

**mandala impact capital report**

**2022**



# **Investing in a carbon reduced food value chain**

**mandala**  
impact  
capital



20  
22

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# MESSAGE FROM MANDALA CAPITAL'S MANAGING PARTNER

At Mandala, we are focused on making scalable and sustainable investments in the food and agricultural sector in India and Southeast Asia.

**We believe we have a critical role to play in harnessing the power of capital to not just to yield financial returns, but to also make a positive impact on the community around us, socially and environmentally.**

## **The theme that we have chosen for our Impact Report this year is Combating Climate Change.**

Climate change is one of the biggest challenges of our times - according to the World Meteorological Organization (WMO), climate change poses risks to as many as 13 out of the 17 UN Sustainable Development Goals (SDGs), including all 8 of the SDGs that Mandala focuses on.

Hundreds of billions of dollars are estimated to be lost annually due to extreme weather events in Asia, with China, India and Japan bearing the brunt of this (US \$238 billion, US \$87 billion and US \$83 billion respectively). Compared to the rest of the world, Asia is deemed to face higher physical risks from climate change.

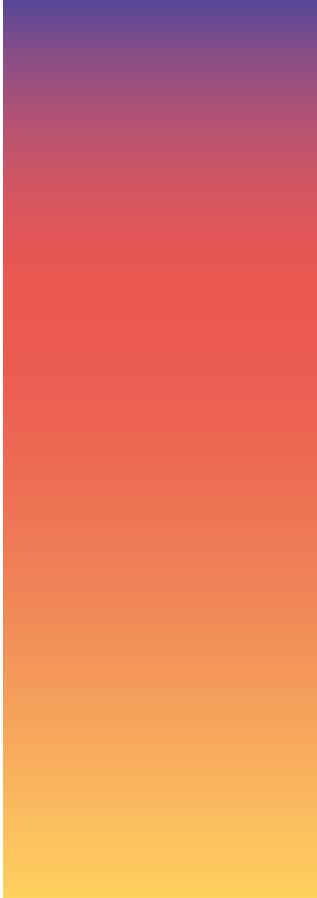
The topic of climate change is all the more relevant to Mandala given that it is inextricably linked to the food and agricultural sector.

On one hand, it puts food production at risk as countries around the world experience

unusually heavy rains or unprecedented heat and drought, threatening food security, livelihoods and human health.

In March this year, China, the largest wheat producer in the world, warned of its worst wheat crop in history, after usual heavy rainfall and record-breaking floods delayed planting last fall. In the same month, India, the second largest producer in the world, recorded its hottest March in 122 years, threatening to cut yields by 6%. We would find that in May, the government announced that it would ban its export of wheat.

## In the absence of climate adaptation and mitigation, McKinsey estimates by 2050:



Between **600 million and 1 billion** people in Asia will be living in areas with a non-zero annual probability of lethal heat waves. This is **compared to a global total of 700 million to 1.2 billion.**

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On average, **between US\$2.8 trillion to US\$4.7 trillion of annual GDP in Asia will be at risk** due to loss of outdoor working hours from increased heat and humidity. This accounts for more than two-thirds of the total annual global GDP impact.

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**US \$1.2 trillion of physical infrastructure could be lost** through flooding in Asia in a given year, accounting for 75% of the global impact.

Coupled with the war between Russia and Ukraine, wheat prices have risen more than 60% this year.

On the other hand, the production, packaging and distribution of food itself contributes one third of greenhouse gas emissions, the very driver of climate change. Up to 26% of global emissions arises from food production, including land clearing, crop production and fertilisation.

As we can see, the relationship between food and climate change is no doubt a symbiotic one. It is clear that the transformation of the

food value chain has a key role to play in not only adapting to climate change, but also mitigating climate change.

To shift towards the use of more sustainable and energy efficient technology, our investee company, Keventer Agro Ltd (Keventer), made the decision to invest in a solar power plant in 2020. The plant spans over 200,000 square feet which makes it the largest rooftop solar panel installation in Eastern India.

We have also invested in Godavari Biorefineries Ltd (Godavari), which is one of the largest integrated bio-refineries in India and one of the

largest producers of ethanol, using sugarcane as feedstock. The production of ethanol goes towards helping India to meet its green energy needs in terms of biofuels for the transportation sector. The company is now working on manufacturing second generation ethanol and energy cane, which will enhance the conversion of biomass into biofuels.

Both of these will help reduce carbon emissions from an energy standpoint, the largest contributor of global emissions.

The issue of reducing carbon emissions from food loss would be addressed by Gati Kausar India Limited (Gati Kausar). 15% of the emissions from food production results from the loss of food due to spoilage in transport and

processing, typically due to the lack of refrigeration. Gati Kausar plays an important role here as it operates a system of temperature-controlled warehouses and trucks which will help prevent unnecessary food wastage.

Our other investee company, Jain Irrigation Systems Limited, would tackle climate change from the angle of adaptation - its drip irrigation products enable farmers to be more efficient in water use in order to address issues of water scarcity, particularly in times of droughts.

**We are heartened to be able to make a real difference to climate change and we hope to continue working towards net zero emissions with our investee companies.**

**Uday Garg**  
Managing Partner, Mandala Capital



# OVERVIEW OF MANDALA CAPITAL

## MISSION STATEMENT

We aim to **create impact** along the entire food chain that is both sustainable and scalable.

## CORE VALUES

### Sustainability:

All our investments and our investee companies' operations are planned and executed in a manner that meets the needs of the present without compromising the ability of future generations to meet their own needs. We also ensure that all our activities strike **a balance between economic, environmental, and social impact** so that they can be maintained in the long run.

### Scalability:

We seek to build ventures with solid foundations and business models that have the ability to grow rapidly to manage growing market demands, in order to create maximum impact **in the most cost-effective and time-efficient manner**.

# HOW WE INVEST

The investment team at Mandala Capital prides itself in **adopting a structured and comprehensive approach to evaluating investments** in agriculture, food, and food-related businesses. This approach has been developed and continuously refined for more than a decade, building upon more than 200 years of combined experience within the team.

1.

## THESIS DRIVEN



We are focused in our research, assessing companies against an expansive rubric through which we dive into a sub-sector level of detail, analyse industry trends and potential disruptions, and identify Mandala's unique value-add to the company. This results in stronger conviction, a better diligence process and greater understanding of the right business valuation.

2.

## DEAL CREATION



We forge strong relationships with the people behind the companies before we invest in them. This allows us to appreciate the nuances behind their strategic and operational decisions that are not captured in spreadsheets, empowering us to become better business partners.

3.

## DEAL STRUCTURING



We are innovative and creative in deal structuring, providing solutions that are non-typical of private equity firms. Our ability to invest across the capital structure also ensures that we can meet the unique needs of the companies while ensuring stable returns for our investors.

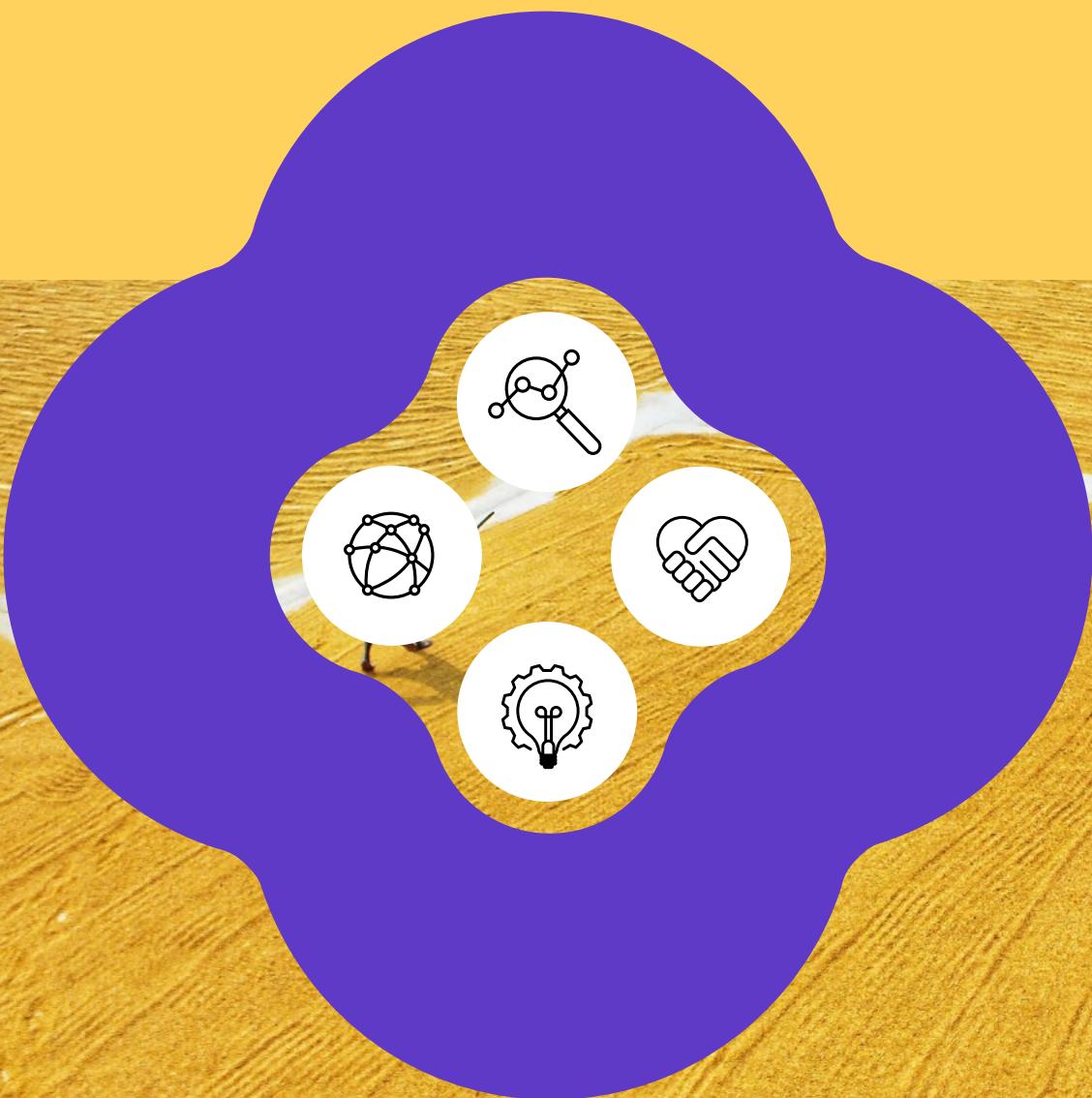
4.

## VALUE CREATION



We are committed to adding value to every company's operational capabilities post-investment, with a focus on efficiency, capacity and governance. Our network of industry thought leaders and our knowledge of new frontiers empower us to do this effectively.

Through this rigorous approach, we are confident that every deal we are engaged in is **beneficial to our companies, our investors, and our world.**



# MANDALA CAPITAL'S PORTFOLIO

## Arcadia Biosciences

Arcadia Biosciences develops and commercializes agricultural traits and products that bring value to growers, processors and consumers, while benefitting the environment and enhancing human health.

[www.arcadiobio.com](http://www.arcadiobio.com)

## SAFL

SAFL is the first private sector NBFC in India providing agri-loans with a wide and diverse range of financing options for almost every need of agricultural activity.

[www.safl.in](http://www.safl.in)

## GK Cold Chain Solutions

GK Cold Chain Solutions is a full stack cold chain service provider with a growing network of cold warehouse facilities across India and an extensive fleet of more than 100 refrigerated vehicles, supported by IoT devices.

[www.gkcoldchain.com](http://www.gkcoldchain.com)

## Godavari Biorefineries

Godavari Biorefineries produces sugar, other foods, biofuels, chemicals, power, compost, waxes, and related products using sugarcane as the primary feedstock.

[www.godavaribiorefineries.com](http://www.godavaribiorefineries.com)



## Jain Irrigation Systems

JIS is the largest drip irrigation company in Asia, and the 2nd largest globally. Its subsidiaries are also engaged in food processing, tissue culture, and solar appliances.

[www.jains.com](http://www.jains.com)

## Jain Farm Fresh Foods

Jain Farm Fresh Foods is a subsidiary of Jain Irrigation Systems engaged in food processing, including fruit pulps and concentrates, and dehydrated products.

[www.jainfarmfresh.com](http://www.jainfarmfresh.com)

## EFRAC

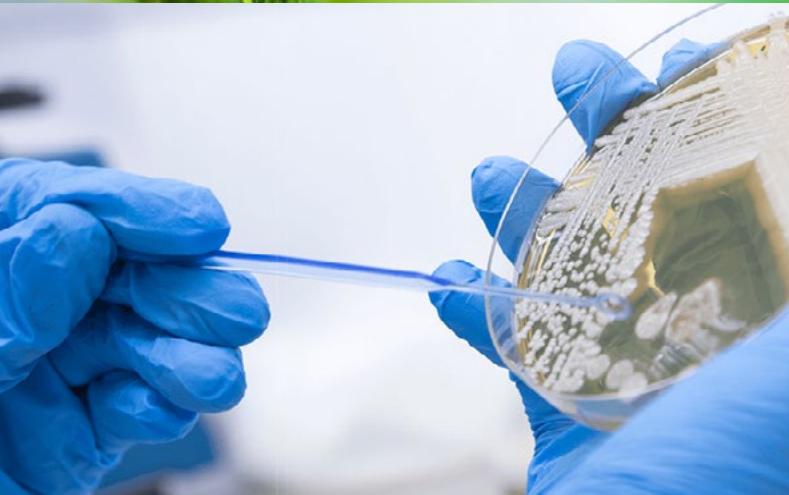
EFRAC is one of the largest integrated food testing and research facilities in India set to be the leading food safety solution provider offering a wide range of technical advice and consultation to the food industry.

[www.efrac.org](http://www.efrac.org)

## Keventer

Keventer is a leading fast-moving consumer goods company business based in eastern India with a wide range of packaged, dairy, and fresh food products spanning across various brands with more than 90 SKUs.

[www.keventer.com](http://www.keventer.com)



# IMPACT REPORTING PRINCIPLES

## 1. Measure and Report Outcomes, Not Just Output

Beyond stating our activities and investment portfolio, we seek to measure the extent to which value has been added to our investments, be it social, economic or environmental impact.

## 2. Analyse based on Context

We design every metric based on a deep understanding of our investees' background and experiences, derived from the strong, long-term relationship we have with the companies. Understanding the context ensures that our assumptions are sound and that our metrics are relevant.

## 3. Establish the Difference Made

We strive to measure accurately the incremental contribution Mandala's investments bring to the table. As such, in every metric, we take into consideration the extent to which the outcomes are a result of other factors (**Attribution**) or what would have happened anyway (**Deadweight**), as well as any unintended negative consequences or displaced benefits (**Displacement**).

## 4. Keep Impact Reporting Accessible and Universal

We translate all the impact created into a familiar, monetary unit and ratio that can be easily understood by all investors, regardless of background and depth of technical knowledge. We believe this will lower the barrier to entry for the impact investing space, encourage more investment, and in turn create even more impact within a shorter time.

## 5. Report Impact with Transparency

We openly share the calculations for each metric and make explicit the assumptions made. This allows all stakeholders to better evaluate the robustness of our impact measurements and hopefully, find the report more useful.

## 6. Constantly Learn and Improve

We maintain a posture of learning and openness to feedback, so that Mandala's impact reporting methodology can constantly improve, and its credibility can be established over time.

# DEFINITION AND CALCULATION OF IMPACT

Based on the principles laid out above, this is how we define and **measure impact in monetary terms**:



## [Impact]

- = [Outcomes - Deadweight - Displacement]
- x [Attribution]



## [Impact per dollar invested]

- = [Impact]
- / [Total investment adjusted to current values<sup>1</sup>]

This model does not distinguish between the effects of equity and debt.

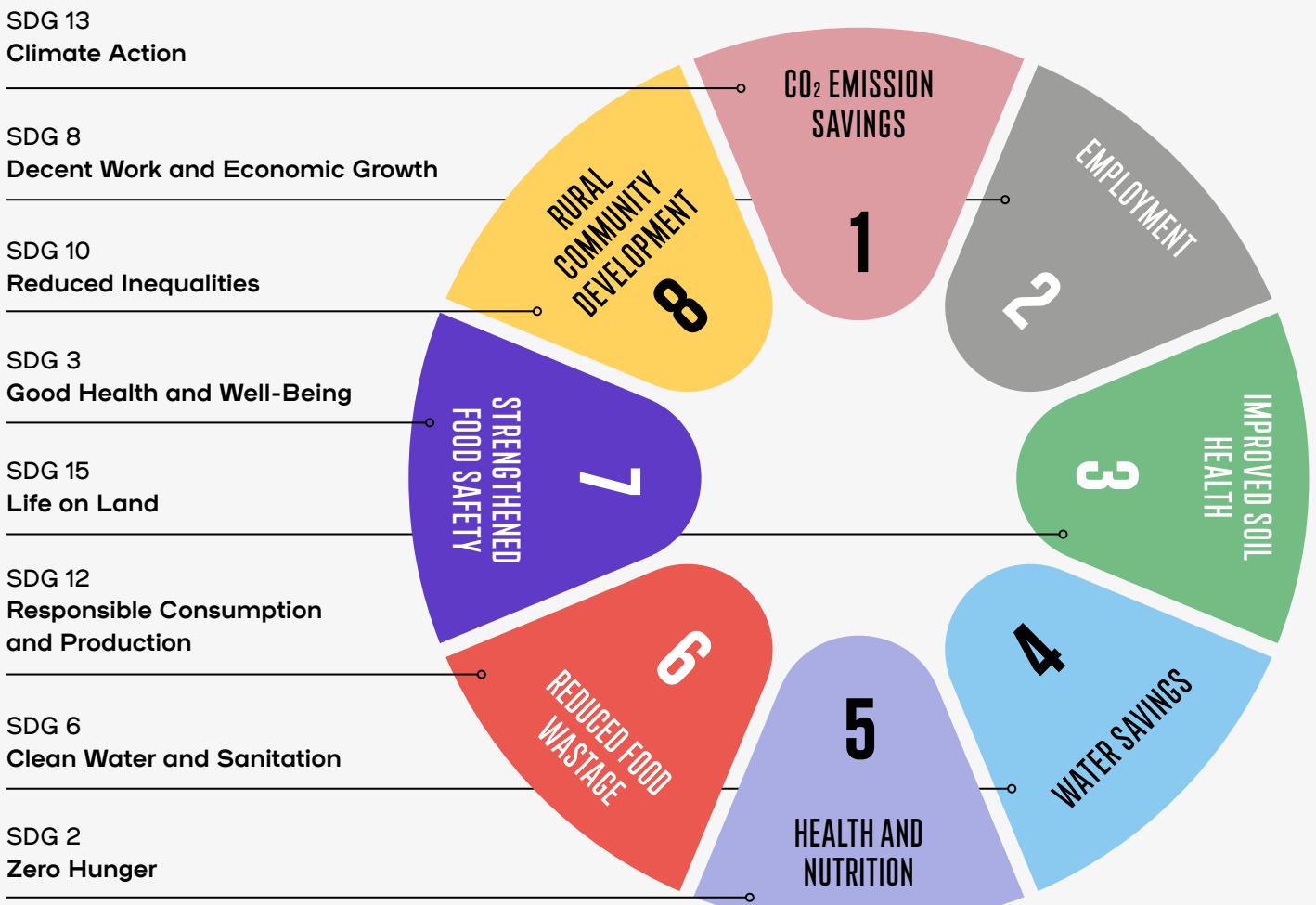
(1)

Based on c. 2% p. a. inflation.



# 8 AREAS OF SOCIAL IMPACT - ALIGNMENT TO THE SUSTAINABLE DEVELOPMENT GOALS

Through Mandala's investments and the efforts of its portfolio of companies, **we have identified these eight primary areas of social impact:**



Each of the eight areas is also **strongly connected to** at least one of **the 17 SDGs**.

Therefore, an alternative way of measuring and reporting Mandala's impact would be the amount of social impact contributed towards each of the SDGs. This can then be compared against UNDP's estimated funding gap required in the developing world to achieve the SDGs, which is USD \$2.5 trillion.

# SNAPSHOT OF IMPACT ACROSS OUR PORTFOLIO



# SNAPSHOT OF OVERALL AGGREGATED SOCIAL IMPACT

The cumulative aggregate social value created by Mandala's investments to 31<sup>st</sup> Dec. 2021 is calculated to be at least **US \$950,227,216**, or 0.04% of the funding needed to achieve the SDGs.

Mandala's cumulative SRoI ratio stands at 3.8x. In other words, for every US\$ 1 invested, approximately US\$3.8 of social value has been created over the years across categories

including water, the environment, food and nutrition, and livelihoods.

The breakdown of impact created across the 8 primary areas can be seen in Figures 1 and 2 below<sup>2</sup>.

(2)

The impact figures do not include Jan-Dec 2021 numbers from Sustainable Agro-commercial Finance Ltd (SAFL).

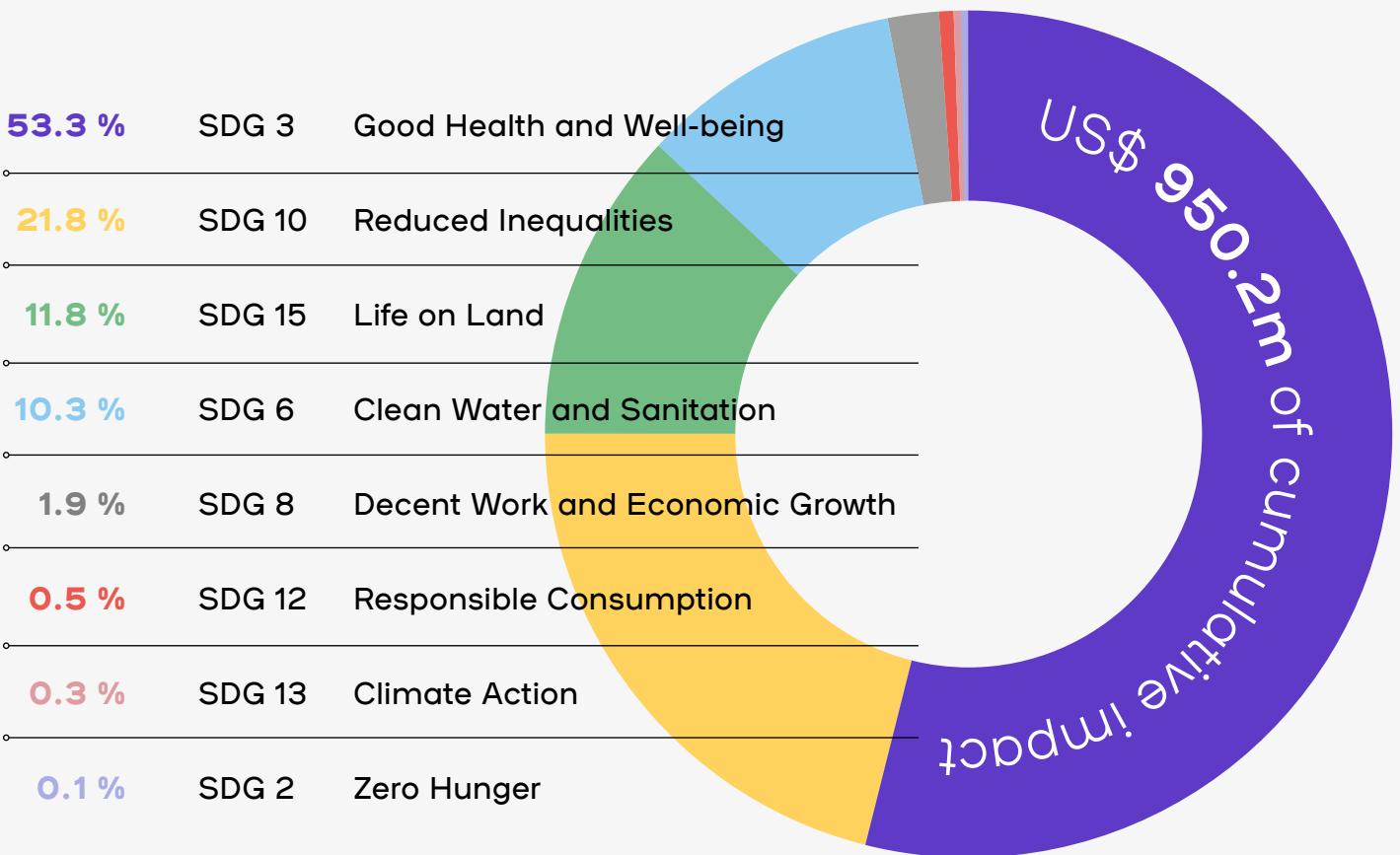
Figure 1

**Summary of Impact** created by Mandala Capital up to 31<sup>st</sup> December 2021

Primary Area of Impact	Jan - Dec 2021		Cumulative	
	Total Impact (US\$ million)	Impact per \$ invested (SRoI)	Total Impact (US\$ million)	Impact per \$ invested (SRoI)
CO <sub>2</sub> Emissions	1.7	0.0004	3.1	0.01
Employment	3.4	0.01	17.7	0.1
Improved Soil Health	0.06	0.0001	112.4	0.5
Water Savings	13.1	0.04	97.7	0.4
Health and Nutrition	0.14	0.0003	0.6	0.003
Reduced Food Wastage	0.5	0.002	4.4	0.02
Strenghtened Food Safety	63.5	0.3	506.9	2.0
Rural Community Dev.	23.9	0.07	207.5	0.9
<b>TOTAL</b>	<b>111.3</b>	<b>0.4</b>	<b>950.2</b>	<b>3.8</b>

Figure 2

## Portfolio Breakdown by SDGs



These monetary values were calculated based on the definition of impact described in Definition and Calculation of Impact and rely heavily on the data collected by Mandala's investee companies. Where estimates or assumptions were required to serve as proxy or to quantify impact, these are described in the subsequent pages to provide full disclosure and transparency behind the reported figures.

Despite efforts to be as accurate as possible in these calculations, as the measurement primarily focuses on tangible outcomes, many other benefits such as the improved well-being of individuals who gained employment, or whose communities were developed, and the second-order benefits to their families

and children have not been quantified yet. This suggests that the impact calculations are likely to underestimate the true social value created by Mandala Capital and its portfolio of investees. The case studies under **Impact Spotlights** provide a more comprehensive understanding of the full impact Mandala's portfolio of companies have created.

The team at Mandala Capital will constantly improve its impact measurement and reporting methodology, and continue to bring all stakeholders an increasingly reliable and meaningful report in the coming years.

**The subsequent pages will cover each area in more detail, including how the impact figures were measured and calculated.**

# 1 CO<sub>2</sub> EMISSION SAVINGS

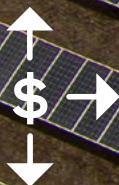
> SDG 13

CLIMATE ACTION



Cumulative Total Impact

US\$ 3,100,000



Impact per dollar invested

US\$ 0.01

## How we measure impact

This metric measures the value to the environment and the nation in terms of CO<sub>2</sub> emission savings earned by building and operating cogeneration (cogen) and solar plants and equipment compared to their conventional coal-fired counterparts.

This metric aggregates the environmental and economic damages avoided and the added financial benefit to the nation through the sale of carbon credits on emission trading schemes.

(Additional installed capacity of cogen plants

× %CO<sub>2</sub> emissions savings from cogen plants)

+ (Additional installed capacity of solar plants and equipment

× %CO<sub>2</sub> emissions savings from solar plants)

×

(Social costs per ton of CO<sub>2</sub> avoided during the period

+ Trade value per ton of CO<sub>2</sub> saved)

×

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumptions

1. The amount of CO<sub>2</sub> emissions saved by cogeneration and solar plants compared to regular coal-fired plants is derived from international research studies,<sup>3</sup> which take into account the lifecycle of CO<sub>2</sub> emissions of the different sources of electricity, including the construction of the plant, its operation and maintenance, and the electricity generation (fuel combustion) process.
2. The social cost of each additional ton of CO<sub>2</sub> emitted is estimated to be US\$37 according to past research studies,<sup>4</sup> calculated on the basis of decreased agricultural yields, harm to human health, and lower worker productivity due to climate change.
3. The value per ton of CO<sub>2</sub> traded is estimated to be US\$20, based on the midcase CO<sub>2</sub> price forecast made on existing emissions trading systems.<sup>5</sup>

## Impact analysis

**Attribution** of the impact is accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

**Deadweight** is not applicable because the metric is calculated based on the savings in CO<sub>2</sub> emissions due to the technology used, in the absence of which there would be no carbon-saving measures in place.

There is also no need to separately account for **displacement** for solar plants and equipment in this metric as the CO<sub>2</sub> emissions produced in building solar plants or equipment is already taken into consideration when calculating the difference in lifecycle emissions. For cogen plants, as there are no reliable estimates of the amount of CO<sub>2</sub> produced in building a cogeneration unit or heat recovery system, the displacement component is not accounted for. However, this is not expected to be large and should not affect the impact figures significantly.

(3)

| Solar Energy Research Institute (1990). CO<sub>2</sub> emissions from coal-fired and solar electric power plants, Golden, CO: Kreith, F., Norton, P., & Brown, D.

| Pehl et al. (2017). Understanding future emissions from low-carbon power systems by integration of life cycle assessment and integrated energy modelling. Nature Energy, 2, 939-945. doi: 10.1038/s41560-017-0032-9

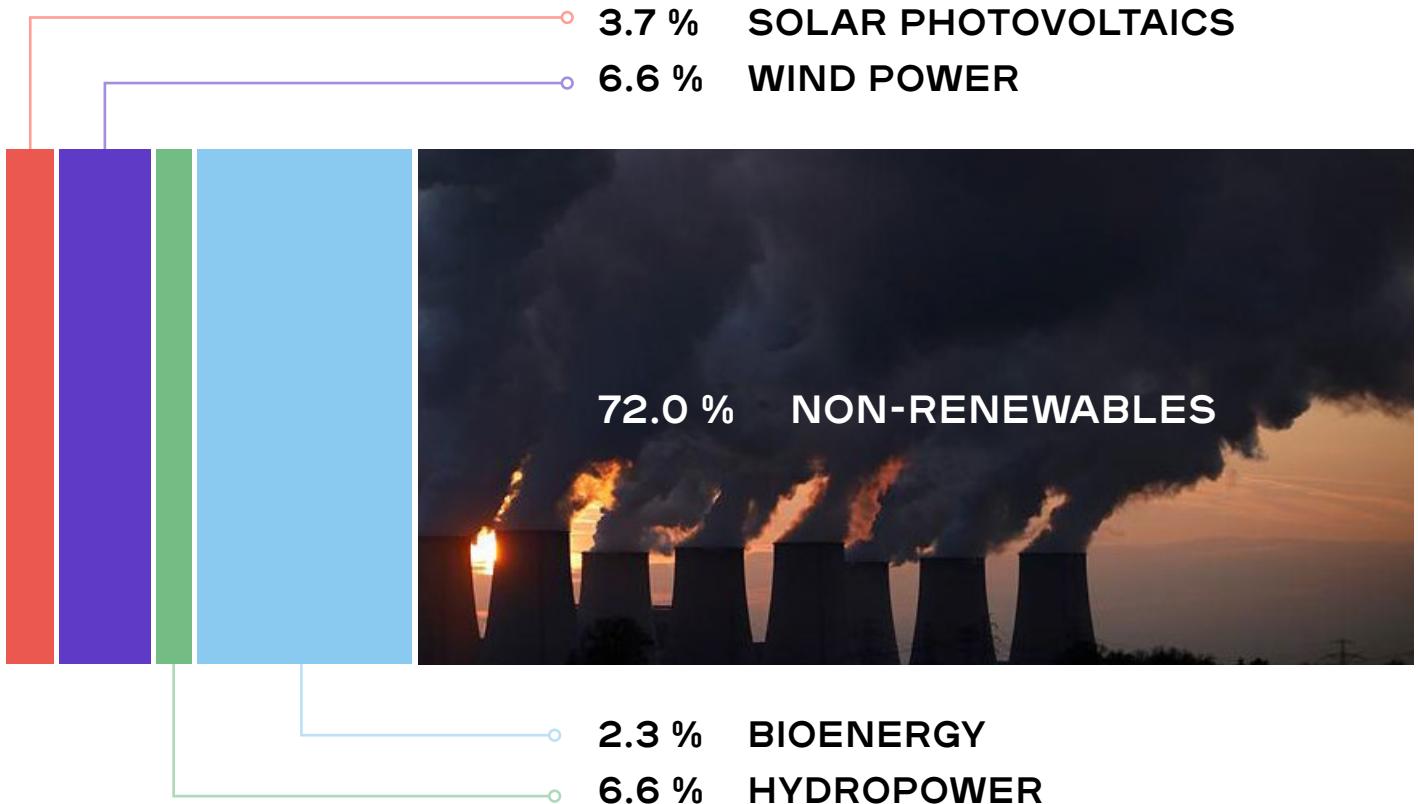
(4)

Than, K. (2015). Estimated social cost of climate change not accurate, Stanford scientists say. Stanford News

(5)

Synapse Energy Economics, Inc. (2015). 2015 Carbon dioxide price forecast. Cambridge, MA: Luckhow et al.

# TYPES OF RENEWABLE ENERGY SOURCES



## CASE STUDY: CLIMATE CHANGE MITIGATION

As the major source of global emissions, the energy sector holds the key to mitigating climate change. **Today, 28% of the world's electricity comes from renewable sources.**<sup>6</sup>

According to the International Energy Agency (IEA), the path to net zero energy-related emissions by 2050 requires large scale deployment of all available clean energy

technologies. By 2050, two thirds of total energy supply should come from wind, solar, bioenergy, geothermal and hydro energy.<sup>7</sup>

(6)  
Ember, (2022, March 30). [Global Electricity Review 2022](#).

(7)  
IEA, (2021, May). Net Zero by 2050 - [A Roadmap for the Global Energy Sector](#).

## Keventer: Deploying the sun for energy

Keventer Agro Limited (Keventer) is a fast-moving consumer goods (FMCG) company headquartered in Kolkata, focusing on packaged, dairy and fresh food products. It is the largest FMCG company in Eastern India with a comprehensive range of over 90 products.

Being conscious of its carbon footprint, Keventer has installed a solar power plant which provides part of the energy demand of its beverage unit at the Barasat facility. **The 2.15 megawatt solar power plant is built over an area of over 200,000 square feet.** As of 2021, the plant generated approximately 190,000 kilowatt hour of electrical energy per month, which is sufficient to power its dairy plant for 11 hours daily. This translates to an average monthly offset of 154 metric tons of greenhouse gas emissions.

## Godavari: From Sugarcane to Energy Cane

Godavari Biorefineries Ltd (Godavari) is a leading, integrated Indian sugarcane processing business with an 82-year operating history, which manufactures products ranging from sugar to high-end chemicals.

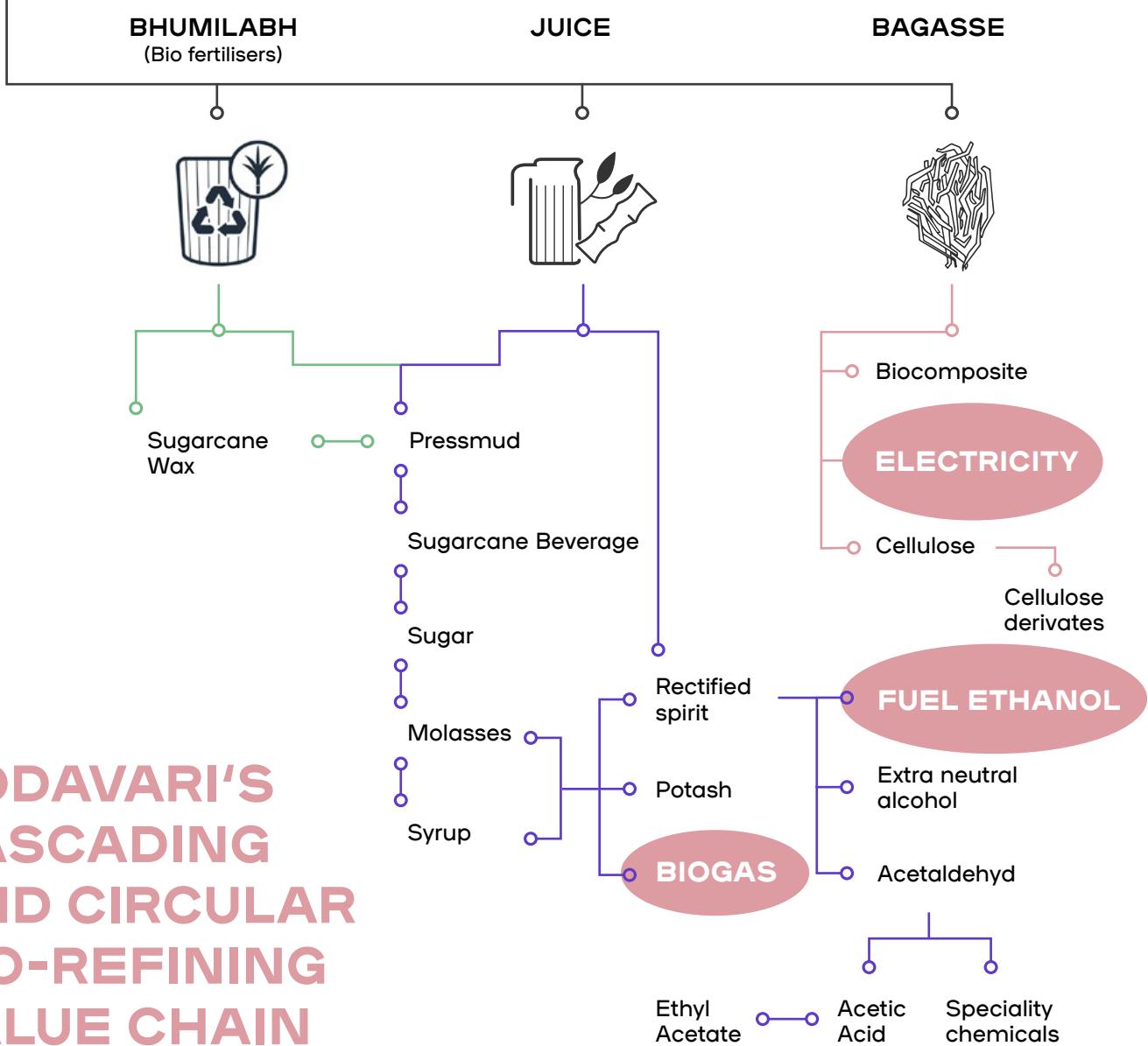
Over the last few years, the company has been transforming itself from a sugar mill with a traditional business model of sugar-molasses-bagasse to **a fully integrated, cascading and circular biorefinery, with a presence across the bio-chemical value chain.** The objective is to generate value from by-products or waste through process optimisation and product innovation, while simultaneously promoting green chemistry, sustainable farming, and energy and water conservation practices.

Currently, Godavari is in the development stage of manufacturing second generation ethanol and energy cane. Compared to conventional sugarcane, energy cane has more fibre than sucrose in its composition, which enhances the production of bioenergy.

The use of biofuels has potential to greatly reduce greenhouse gas emissions. While the burning of biofuels releases about the same amount of CO<sub>2</sub> compared to the burning of fossil fuels, the CO<sub>2</sub> released is net off by the CO<sub>2</sub> captured in the growth of the biomass feedstock.

**The company exports more than 100 million units of surplus power from bagasse to the grid,** providing much needed power to the community and nearby villages. This has also enabled Godavari to earn carbon credits under the United Nations Framework Convention on Climate Change (UNFCCC).

## SUGAR CANE FARM



**GODAVARI'S CASCADING AND CIRCULAR BIO-REFINING VALUE CHAIN**

# 2 EMPLOYMENT

> SDG 8

DECENT WORK  
AND ECONOMIC  
GROWTH



Cumulative Total Impact

US\$17,700,000



Impact per dollar invested

US\$0.1

## How we measure impact

This metric measures the value to the people who receive employment because of the companies' operations, made possible by the investment. This metric quantifies the additional income earned by the employees, after considering the income they would otherwise have received.

A discount factor equal to Mandala Capital's equity stake in the investee is also applied to more accurately account for the incremental value creation that occurred as a result of Mandala Capital's investments.

Total employee spend per year

- Employee spend on urban employees
- (25%
- ✗ Employee spend on male, rural and low-income employees)
- (17.5%
- ✗ Employee spend on female, rural and low-income employees)

x

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumptions

1. Urban employees that were hired by Mandala Capital's investees are assumed to receive a similar wage compared to that they would receive from other employers; hence this amount is subtracted from the impact calculation.
2. Rural and low-income workers are defined as workers employed outside Tier 1 and Tier 2 cities and are on average expected to earn four times less than urban dwellers.<sup>8</sup> As such, we deduct only 25% of the spending on (male) rural / low-income employees to account for the incremental impact created.
3. According to India's Open Government Data Portal, the average agricultural daily wage rate for women is approximately 70% of men's wages.<sup>9</sup> Hence, we deduct 17.5% (70% of the 25% used above) of the employee spend for low-income female workers in the impact calculation.

## Impact analysis

**Attribution** of the impact is accounted for via the portion of equity stake and share of debt Mandala Capital has in the companies.

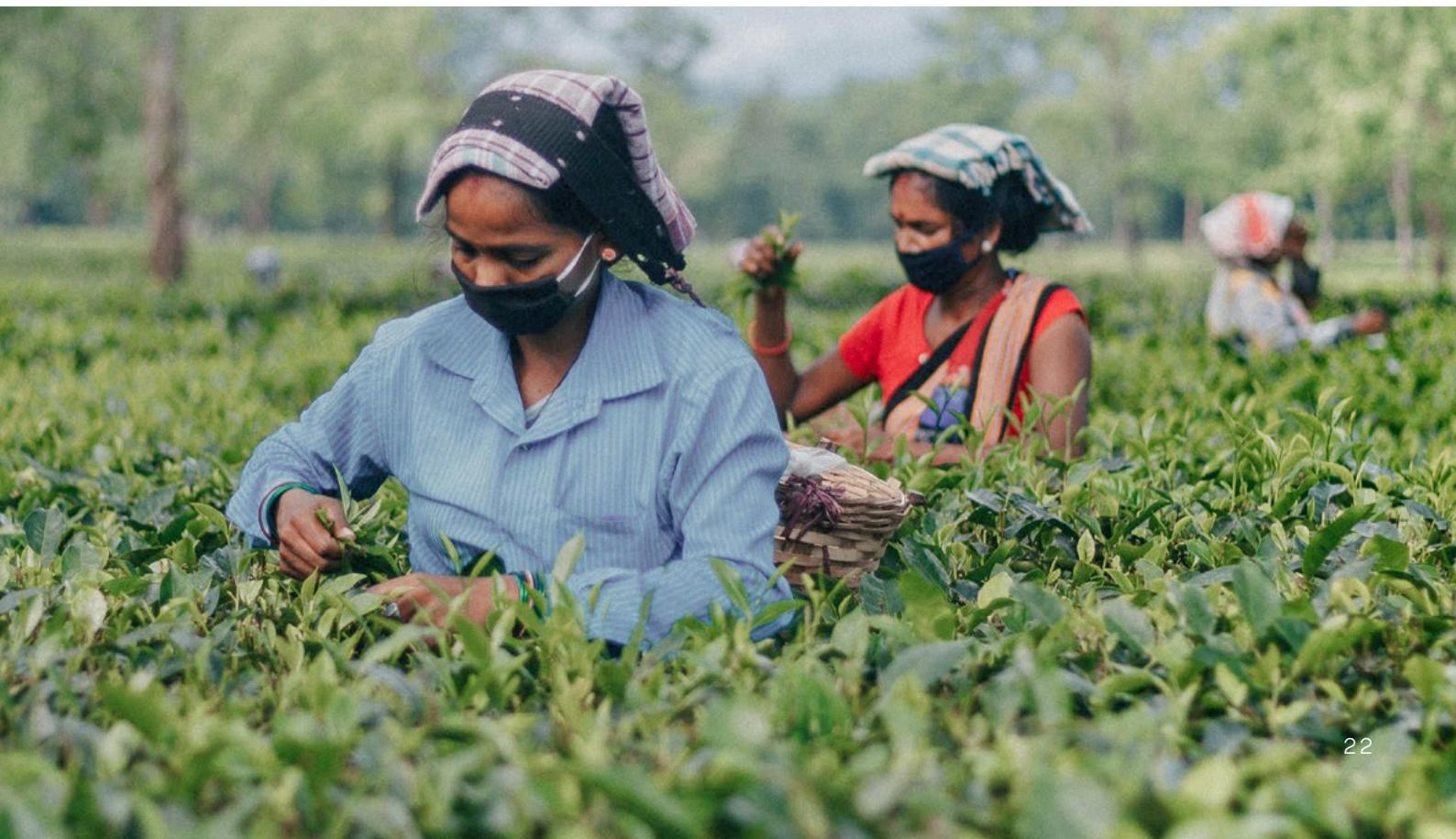
To account for **deadweight**, expenditure on urban employees was deducted from the impact figure and discount factors were applied on the employee spend on rural and low-income employees.

(8)

Datta, P. (2004, July 3). *The Great Indian Divide*. Frontline, 21(4), 28-31

(9)

Open Government Data (OGD) Platform India (2015). [Average Agricultural Daily Wage Rate Rural in Rupees](#).



# 3 IMPROVED SOIL HEALTH

> SDG 15

LIFE ON LAND



Cumulative Total Impact

US\$112,400,000

Impact per dollar invested

US\$0.5

## How we measure impact

This metric measures the value to the environment and the nation in terms of improved soil health by the soil testing activities performed by Mandala Capital's investees and their resulting recommendations and implementations to the tested land holdings.

This metric quantifies the incremental crop value as a result of extended soil fertility and improved health due to the soil testing services and resulting improvements in land management.

Acres of soil tested

- Healthy soil
- Severely damaged soil

x

Extension of soil life in years

x

Crop value per acre per year

x

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumptions

1. According to national statistics provided by the Indian Council for Agricultural Research and the Indian Space Research Organization,<sup>10</sup> an estimated 30% of arable land is in very good health and 58% of arable land is severely damaged and would not return to a healthy state in the short term via agricultural management efforts.

Thus, we estimate that 12% of arable land are in the mild or early stages of degradation and can be easily reclaimed with proper agricultural management practices given the right information about the soil's nutrient levels.

2. Based on a previous case study of similar land management projects in India,<sup>11</sup> the outcome of implementing recommendations arising from soil testing can extend at least some proportion of damaged soil by 1 year. This is the value used to estimate the average life extension of the land sampled for testing.

## Impact analysis

**Attribution** of the impact is again accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

**Deadweight** is considered in the impact calculation by discounting soil that is irreversibly or severely damaged and cannot be reclaimed easily, as well as soil that is already healthy and will not receive significant quality improvements.

**Displacement** is considered negligible because the samples taken are small and have no expected negative impact on the soil health or the quantity/quality of crops produced.

There is much room for improvement for this metric to more comprehensively quantify the increase in crop value due to increased yields and improved food quality, but we are limited by the availability of data and local research to provide a reliable measure of such impact, which also differs based on the crop grown and environmental factors.

The value-add of stronger food security in the country and environmental impact of reduced fertilizer usage are also excluded in this impact calculation.

(10)

In "Degraded and Waste Lands of India" (2010), a report by the Indian Council for Agricultural Research and the National Academy for Agricultural Sciences, India is reported to have 141 million hectares of arable land, out of which 100 million hectares (71%) is under-going degradation. An article by Indian Space Research Organization estimates that 81 million hectares (58%) is experiencing desertification.

(11)

| Farming communities in India improve soil fertility and earn higher income. (n.d.). Source: [undp.org](http://undp.org)  
| [Sustainable land and ecosystem management in shifting cultivation areas of Nagaland for ecological and livelihood security](#). (n.d.).

# 4 WATER SAVINGS

> SDG 6

CLEAN WATER AND SANITATION



Cumulative Total Impact

US\$ 97,700,000

Impact per dollar invested

US\$ 0.4

## How we measure impact

This metric measures the value to the environment in terms of water savings earned by the technology utilized and activities engaged by Mandala's investees.

There are 3 main sources of water savings across Mandala's investees: drip irrigation technology (which uses up to 70% less water as compared to flood irrigation), rainwater harvesting, and water reuse and recycling. This metric quantifies the cost savings earned from the water that is saved.

(Meters of drip irrigation sold

- × Average annual water savings per meter lateral)
- + (Cubic meters of water recycled or reused for gardening
- × Cubic of water per cubic meter)

×

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumptions

1. The average annual water savings per meter lateral is derived based on self-reported data from the investee companies, taking into account the land fallowing period and the monsoons.
2. The cost of water is derived from the typical water price in most major states of India, which is 15 INR (or US\$ 0.21) per kilolitre.<sup>12</sup>

## Impact analysis

Similar to previous metrics, **attribution** of the impact is accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

**Deadweight** is considered negligible as there would be no water savings in the absence of the companies' irrigation projects or water conservation activities.

**Displacement** to the environment is also considered negligible; while many irrigation systems and projects could have consequences on the local water supply and soil salinity, the use of micro-irrigation systems by Mandala Capital's invested companies avoids these negative effects, bolstering confidence in the calculated impact figure.

In fact, the reported figure is likely to be a conservative estimate of the true impact created given that the cost of water in some cities is much higher than the typical price used. Furthermore, the positive spillover effects of the micro-irrigation projects undertaken by Mandala's invested companies on the environment and on the farmers have also not been included in this calculation.

## CASE STUDY: CLIMATE CHANGE ADAPTION

A 2020 study by researchers from the Indian Institute of Technology Gandhinagar found that 10-15% of rice and maize crop areas are affected by flash droughts during the monsoon season in India every year.<sup>13</sup>

The development of more efficient irrigation systems can help to alleviate the issue of water scarcity caused by climate change by reducing water demand and water evaporation losses through providing the necessary water resources to the crops when required.

(12)

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Shanti Shwarup Mahto and Vimal Mishra (2020). [Dominance of summer monsoon flash droughts in India](#). *Environmental Research Letters* 15 104061.

## Responding to Water Scarcity through Innovative Irrigation Management

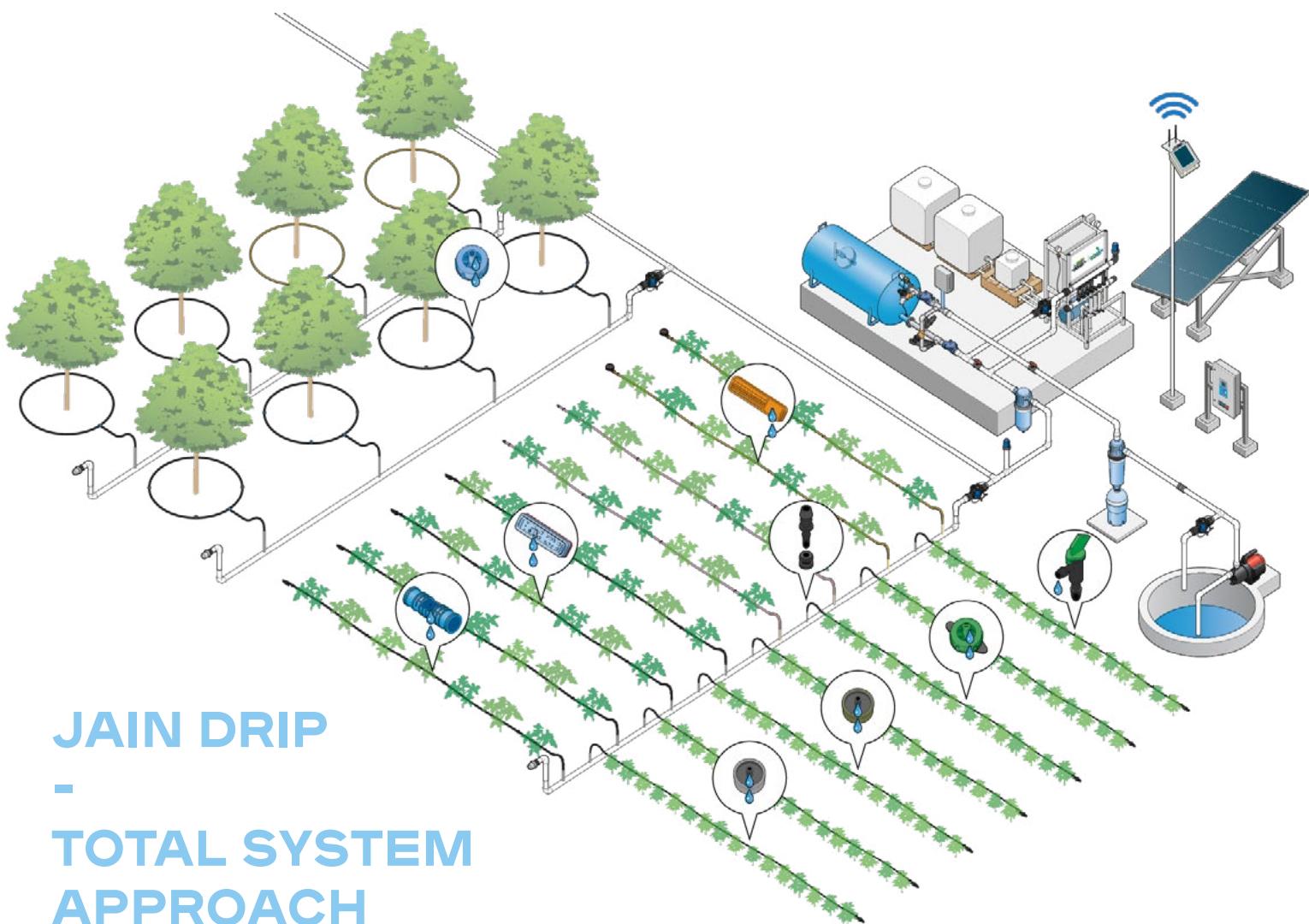
**Jain Irrigation Systems Ltd** (JISL) is the largest micro-irrigation company in the world, manufacturing a full range of precision-irrigation products. Compared to traditional surface irrigation systems, its drip and sprinkler systems enable farmers to yield water savings of over 30-85%.

Its drip irrigation system delivers water to the crops through a network of mainlines, sub-

mains and lateral lines with emission points spaced out along their lengths. Each emitter is able to supply a precisely controlled and uniform application of water and nutrients directly into the root zone of the plants.

The system can further be paired with a web-based software and sensors, which can help to control and monitor variables such as pressure, flow level and soil moisture is able to provide a pressurised and fully automated drip irrigation system.

Illustration: ©Jain Irrigation Systems Ltd.



# 5 HEALTH AND NUTRITION

> SDG 2

ZERO  
HUNGER

Cumulative Total Impact

US\$ 600,000

Impact per dollar invested

US\$ 0.003

## How we measure impact

This metric measures the value added to the nation in terms of healthy fruits and vegetables sold to people due to Mandala Capital's investees' operations. This metric measures the monetary value of the food that is sold.

Tons of fruits and vegetables sold

× Average value of ton of food

×

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumption

Based on inputs from the investee companies, the average value of 1 ton of food is taken to be Rs 500 (c. US\$7.1).

## Impact analysis

As there is no practical way to measure the differential impact of the consumption of specific foods on a person's health and well-being, it was not immediately feasible to calculate impact in terms of healthcare costs saved or stronger economic productivity due to avoided illnesses.

Consumption of food sold on the market cannot be tracked reliably as well. Hence, this metric simplifies the impact calculation to an aggregate of the market value of the healthy foods that are sold as a baseline proxy of the social impact of providing quality food to people.

As more literature and research is conducted, a more compelling and comprehensive calculation for this metric will be developed.

**Attribution** of the impact is accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

**Deadweight** and **displacement** are both considered negligible here as it is unlikely that the amount of fruits and vegetables in people's diets are hitting a saturation point or that there is an over-supply of fresh, healthy produce that would lead to wastage.



# 6 REDUCED FOOD WASTAGE

> SDG 12

RESPONSIBLE CONSUMPTION & PRODUCTION

Cumulative Total Impact

US\$4,400,000

Impact per dollar invested

US\$0.02

## How we measure impact

This metric measures the value added to the nation in terms of food wastage avoided due to Mandala Capital's investees' operations.

There are 2 primary methods used in preserving the food - cold chain technology and food processing. This metric measures the monetary value of the food that is preserved.

Cold chain capacity owned and leased

+ (Reefer trucks owned and leased)

× Average reefer truck capacity)

- Portion of food double counted

×

% Food wastage avoided due to cold chain

+

Tons of processed food

×

% Food wastage avoided due to processing

×

Average value per ton of food

×

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumptions

1. The average reefer truck capacity is derived based on self-reported data from the investee companies.
2. Based on investee companies' inputs, the average value of 1 ton of food is taken to be Rs 500.
3. The typical wastage incurred without cold chain technology or without food processing was then derived from secondary research and based on international and regional research sources.<sup>14</sup>

## Impact analysis

**Attribution** of the impact is again accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

**Deadweight** is not applicable here because the metric is calculated based on the food wastage avoided due to the preservation or processing technology used; in its absence there would be no measures in place to avoid such wastage.

**Displacement** could occur in the form of damaging nutrients in the food when undergoing processing - in that case, even though the physical form of the food is preserved, the nutritional and health value may be compromised. This is however considered to be low and severely outweighed by the increase in provision of food and food choices to consumers, especially in India which has a high (40%) post-harvest loss of fresh fruits and vegetables.<sup>15</sup>

Given that food processors can also add nutritional value to the food through their processing methods, the net value-add is considered to be positive. To avoid over-complicating the impact calculation, both the negative and positive impacts of processing on the nutritional value of food are not considered in the measurement.

(14)

| The International Institute of Refrigeration. (2009). 5th informative note on refrigeration and food. France.

| Asian Productivity Organization. (2006). Postharvest management of fruits and vegetables in the Asia-Pacific region. Italy: Rolle, R.

(15)

Asian Productivity Organization. (2006). Postharvest management of fruits and vegetables in the Asia-Pacific region. Italy: Rolle, R.

# CASE STUDY: CLIMATE CHANGE MITIGATION

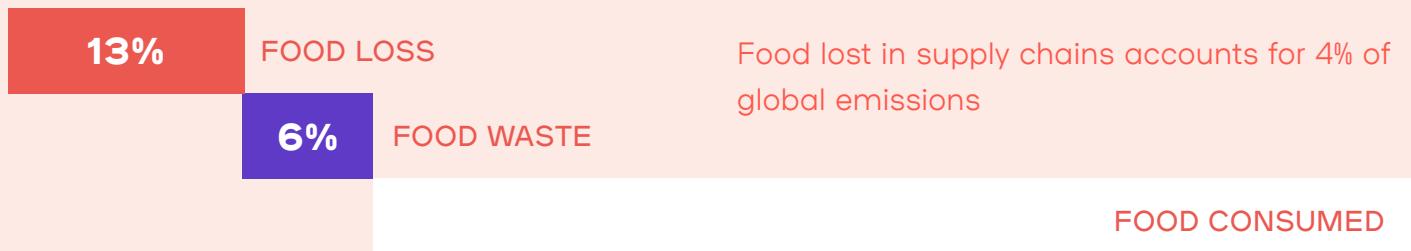
**Food production accounts for 26% of the world's greenhouse gas emissions** and almost a quarter of it (6%) comes from food wastage.<sup>16</sup>

It is estimated that every year, a third of all food produced goes to waste. Food wastage can happen when food is damaged and spoilt at production and distribution level (food loss) or when food is discarded at the retailer and consumer level (food waste). Between the two, food loss is the larger issue globally, especially when it comes to developing countries.

Every year, approximately **13% of all food produced is lost due to a lack of refrigeration**.<sup>17</sup>

The issue of food loss can be addressed by making sure that perishable foods like meat, fish, dairy and produce are kept at the optimum temperature - one where cold chains come into play, a network of temperature controlled packhouses, processing factories, cold storage warehouses, truck-trailers and more.

## FOOD PRODUCTION IS RESPONSIBLE FOR 26% OF GLOBAL GREENHOUSE EMISSIONS



## Keeping Food **Cold and Fresh**

**GK Cold Chain Solutions** (GK Cold Chain) is a full stack cold chain service provider that offers temperature-controlled logistics solutions with a growing network of cold warehouse facilities across India and an extensive fleet of more than 100 refrigerated vehicles, supported by IoT devices.

The company uses tech enabled WMS (warehouse management systems) and TMS (transport management systems) with a focus

on data analytics, AI and ML to improve its service quality.

Through these, GK Cold Chain helps to ensure the quality and freshness of products as they traverse cities across India.

(16)

Our World in Data, (2020, March 18). [Food waste is responsible for 6% of global greenhouse gas emissions.](#)

(17)

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# 7 STRENGTHENED FOOD SAFETY

> SDG 3

GOOD HEALTH AND WELL-BEING



Cumulative Total Impact

US\$ 506,900,000

Impact per dollar invested

US\$ 2.0

## How we measure impact

This metric measures the value added to the consumers in terms of illnesses or deaths avoided relating to foodborne diseases as a result of Mandala's investees' activities that strengthen food safety.

There are 2 primary activities involved in reducing consumers' exposure to contaminated food: cold chain technology and testing of processed foods. This metric measures the healthcare and economic cost savings of the avoided illnesses and deaths.

(Market share of cold chain capacity owned and leased

- × % Contamination risk avoided due to cold chain)
- + (Market share of reefer trucks owned and leased
- × % Contamination risk avoided due to reefer trucks and market share of food tested)
- + (Market share of food tested
- × % Contamination risk avoided due to reefer trucks and market share of food tested)

×

Estimated Indian population consuming packed or processed foods

×

Annual average healthcare spending on FBDs

×

Average % equity stake and % debt share

IMPACT PER YEAR =

## Key assumptions

1. The proportion of the Indian population consuming packed or processed foods is assumed to be 75%, based on estimates provided by the investees.
2. The contamination risk avoided due to cold chain technology, taking into account the contributions of each component in the cold chain process, and the contamination risk avoided due to testing of processed foods, is estimated based on findings from international research studies.<sup>18</sup>
3. The cost of illness/death is calculated via the human capital approach; total health-care costs for foodborne diseases (FBDs) in India in 2010 amounted to USD \$1.8 billion for 100 million cases.<sup>19</sup>

## Impact analysis

**Attribution** of the impact is again accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

**Deadweight** and **displacement** are considered negligible. Deadweight could occur in the form of consumers being their own "guards" against eating spoiled food and hence avoiding contamination, but this is difficult to estimate. By implementing cold chain technology and setting up a food testing lab, there are no expected negative impacts created since food safety can only be improved.

One limitation of this metric is that it does not quantify the full societal impact of food testing. For instance, the economic costs of foodborne diseases and the losses in the agricultural and food sectors and the trade impacts are not accounted for in this calculation.

There are also other food safety initiatives, such as food safety clinics, conducted by Mandala Capital's investees which are challenging to include in the impact calculation. The impact that these could achieve in conjunction with testing and refrigeration would be much higher.

(18)

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- Wageningen University & Research. (2017). [The economics of food safety in India - a rapid assessment](#). Netherlands: Kristkova, Z., Grace, D. & Kuiper, M.

# 8 RURAL COMMUNITY DEVELOPMENT

> SDG 10

REDUCED INEQUALITIES



Cumulative Total Impact

US\$ 207,500,000



Impact per dollar invested

US\$ 0.9

## How we measure impact

This metric measures the value added to the rural community and people's lives because of the companies' operations and expenditures, made possible by the investment.

The metric quantifies the added income earned or credit obtained by the farmers, the additional capital expenditure investments in the rural areas, and the added CSR spending made by the companies.

(50%)

- ✖ Payments made to farmers for purchases of goods)
- Market value of goods
- + Value of equipment sold to farmers
- + Credit extended to farmers
- + Capital expenditure investments in rural areas
- + CSR spending

x

Average % equity stake and % debt share

=

**IMPACT PER YEAR**

## Key assumptions

1. Payments made to farmers are mostly done via the facilitation of farming contracts, where Mandala Capital's investee companies would pay the farmer either the current market price or the pre-agreed price, whichever is higher.<sup>20</sup> We have assumed the additional value-add to the farmers to be 50% of the total payments made.
2. For many farmers, the only alternative to the loans offered by Mandala Capital's investees are local moneylenders, whose credit terms are significantly worse: payment cycles are short, collateral and paperwork requirements are challenging to meet, and interest rates are high. Therefore, as farmers are unlikely to obtain any credit at equivalent terms otherwise, there is no deduction applied on the value of credit extended to farmers.

## Impact analysis

**Attribution** of the impact is accounted for via the portion of Mandala Capital's equity stake and share of debt in the companies.

To account for **deadweight**, a generous estimate of the market value of goods was deducted from the impact figure. This however does not take into account the additional value-add of the income stability and increased profits that contract farming provides to the farmers.

**Displacement** from the capex investments is assumed to be negligible at present, given that the investments are greenfield projects and the factories are built on existing company-owned land or rented land - farmers are thus not displaced through this process. All environmental standards are also adhered to in these projects. The value of other small business activity that is crowded out or replaced by the capex spending cannot be estimated reliably and is thus omitted in this calculation.

The positive outcomes arising from the rural community development efforts of Mandala Capital's investees - such as improved individual and community well-being and stronger businesses - are also not included in the impact calculation, leading to an arguably underestimated impact figure.

(20)

Harvard Business School. (2018). *Jain Irrigation Systems Limited: Continuing a legacy*. Boston, MA: Reinhardt, F., Trumbull, G. & Rao-Kachroo, M.

# LOOKING AHEAD

We are facing an increasingly uncertain future. **In the next two years, there is a real risk of a food crisis.** Supply chain challenges caused by the Russia-Ukraine war are constraining the supply of fertilizer globally. There is a possibility that the fertilizer shortage, coupled with declining soil quality, poor resource availability and extreme weather due to climate change, could cause global food production to drop significantly next year.

This comes at a time of increasing social unrests, rising income gaps and geopolitical tensions in Asia and Europe - all of which could be exacerbated due to a food crisis. Typically in such a situation, the poor will be the most vulnerable, and this could ensue in a downward spiral for them.

We do not believe technology can provide answers in the short term, though we have no doubt that technology adoption will be the only way for companies to compete, to stay resilient in the face of climate change and supply chain challenges and to usher in a real food revolution in the long term.

In the spirit of supporting greater investments in agritech, we recently launched Mandala Innovation as a platform for funding innovative agritech companies. We are selective in choosing companies where our team can add significant value and where we see a clear short-term path to profitability. Mandala Innovation will also serve as a feeder for our main Funds as the companies make progress in their operations.

We are in the midst of a review of our impact framework and strategy and are speaking to a few impact specialists to assist us with this exercise. We are also considering adding dedicated resources to this process. We expect this exercise to be completed before our next report.

Finally, we are planning to hold our annual Food, Future, Funds Symposium this year after a 2-year hiatus. We have been tied up due to the launch of Fund III and some active deals in the pipeline but we are looking to send out dates and invites post summer.

We look forward to catching up with you with the easing of COVID restrictions and we hope to see you at the Symposium.



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