org/media/downloads/IFC-2010-WaterFootprintAssessments-JainIrrigationSystems_1.pdf)

GLOBALG.A.P. website. Access at: www.globalgap.org

REFERENCES

Corporate Announcement (2013, January 21). Jain G.A.P. Aligns with Global G.A.P for Ensuring Global Food Safety. Access at: http://www.business-standard.com/article/press-releases/jain-g-a-p-aligns-with-global-g-a-p-for-ensuring-global-food-safety-110041300122_1.html

IFC Inclusive Business Model Case Study (2014, May). Inclusive Business Case Study: Jain Irrigation Systems Limited (JISL). Access at: <https://www.ifc.org/wps/wcm/connect/f6fcd8047e252ca9d05fd299ede9589/Jain%2BTemporary.pdf?MOD=AJPERES>

JK Paper Limited

Annual Report: http://www.jkpaper.com/images/pdf/annual_reports/ar-2016-2017.pdf

Mountain Hazelnuts Group Limited

Louise Lee (2012, January 6). Big Business in Bhutan: How the Humble Hazelnut Could Help Bhutan. Access at: <https://www.gsb.stanford.edu/insights/big-business-bhutan-how-humble-hazelnut-could-help-bhutan>

GAFSP (2016). CASE STUDY - Bhutan: Blending Happiness and Hazelnuts with Finance. Access at: <https://www.ifc.org/wps/wcm/connect/b1a42377-172a-4601-9690-a9390886a848/GAFSP-Blending+Happiness-and-Hazelnuts-with-Finance.pdf?MOD=AJPERES>

Mountain Hazelnuts website, "Operational Model." Access at: <http://www.mountainhazelnuts.com/operational-model/>

FAO website, "Climate-Smart Agriculture." Access at: <http://www.fao.org/climate-smart-agriculture/en/>

CGIAR website, "Climate-Smart Agriculture." Access at: <https://ccaafs.cgiar.org/climate-smart-agriculture-o>

BigBasket.com

ICAR website. Access at: <http://www.icar.org.in/>

Vivian Frenandes (2016, 25 August). Can On-Demand Grocery Startups Change the Fate of Farmers in India? Retrieved from: <https://yourstory.com/2016/08/can-app-based-grocers-groom-smallholder-farmers-in-profitable-agriculture/>

Olam International Limited

Olam website. Olam Livelihood Charter Report, 2016. Access at: <http://olamgroup.com/sustainability/olam-livelihood-charter/>

Indian Sugar Mills Association website. Access at: <http://www.indiansugar.com/>

Supreme Seed Company Limited

Tonkonogy et al. (2017). Climate Resilience and Adaptation Finance and Technology Transfer Facility (CRAFT), Instrument Analysis September 2017. Access at: <https://climatepolicyinitiative.org/wp-content/uploads/2017/10/Global-Lab-Instrument-Analysis-CRAFT.pdf>

<https://www.slideshare.net/BioversityInternational/resilient-seed-systems-and-adaptation-to-climate-change-55325784>

United Nations Framework Convention on Climate Change website. Access at: <http://unfccc.int/2860.php>

ABBREVIATIONS

CIF	Climate Investment Fund
CO₂	Carbon Dioxide
CoP	Conference of the Parties
ERPA	Emission Reduction Purchase Agreement
FY	Financial Year
G.A.P.	Good Agricultural Practice
GAfsp	Global Agriculture and Food Security Program
IFC	International Finance Corporation
ISMA	Indian Sugar Mills Association
KABP	Knowledge, Attitude, Behavior, and Practices
MAS	Manufacturing, Agribusiness, and Services
MW	Mega Watts
PoP	Package of Practices
PPCR	Pilot Program for Climate Resilience
PVC	Polyvinyl Chloride
SMS	Short Message Service
t/ha	Ton Per Hectare
WF	Water Footprint

PRODUCTION

IFC's MAS Advisory Services in South Asia has assembled nine case studies from leading private sector companies in South Asia, all of which are IFC investment and advisory clients implementing climate-smart agriculture initiatives. The case studies focus on the business rationale for climate-smart agriculture initiatives and illustrate the business results and development impact of those efforts, thus far.

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