



Fiji's sugar journey

Competitiveness, inclusion and sustainability



Market Development Facility

June 2021

Market Development Facility (MDF)

MDF is an Australian Government-funded, multi-country initiative that promotes sustainable economic development through higher incomes for women and men in partner countries.

MDF connects individuals, businesses, governments and NGOs with each other and with markets at home and abroad. This collaboration effort enhances investment and coordination opportunities and allows partnerships to flourish, strengthening inclusive economic growth.

MDF is funded by the Australian Department of Foreign Affairs and implemented by Palladium in partnership with Swisscontact.





Fiji's sugar journey

Competitiveness, inclusion
and sustainability

Acknowledgements

Market Development Facility (MDF) acknowledges the Australian Government's support via the Department of Foreign Affairs and Trade in funding MDF activities and making valuable contributions to this paper.

To highlight MDF's journey in piloting and scaling up innovative business models and achieving wider market change, MDF Fiji draws on the experiences of its country team, business partners and other organisations in the sugar industry in Fiji. The country research, conducted in November 2020, employed MDF's results measurement system to track the changes that occurred over the past five years. Data gathering included visiting MDF partners, other private sector organisations and farming households in Viti Levu and Vanua Levu, as well as discussions with the MDF Fiji team and interviews with other key stakeholders.

MDF would like to thank private sector partners and other stakeholders who provided invaluable insights into Fiji's sugar industry: Allied Motors Pacific Pte Ltd, Cambridge Farms Fiji Ltd, Crazy Twinz Ltd, Fiji Development Bank, Fiji Sugar Corporation, Fiji Sugar Industry Tribunal, Jack's Motor Traders (Fiji) Ltd, Lovely Auto Repairs & Engineering, Sarava-Navau Cane Farmers Cooperative Ltd, Tavarau-Raviravi Cane Farmers Cooperative Ltd and Mrs. Shahin Khan.

This report is published by Market Development Facility in November 2021. The writing, editing and design of the report was conducted by the MDF staff, together with the following contributors:

Graphic Design: Stella Pongsitanan
Editor: Alice Fogliata Cresswell

Abbreviations and acronyms

CJS	Charan Jeath Singh
CSR	Colonial Sugar Research
DFAT	Department of Foreign Affairs and Trade
FDB	Fiji Development Bank
FSC	Fiji Sugar Corporation
HACCP	Hazard Analysis Critical Control Point
MDF	Market Development Facility
MOA	Ministry of Agriculture
MRM	Monitoring and Results Measurement
PIC	Pacific Island Country
SCI	Standard Concrete Industries

Table of Contents

Introduction and structure of the paper | 8

Background and audience | 8

Structure of the paper | 8

Summary: Fiji's sugar industry from 2012 to today | 9

Background | 11

History and performance of the Fiji sugar industry | 11

MDF's rationale for investing in the sugar industry | 12

Understanding the market | 14

Reasons for the sugar industry's underperformance | 14

Prioritising the critical functions that MDF could address | 15

Promoting innovative business models to reinvigorate Fiji's sugar industry | 18

Innovation 1: Access to agricultural lime | 19

Innovation 2: Access to mechanical harvesting | 23

Innovation 3: Improving quality and marketing to higher-value markets | 27

Systemic change and inclusive impact on the industry and farmers | 30

Inclusive impact on farming households | 34

Empowering vulnerable farmers with quality inputs | 36

Mitigating environmental deterioration and climate change | 37

References | 38



Introduction and structure of the paper



Background and audience

This case study tells the story of MDF Fiji's journey in the sugar industry, from piloting to scaling up innovative business models, to strengthening the industry's competitiveness and making it more inclusive.

It provides insights on the shifting focus, interventions and partnerships that stimulate systemic change in the Pacific.

MDF hopes that this case study will be of interest to individuals and organisations involved in promoting more inclusive, sustainable markets.



Structure of the paper

1

The first section provides an overview of the sugar industry in Fiji, particularly before and after MDF involvement. This section also explains the rationale for MDF investment in sugar, presenting a key opportunity for the industry and its potential for inclusive growth.

2

The second section describes the industry, its history and performance, missed opportunities and reasons for underperformance.

3

The third section details the innovations promoted by MDF in Fiji's sugar industry.

4

The fourth section presents the results achieved through MDF's interventions.

Summary: Fiji's sugar industry from 2012 to today

MDF began working in Fiji's sugar industry in 2012. At the time, the industry had been in decline for several years, and its future was uncertain. Export earnings had fallen below the levels experienced in the 1990s, and soil quality had deteriorated due to decades of deleterious practices. This environment caused the volume and quality of sugarcane production to decline from an average of 52 tonnes a hectare in 1995 to 40 tonnes a hectare in 2018.^{1,2} Production was further hampered by shortages of agricultural labour, on which the industry relied (at the time) for manual harvesting.

The sugar industry in Fiji has historically exported bulk raw sugar without a specific focus on the price or quality. This practice was protected by the European Union's Lomé Convention, which guaranteed Fiji the sale of up to 200,000 tonnes of raw sugar per year at up to three times the prevailing world price. When this preferential treatment expired in 2017, Fiji struggled to compete with the more efficient production practices of Brazil, China, India and Thailand. This decline in the industry's competitiveness has had a material impact on the livelihoods of sugarcane farmers, who earned an average of USD 300 less annually per household over a decade.³

By 2020, the fortunes of Fiji's sugar industry were taking a turn for the better. MDF contributed to a wave of change by supporting improvements in agricultural inputs, mechanisation, quality and marketing. The introduction of a soil additive—agricultural lime ('ag lime')—restored essential nutrients, doubling or tripling sugarcane yields. This improvement encouraged more farmers across Fiji to use ag lime, from 472 households in 2016 to 3,000 in 2018.⁴ Yields were also less affected by labour shortages, as local businesses

began importing mechanical harvesters suited to Fiji's agricultural conditions, which reduced harvesting cost and time. In 2020, farmers harvested 40 per cent of all sugarcane yields using mechanical harvesters.⁵

These changes have improved the quality of the sugar produced in Fiji in several ways. This improvement has enabled the national industry to shift from exporting raw sugar in bulk to developing and marketing sugar as a finished, branded product for higher-value markets. These higher-quality, branded products have experienced rapid uptake in markets in New Zealand and several Pacific Island Countries (PICs). Overall sugarcane production also steadily increased, from 1.3 million tonnes in 2017 to 1.7 million tonnes in 2019.

MDF's work has triggered further investment to revitalise the industry. The Fiji Sugar Corporation (FSC), the Ministry of Sugar and the Fiji Development Bank (FDB) have invested in cane replanting grants, advanced input systems for farmers and harvesters for farmer cooperatives. FSC, Fiji's principal sugar processor, is upgrading its processing and packaging facilities, including installing liquor screens to prevent contaminants. The Corporation is also reviewing its boiling formula to further reduce the presence of non-ferrous residue, metal particles and lumps from its final product. The industry now has a healthier outlook, and all stakeholders are re-engaged and committed to developing high-quality products that can compete in international markets. This effort will help the industry to remain a key contributor to Fiji's economy. MDF sees the story of sugar in Fiji as an illustration of how systemic change can be achieved, starting from an initial investment in 2012 and leading to the current, transformed market landscape. This case study attempts to narrate that story.

¹ Sugar cane yield (hg per ha) in 2019 (World Data Atlas, 2019). <https://knoema.com/atlas/Fiji/topics/Agriculture/Crops-Production-Yield/Sugar-cane-yield>

² Fiji sugarcane (Food and Agriculture Organization, 1996). <http://www.fao.org/3/x0513e/x0513e19.htm>

³ MDF Monitoring and Results Measurement (MRM) data.

⁴ MDF MRM data.

⁵ MDF MRM data and in-depth interviews conducted in November 2020.





Background



History and performance of the Fiji sugar industry

Fiji began manufacturing crystallised sugar from sugarcane in 1862.⁶ Since then, it has become an important commodity in the country, now involving more than 25 per cent of the national labour force. Sugar accounts for about 1.2 per cent of gross domestic product and constitutes 4.3 per cent of total exports.⁷

Unlike many other export-oriented sectors, most production inputs to the industry are produced domestically, generating significant cross-sectoral linkages and impact. Approximately 10,000 Fijian farming households (15 per cent of the population) cultivate sugarcane.⁸ However, over 200,000 people depend on the industry more widely. For example, FSC hires up to 2,000 workers during the peak cane crushing season. At the industry's height in the late 19th century, there were 10 mills for processing sugarcane. As of 2020, only three of these mills in the towns of Lautoka, Ba and Labasa were still operational. A fourth mill in Penang shut down after sustaining damage during Tropical Cyclone Winston in 2016.

The Government of Fiji owns 68 per cent of FSC, the sole miller in the country; other statutory bodies, local firms and individuals own the remaining shares. The sugar industry was nationalised in 1973, when the Government of Fiji acquired a majority shareholding in the Colonial Sugar Refining Company, which had dominated the industry in the first half of the 20th century, to form FSC.

Following nationalisation, sugarcane production decreased from 2.9 million tonnes in 1970 to 2.2 million tonnes in 1975. This decrease, due to fluctuating sugar prices, prompted farmers to shift away from sugarcane production and caused mills to close. With the closure of these mills, farmers struggled to transport their cane to the remaining operational mills, which were often much further away than the recently closed mills.

To reinvigorate production, Fiji was given preferential pricing under the European Union's Lomé Convention, which guaranteed the country the sale of up to 200,000 tonnes of raw sugar per year at up to three times the prevailing world price. Under this agreement, production peaked in 1996 at 4.8 million tonnes. However, when preferential treatment expired in 2017, Fiji struggled to compete with the more efficient production practices of Brazil, China, India and Thailand. The productivity and quality of Fiji's sugarcane had declined, and although cultivation had expanded, sugar output per tonne of cane was no longer optimal due to the quality of the local soil.

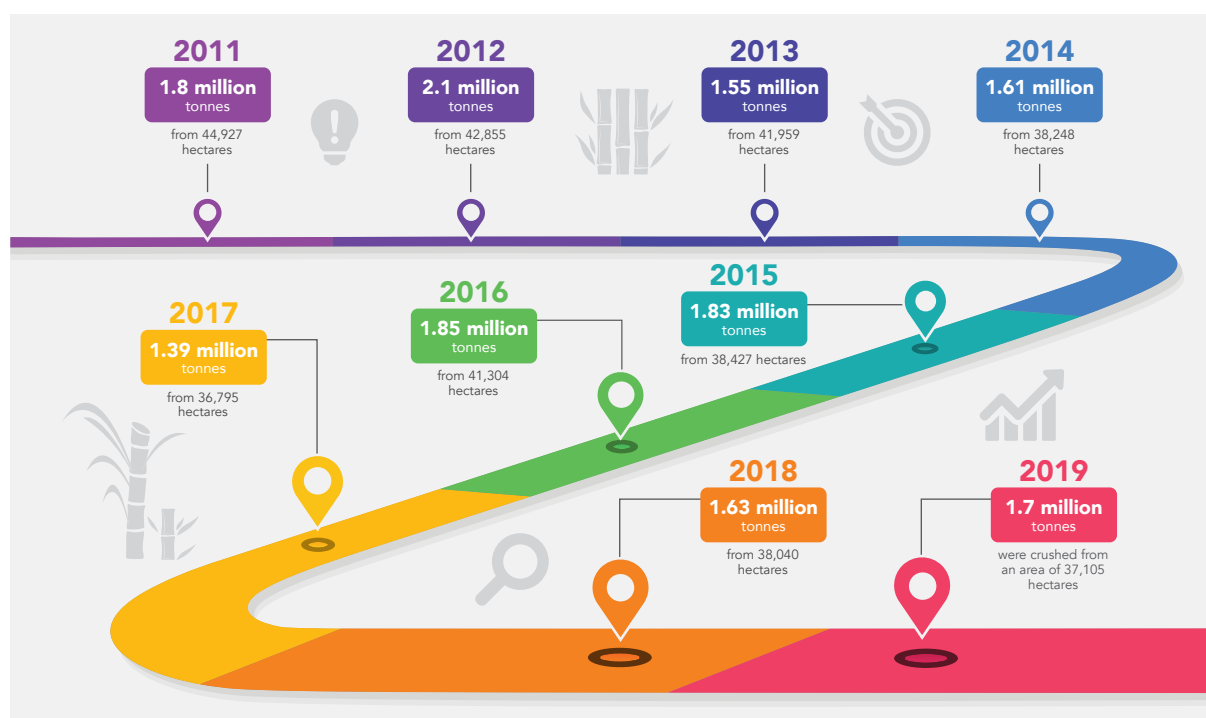
Crop yield, sugar content and the overall quality of sugarcane harvests depend on the quality of the soil, which relies on appropriate agricultural practices. Outdated practices, including cane burning before each harvest and the use of artificial fertilisers, have significantly decreased the quality of the soil in Fiji, resulting in diminished yields and quality of cane crops.



⁶ Fiji sugarcane (Food and Agriculture Organization, 1996). <http://www.fao.org/3/x0513e/x0513e19.htm>

⁷ 2019 Annual Report (FSC, 2019). <http://www.parliament.gov.fj/wp-content/uploads/2020/09/99-Fiji-Sugar-Corporation-2019-Annual-Report.pdf>.

⁸ Fiji's Sugarcane Farmers Will Benefit from Diversifying (Singh, A., 2020). <https://devpolicy.org/fijis-sugarcane-farmers-will-benefit-from-diversifying-20200226/>



MDF's rationale for investing in the sugar industry

The impact of the sugar industry on Fiji's rural population is undeniable. Sugarcane is the dominant crop in Vanua Levu, particularly in areas with high poverty rates. MDF recognised the opportunity to improve sugarcane productivity and quality by increasing the use of appropriate inputs and mechanisation. This strategy aimed to support the industry to shift from bulk raw sugar exports to value-added products, opening new market opportunities and exploiting Fiji's advantageous geographical position to supply growing Pacific and Asian demand for sugar products.

A more vibrant sugar industry can help to maintain or increase the incomes of poor farming families and disadvantaged minorities. Increased earnings promote the resilience of farming households by allowing them to make small investments to improve their farms. Increased household incomes and mechanisation also benefit women, who play an influential role in deciding how their households use additional income.⁹ Mechanical harvesting reduces the burden on women to perform or support manual labour during harvests.

In addition, improving the performance of high-value agriculture, such as sugar, corresponds with the priorities of the Australian Department of Foreign Affairs and Trade (DFAT) and the Government of Fiji. High-value crops comprise less than 2 per cent of the total agricultural production in the country, but they generate 7 per cent of the total agricultural export value¹⁰ and contribute heavily to foreign exchange earnings. MDF's interventions align with the Government of Fiji's National Export Strategy and its five- and 20-year National Development Plans and with DFAT's Aid Investment Plan Fiji: 2015–16 to 2018–19, which prioritised private sector development through investments in exports.

⁹ See a detailed analysis of household income and dynamic changes in MDF Beyond Income Study (2018). <https://marketdevelopmentfacility.org/wp-content/uploads/2019/07/Beyond-Income-FINAL.pdf>

¹⁰ MDF MRM data and MDF Fiji Market System Strategy: Exporting High Value Agriculture.



MDF's approach to promoting sustainable, pro-poor change in the sugar industry:

- MDF selected horticulture because of its importance to the livelihoods of many households, opportunities for market growth, and feasible prospects to trigger change.
- The sugar industry's productivity was hampered by inappropriate inputs and mechanisation, and relied on low-margin, bulk commodity markets due to the lack of value adding and branding.
- MDF introduced new business models that allowed businesses to profitably supply affordable inputs and equipment to farmers and encourage their uptake. Subsequent interventions focused on increasing value addition and marketing.
- MDF's theory of change was that stimulating businesses and government to deliver more effective inputs, mechanisation and marketing would raise productivity, quality and sales, driving up returns across the value chain and improving the livelihoods of sugarcane farmers.



Understanding the market

 *In and before the 1980s, Fiji was regarded internationally as an efficient producer and reliable supplier of high-quality sugar.¹¹*

Since the mid-1980s, Fiji's milling efficiency has declined, farm productivity has decreased, and crop quality has failed to meet the requirements of the international sugar market. Farmers have lost confidence in the industry due to low returns, causing reduced investment in farm maintenance or even exit from sugar cultivation entirely.

Reasons for the sugar industry's underperformance

In international sugar markets, Fiji is disadvantaged by its small production volumes compared to larger countries. Production costs are driven up by inefficient domestic transport: rail and road networks are limited and subject to tonnage limits, fuel costs are high and journey times are lengthy. In the past, Fijian sugar was only competitive because of preferential trading arrangements and favourable quarantine regulations that gave access to Australia, New Zealand, the United States and Canada, Europe, China, and neighbouring PICs.

The industry's performance has also been hampered by other factors.



Extreme weather events

Extreme weather events, such as tropical cyclones and droughts, have caused significant damage to the sugar industry, including the closure of one of Fiji's four mills in 2016. While these events continue to pose a significant threat to cultivation and processing, the industry has been resilient. Following the closure of the mill in Penang, FSC quickly restarted production and increased the capacity of its remaining mills. Farmers have diversified by intercropping sugarcane with shorter-yielding horticulture, reducing their reliance on sugarcane as a cash crop.



Outdated agricultural practices

Outdated agricultural practices have degraded soil quality and reduced productivity. Farmers frequently burn sugarcane before each harvest, use low-quality or unsuitable fertilisers that increase soil acidity and 'ratoon' sugarcane crops, growing cane from cut stalks rather than replanting the crop.¹² These cost-reduction practices harm the quality of the soil and negatively impact yields.

¹¹ Globalisation and Governance in the Pacific Islands (Firth, S., 2006).



Shortages of agricultural labour

Shortages of agricultural labour caused by changing rural demographics have left the industry dependent on an ageing population and inappropriate machinery. Sugarcane harvesting has traditionally relied on manual labour. However, as rural populations increasingly migrate to cities to pursue other employment opportunities, agricultural labour has become scarce, costly and less reliable. Farmers have increasingly replaced manual labour with machinery, much of which is in disrepair or unsuited to Fiji's farm conditions.



The loss of preferential access to the European Union

The loss of preferential access to the European Union under the Lomé Convention in 2017 caused a sudden decrease in the competitiveness of the Fijian sugar industry due to low volumes and high production costs compared to other countries. Production costs in Fiji are high due to outdated processing equipment and declining sugarcane quality. These factors reduce the conversion rate of sugarcane into processed sugar and hinder the country's ability to compete in international markets.



Prioritising the critical functions that MDF could address

Of the constraints stifling the performance of the Fijian sugar industry, MDF identified three functions that the program's interventions could feasibly improve:



Inputs that improve soil health by decreasing acidity

Acidity refers to the pH level of soil, which influences the nutrients available for plant development. Artificial fertilisers increase acidity, preventing optimal plant growth and decreasing yields. Faced with poor soil health and declining yields, Fijian farmers have been applying large amounts of artificial fertiliser to their land. These fertilisers further decrease soil health and productivity, creating a vicious cycle of declining soil health. Acidic soil is a widespread problem in sugarcane-producing countries; however, MDF observed that Fijian farmers had not adopted the relatively simple solution of applying soil enhancers, which is a common practice in other countries. Introducing relevant agricultural inputs, such as ag lime as a soil additive, could reverse deteriorating soil health and increase sugarcane yields by neutralising soil acidity through natural chemical processes. The initial research on soil health was conducted by The Australian Centre for International Agricultural Research¹³ and the Lime Task Force was established to trial lime usage on taro in Taveuni and pasture development in Tailevu.

¹² Energy Potential of Sugar Cane Biomass in Brazil (Ripoli, T.C.C., Molina, W., and Ripoli, M.L.C., 2000). https://www.researchgate.net/publication/26365356_Energy_potential_of_sugar_cane_biomass_in_Brazil.

¹³ Identifying Pilot Sites and Research Methods for Soil Health Research in the Pacific Region (The Australian Centre for International Agricultural Research, 2011). http://era.daf.qld.gov.au/id/eprint/2671/1/ACIARfr2011_03_10038_Smith.pdf



Mechanical harvesting to compensate for labour shortages

For years, the sugar industry has been unable to attract young people to harvest sugarcane. Almost 80 per cent of Fijian sugarcane farmers are now over 50 years old.¹⁴ The shortage of labour has been compounded by a lack of appropriate, serviceable machinery that could be used to replace the shrinking pool of manual labour. MDF observed that the few machines available were inappropriate and might damage soil and sugarcane crops. They were also frequently inoperable because spare parts and maintenance services were often unavailable in Fiji. Access to better mechanical harvesters, after-sale service and necessary parts could offset the shortage of manual labour and preserve soil health and increase sugarcane quality.



Quality control and marketing to reposition Fijian sugar as a quality, branded product

The loss of preferential pricing has prevented Fiji from competing with other major sugar producers. In the 30 years that the national industry benefitted from preferential pricing, there had been no incentive to invest in market research, product development or promotion. Considering the country's unique image and geographical position, improvements in product quality and marketing, combined with improvements in yields and harvesting, could help Fiji shift away from selling bulk raw sugar and transition into higher-value export markets, selling a value-added, premium final product.

¹⁴ Labour Shortage a Factor in the Decline of Fiji Sugar Production (Fiji Sun, 2019). <https://fijisun.com.fj/2019/02/12/labour-shortage-a-factor-to-the-decline-of-fiji-sugar-production/>



Promoting innovative business models to reinvigorate Fiji's sugar industry

MDF's research into opportunities and underperformance in Fiji's sugar industry led to the prioritisation of three innovations that would improve productivity and product quality and reposition Fiji's sugar in international markets. Each of these innovations is explained individually below; the next section presents the impact of these innovations on the sugar market system's performance, inclusivity and environment.



The **first innovation** entailed enhancing soil health by working with key stakeholders to increase farmers' access to, and use of, ag lime. This highly effective soil conditioner reduces acidity and facilitates soil nutrient uptake in plants. MDF commenced its work in the sugar industry in 2012 by identifying potential suppliers of ag lime and connecting them with distributors and farmers. This work involved establishing a new business model for production, distribution and retail and increasing farmers' awareness of good agricultural practices. While the use of ag lime proved successful, labour shortages in 2016 (particularly in Vanua Levu) prevented farmers from fully harvesting the additional yield.



Based on the results observed, MDF introduced the **second innovation**, which sought to provide mechanical harvesting services to farmers in the Seaqaqa–Labasa area who were unable to find enough labourers to harvest their cane manually. This work involved introducing a new business model to procure appropriate mechanical harvesters and provide after-sale services. In 2016, Fiji's sugarcane production and harvest reached a new peak because of yield increases from ag lime, increased mechanical harvesting and a government grant for cane replanting.



After Fiji lost preferential pricing treatment from the European Union in 2017, it became unclear how the country would exploit its increased production and harvesting capabilities. MDF shifted its focus to a **third innovation** to assist the industry in repositioning itself in traditional markets, including Australia, New Zealand and PICs. This innovation focused on shifting from bulk raw sugar to a higher-quality, value-added and branded product. The new business model involved FSC introducing quality control procedures, premium products and new marketing techniques. This shift would create a demand pull and introduce incentives across the industry to upgrade and maintain its performance.





Innovation 1: Access to agricultural lime



Background

Declining sugarcane yields pushed farmers and the industry to apply a variety of methods to halt this decline, including the use of artificial fertiliser, chemicals and new cane varieties. When these solutions proved unsuccessful, an official task force was formed in 2011 to investigate the apparent soil deterioration. Investigations concluded that years of inappropriate agricultural practices and intensive monocropping had caused severe soil acidification, decreasing yields.

During the Colonial Sugar Research (CSR) period, CSR advised farmers to apply coral sand to their sugarcane plots, as this contains a high percentage of acid neutralising chemicals. This practice became lost over time, and those farmers that remembered the advice found it difficult or expensive to procure the minerals locally. Most farmers had come to rely on artificial fertiliser to boost short-term yield, not realising how much this treatment regimen can harm soil health.

The industry had recognised the nature and extent of this problem, and MDF was encouraged to address the soil acidity constraint. The formation of the task force demonstrated the industry's commitment to tackling this issue.



In the CSR time, the application of coral sand in the soil was compulsory for farmers. But when we took over, the practice gradually declined and then stopped. Our extension field staff are now carrying out agriculture lime trials in all sectors so that we can educate farmers.

Rajnesh Narayan,
Extension Services Manager, FSC



Solution

MDF aimed to develop a business model through which ag lime would be affordable, available in convenient pack sizes and widely distributed on a commercial basis. The fact that soil pH was a growing concern across the agricultural sector indicated wider commercial potential for ag lime. However, at the time, ag lime was expensive, only imported in small volumes and used primarily by a small number of commercial farmers. Most farmers were unaware of the product, its benefits or its availability. There was also no understanding of its potential demand among farmers, which inhibited the emergence of a domestic market.

MDF aimed to make ag lime accessible and affordable to farmers by initiating production and distribution of the first domestic ag lime product in Fiji. In July 2012, MDF conducted a scoping exercise to find businesses that could potentially produce ag lime. The team identified Standard Concrete Industries (SCI), as a viable partner with the capacity and incentives to produce ag lime. SCI is Fiji's leading supplier of aggregates, cement and ready-mixed concrete. It runs the only established lime quarry in the country, which was previously used solely to produce crushed natural limestone for road construction.

MDF's proposed partnership was initially met with scepticism. Although the lime produced by SCI for road construction is the same substance used to treat soil, agricultural application requires the lime to be ground more finely. Having operated in the construction industry for decades, SCI was unfamiliar with the agricultural sector and unaware of the need and potential market for ag lime.

MDF provided SCI with a market feasibility study¹⁵ demonstrating a strong business case for serving the agricultural sector. The study estimated the potential demand for the product in Fiji, provided evidence for its efficacy on soil health and crop yields and highlighted its potential for success. This evidence-backed business case persuaded SCI to invest in the setup to produce finer lime, including constructing a dedicated packing shed and providing labour to pack the ag lime.

MDF was aware that the introduction of a good product does not necessarily ensure its immediate, widespread adoption. Farmers are unlikely to be able to access or use a product unless they are aware of its benefits, motivated to use it and able to buy it. Considering these potential constraints, MDF supported SCI by:

- ✎ Coordinating and placing the product to ensure that ag lime, once available, reached farmers
- ✎ Working with SCI and retailers to (1) undertake soil testing, (2) develop promotional material, (3) advise on correct application methods, (4) execute awareness-raising campaigns, field promotions, media coverage and demo plots, and (5) distribute free samples.

SCI and MDF launched the new ag lime product in August 2013. While uptake was successful in certain locations on Viti Levu (Fiji's largest island), distribution proved difficult in many of the country's sugarcane belts. To ensure that ag lime became more readily and widely available, MDF shifted its focus to find ways for ag lime to be distributed through channels that farmers already accessed for other goods.

In 2016, MDF began facilitating partnerships between SCI and potential distributors. These partnerships resulted in ag lime being stocked in existing agricultural input and hardware stores, with distributors moving ag lime through their existing distribution channels. These partnerships proved crucial, as the new partners had extensive networks reaching remote areas and experience in the cost-effective distribution of a variety of products. Such experience ensured access to target populations throughout Fiji.

MDF identified three key hardware firms as distributors of SCI's ag lime. KK's Hardware and Global Cargo Traders served Fiji's Western division, while A. Hussain & Sons served the northern division. MDF worked with SCI and the distributors to build up stocks and increase capacity to deliver ag lime, including preparing additional marketing campaigns and organising direct engagement with farmers. MDF also worked with these partners to engage with other key stakeholders to endorse the use of ag lime, including the Ministry of Agriculture (MOA), the Ministry of Sugar and FSC. Extending engagement with stakeholders such as MOA helped ensure that ag lime use would spread beyond sugarcane and into the wider agricultural sector.



Market reaction

Although the process of promoting ag lime has not been simple or linear, uptake has grown steadily. MDF worked with FSC to keep stakeholders informed and engaged throughout the process. This active role, combined with farmers' word of mouth, increased demand and product availability, leading to peak ag lime usage in 2017. It also encouraged the Ministry of Sugar and FSC to place ag lime on their list of recommended (and, subsequently, mandatory) inputs used in replanting, supported by

annual replanting grants. Additionally, FSC already had a system in place through which farmers could access inputs in advance and pay for them with the proceeds from cane harvests.

When farmers replanted cane and used ag lime, their average yields doubled; ratoon crop yields typically increased by at least 30 per cent when using ag lime. As product awareness and accessibility increased,

¹⁵ Aglime for Fiji (ProAnd Associations Australia Pty Ltd, 2013). https://issuu.com/marketdevelopmentfacility/docs/aglime-for-fiji-_mdf

farmers became willing to dedicate more land to sugarcane production. Continuous demand among farmers, particularly in the Labasa area, strengthened FSC's confidence in the product. FSC responded to this demand by ensuring that its suppliers had continuous access to ag lime, resulting in further market expansion and the entry of additional suppliers.

The introduction of ag lime has been positive, and the product is now being widely used; however, the market's reaction has not always been stable. For several years after the product was launched, SCI maintained production and delivery to distributors. Eventually, rising demand for construction material encouraged SCI to prioritise other products, and the production of ag lime began to decline. Distributors also encountered cashflow challenges due to incompatible payment terms between distributors, SCI and FSC.

Recognising the importance of ag lime, the Ministry of Sugar and FSC sought alternative strategies to ensure farmers' continued access. They retained ag lime in the annual replanting grants program and identified South Pacific Fertilisers, a key input provider for FSC and sugarcane farmers, as an alternative ag lime provider. The company now imports large volumes of ag lime and fertiliser, and it distributes and retails its products

to sugarcane farmers at prices that are more affordable than past imported products.

Ag lime uptake has expanded beyond sugar and into other horticulture and root crop sectors. The work between MDF, SCI and MOA resulted in ag lime being included as a subsidised input for farmers after tropical cyclones. This subsidisation has stimulated long-term and increased demand among farmers, from 60 households in 2013 to 530 in 2017. Such demand has also encouraged new firms to import and sell ag lime.



We planted a new cane with ag lime, and then we did two acres without ag lime, just a fertiliser. We saw a big difference. The first was 112 tonnes, and the second was 68 tonnes.

Shahin Nisha Khan,
Sugarcane farmer/harvester operator

Quick facts



Number of benefitting households

4,272



Additional income generated

USD 6 million



Average additional income per household

USD 1,400



Average additional yield per acre

10 tonnes

an increase of 20–50%
(depending on the origin soil acidity level)



Total additional yields experienced (2013–2019)

290,000 tonnes



Note: All above figures are as of January 2020.





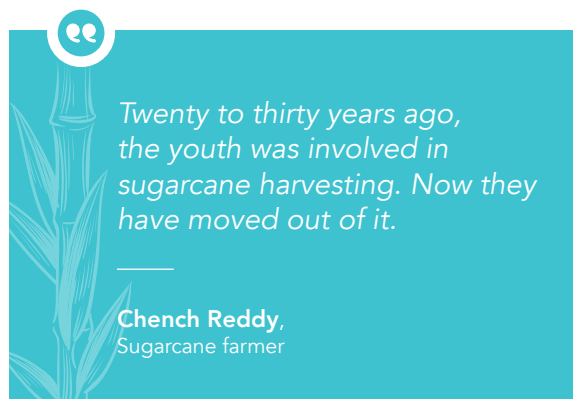
Innovation 2: Access to mechanical harvesting



Background

As the application of ag lime increased sugarcane yields, the labour constraint on harvesting intensified. Rural youth were migrating to urban centres in search of better-paying, year-round jobs, which depleted the pool of agricultural labour in rural communities. With the demand for labour outstripping supply, the workers that remained in farming communities demanded higher pay and supplementary compensation, in the form of food and accommodation during the five-month harvesting period. While labour costs and volumes of unharvested crop increased, sugar prices remained stagnant and farmers could not afford to fully harvest their cane harvests. MDF estimated that much of the 15,000 tonnes of increased yield achieved through the application of ag lime would remain unharvested.

Machine harvesters have long been an alternative to manual labour in Fiji. However, when MDF began its interventions, only nine machines were in use, which was insufficient to support harvesting at any scale. The machines, imported second-hand after extensive use in Australia, were prone to breaking down. Spare parts and maintenance services were not widely available, and faulty harvesters were often abandoned. Existing



harvesters were operated by businesses, which lacked the resources and know-how to maintain and operate the machines. Existing harvesters consumed a lot of fuel and were bulky and unsuitable for Fiji's soil and sugarcane planting patterns. Consequently, mechanical harvesting was inefficient and detrimental to yields. Farmers that used the existing harvesters reported extensive soil erosion and cane damage.



Solution

MDF aimed to leverage the momentum triggered by the ag lime innovation to introduce more appropriate and sustainable harvesting equipment and services. The team developed a business model that would make profitable harvesting services available to a significant portion of Fiji's sugarcane farmers. Under this business model, MDF sought a partner with the capability and motivation to operate harvesters on a large-scale, commercial basis. The team identified the Charan Jeeth Singh (CJS) Group, which has been operating for 20 years in several industries, including retail, hospitality, and sugarcane and vegetable farming. Through its agricultural services, CJS was acquainted with industry actors that would prove critical to the success of the

innovation, including FSC, the Sugar Tribunal and cartage providers.

CJS was inclined to invest in a mechanical harvester on Vanua Levu, which had experienced labour shortages. However, the Group was reluctant to make such a costly investment due to scepticism about the efficiency that harvesters could achieve in Fiji. To date, harvesters in Fiji have processed an average of 12,000 tonnes of cane per year compared to the 100,000 tonnes processed in Australia. CJS was concerned about the potential profitability of the innovation and was discouraged by the mixed results of earlier businesses that had ventures into mechanical harvesting. MDF needed to demonstrate

that there was a viable business case for the innovation, firstly to encourage CJS to invest, and then encourage market expansion by other businesses.

MDF worked with CJS to examine the business model and ensure that annual revenues could feasibly cover all operating and overhead costs (including operators, servicing and financing) while still returning a reasonable profit. A positive commercial model proved feasible, albeit with a long payback period.¹⁶

MDF supported CJS to source and acquire a new harvester suited to Fijian terrain, soil and planting patterns. Sugarcane is an annual crop harvested from July to November. Revenue produced during this brief period must cover the full costs of a harvester and make a profit. Procuring a reliable, high-quality machine was therefore crucial to ensuring profitability.

A new, affordable Case IH harvester from CNH Industrial in India was selected, capable of harvesting multiple varieties of Fijian cane. The Case IH harvester is nine tonnes lighter than the country's existing machines, reducing soil and cane damage. CJS travelled to India with a local engineer to assess the machine's features and choose the model most suitable for Vanua Levu's

soil. During the visit, the delegation underwent training on the operational features of the machine.

The supplier sent a technician to Fiji to support assembly of the harvester. The technician was also required to provide training and guidance during the first harvesting season, which added to the cost. However, this troubleshooting proved invaluable, as it allowed problems to be fixed on site, reducing costly downtime, and helped build local capacity for mechanical testing and maintenance. MDF also worked to ensure the availability of after-sale services and parts to keep harvesters operational throughout the harvesting season.

CJS convinced cartage service providers to modify their trucks to be able to transport mechanically harvested cane. Manually harvested cane can be transported in any type of truck, as the long harvest canes can be stacked; mechanical harvesting produces pellet-size cane that requires a caged bin in order to be transported. Five truck operators modified their trucks, and CJS modified two of its own, ensuring the ability to transport the mechanically harvested cane from farms to processing locations.

Quick facts



Number of
benefitting
households

1,317



Average cost savings
per tonne compared
to manual labour

USD 4.50



Average savings for farming
households harvesting
200–300 tonnes annually

USD 774 - 1,161


Note: All above figures are as of January 2020.

¹⁶ The business model was developed on the conservative of 10,000 tonnes harvested annually, at USD 10 per tonne. In this instance, the business revenue would be USD 100,000 per annum, of which 70 per cent would be reserved for costs, and 30 per cent would be reserved for annual profit. The payback period for a loan would be an average of five years.



Market reaction

Using mechanical harvesters had an immediate benefit on farmers. Sugarcane that once could have taken up to five months to harvest manually could now be harvested in a few weeks. The time saved enabled farmers to prepare their land and plant sugarcane crops before the rainy season begins. It has also significantly reduced the burden on women. The dwindling number of sugarcane workers had caused harvesting gangs to charge exorbitant rates and make demands that added to the daily work burden of women in farming households. The use of mechanical harvesters has reduced women's workload and limited the need for uncomfortable interactions with hired labourers. It has also increased the incomes of sugarcane farming households.



When my husband passed away, we were very worried about the cane. It is hard when I have to get labourers. I have to pick them up and give them breakfast. At 10 o'clock, I have to give them juice and lunch, as well as yaqona and kava. It's very expensive for me; can't afford that.

Saiful Nisha Khan,
Sugarcane farmer

A mechanical harvester in Fiji typically operates at 50 per cent efficiency due to Fiji's difficult terrain. It can harvest about 10,000–15,000 tonnes in a season and service roughly 80 farming households. In 2016, CJS introduced the first suitable machine to Vanua Levu farmers. This machine initially harvested cane for 44 family farms; in 2018, this increased to 90 farms.

FSC and the Ministry of Sugar were impressed by the immediate benefits of the innovation and sought to make mechanical harvesting widely available in Fiji during the 2017 harvest. In cooperation with the Ministry of Sugar and the Sugar Tribunal, FDB suggested financing mechanical harvesters under the bank's agricultural

services loan scheme. The Government invested more than USD 1 million in the initiative, and farmers formed cooperatives in order to access the finance. Under this initiative, the Government pays one-third of the purchase price, while farmers (as either individuals or cooperatives) pay the remaining two-thirds. The program covered Vanua Levu and Viti Levu, Fiji's two main sugarcane growing islands. By 2019, the newly formed cooperatives were importing machines to Fiji, enabling more farmers to harvest greater proportions of their crops more quickly.



What is happening now is that farmers are concentrating on plantation and cultivation of crops, and the harvesting process lies on the harvester's side. That is a huge relief to the farmers.

Mohammed Rafiq,
President,
Coqela Naleba Cane Farmers Cooperative

After CJS purchased the Case IH harvester from CNH Industrial in India, a CNH salesperson joined the company's main competitor, Shaktiman. Shaktiman soon thereafter entered the Fijian market, selling a similar machine at a similar price and offering cooperatives a free trip to India with the purchase of a machine. The competition between Case IH and Shaktiman drove down the price of harvesters, from about USD 225,000 in 2016 to USD 150,000 in 2020, making the machines more affordable. FSC became concerned that the competition was becoming too intensive and potentially destructive. To mitigate this risk, FSC began to allocate harvesting zones to different service providers.

Because of this allocation scheme, the number of farms served by CJS's harvesters dropped from 90 to 42 in 2019. However, this allocation created more stability and predictability of revenue for service providers and ensured equitable access to machines for farmers. This coordinating tactic resulted in the substantial expansion

of machine harvesting across the country, with over 80 cooperatives and individuals buying harvesters (56 from Case IH and 24 from Shaktiman). Case IH and Shaktiman opened offices in Viti Levu and established agent offices to provide after-sale services. One of the maintenance providers, Allied Motors, is cooperating with CNH to bring other machinery, such as small tractors, to Fiji.

The restrictions put in place to limit the spread of COVID-19 prevented foreign operators and technicians from visiting Fiji. These restrictions led to an expansion of local maintenance and operating services. To meet the need for skilled machine operators and technicians, FSC conducted training with Case IH and Shaktiman to teach interested Fijians how to install, operate and service the harvesters. During the 2020 harvesting season, trained locals operated all the harvesters, and local mechanics gained the skills necessary to service and repair the machines.

At least three mechanic firms have begun offering truck modification services. Fiji previously had no trucks suitable for transporting mechanically harvested cane; most truck owners had to modify their own trucks to haul the newly harvested yield. However, mechanics have started to seize this new opportunity to provide modification services to facilitate cane transportation. The largest of these mechanic firms, Lovely Auto Parts, began modifying trucks in 2016. They grew their business significantly in 2017 and modified more than 50 trucks, including some owned by FSC. The average cost of truck modification is USD 8,000. Truck operators can realise a return on this investment in about three seasons.

The widespread availability and use of mechanical harvesters, the emergence of supporting maintenance services and technician training, and government programs have helped resolve the harvesting bottleneck that was limiting the benefits of ag lime application. Farmers are now able to harvest more of their sugarcane crops more efficiently and affordably, with less damage to soil and crops.



While we have helped the people on the flat plain areas, we are also very much working towards helping the people on the hilly areas. Very soon, we are going to have a little more modernised harvester that has a track at the back. And it can go up to 15 degrees or more than that.

Sanjay Kumar,
Ministry of Sugar



Innovation 3: Improving quality and marketing to higher-value markets



Background

The increased use of ag lime and mechanical harvesters laid a solid foundation for the industry's productivity. However, Fiji's weak competitiveness in international markets became increasingly apparent after the loss of preferential treatment—in terms of price but also lack of product quality and marketing.

Since sugar cultivation began in Fiji in the early 1800s, it has produced sugar for domestic consumption and for export, with the former accounting for 10–20 per cent of production. Exports of bulk raw sugar were sent to European Union markets at preferential, high prices. This agreement was established under a framework to assist sugarcane industries from developing countries compete with larger producers from developed nations.

Considering this preferential regime and the gradual growth in the domestic market, FSC was under no pressure to be competitive, build a brand or invest in quality improvements, even though foreign contaminants often compromised the quality of its sugar. The withdrawal of preferential treatment in 2017 put FSC in a precarious position in the international market for bulk raw sugar: Fiji could not compete on price or quality. MDF realised that the gains from improved inputs and mechanisation would be lost if Fiji did not improve its competitive position.



Solution

MDF understood that Fijian sugar needed to shift away from bulk raw sugar, where it could no longer compete on price, and penetrate higher-value international markets. This shift would require changing FSC's business model to one based on international quality standards and branding as a premium, value-added product. The concept of Sugars of Fiji was born.

MDF's reputation, relationships and results achieved during its preceding interventions gave FSC the confidence to embark on a partnership to transition to leaner operations, better quality control and a research-based marketing strategy. MDF aimed to demonstrate that it was possible for one of Fiji's largest state-owned enterprises to innovate and operate more efficiently and profitably. By 2018, FSC had installed a new marketing team and begun planning for exports to new markets; the Corporation was ready to embrace change.

In partnership with FSC, MDF facilitated a Hazard Analysis Critical Control Point (HACCP) assessment of FSC's processing and packaging facility. The team also

conducted comprehensive market research on several factors, including distribution arrangements and product placement, necessary to create a new branded sugar product. The adoption of HACCP quality standards would reduce sugar waste at the packaging facility and enhance efficiency by streamlining processes, therefore saving water, electricity and fuel consumption. The goal was to shift FSC from loss to profit, which would enable them to reward farmers with price premiums for improved production and quality.

With support from MDF, FSC received the HACCP assessment and subsequent recommendations in mid-2018. Though not yet certified at the time of writing, FSC has implemented most of the recommendations to produce and package sugar using appropriate food management procedures. Implemented recommendations include the engagement of a full-time Quality Control Supervisor for milling and packaging, as well as the development of proper food management manuals for the packaging factory. These measures will improve sugar quality.¹⁷ After improving the production process,

¹⁷ Mills Upgrades to Improve Sugar Quality (FBC News, 201). <https://www.fbcnews.com.fj/news/mills-upgrades-to-improve-sugar-quality/>

MDF and FSC shifted their focus to marketing. MDF assisted FSC to hire an international consulting firm, Windward Commodities,¹⁸ to:

- 👉 Conduct a market assessment to analyse the potential profitability of Fijian sugar by product type and market segment
- 👉 Design a new product range and branding approach based on the findings of the market assessment
- 👉 Implement a new marketing and sales strategy for a pilot of 1,000 tonnes of premium sugar.

Windward Commodities researched the demand for Fijian sugar in New Zealand, investigating how retailers displayed products, as well as the type of packaging and brand identity that resonated the most with customers.

The market research yielded information on consumer preferences, recommended the most suitable distribution and sales channels, and generated introductions to selected distributors. FSC and Windward Commodities embarked on a year-long process to design a brand, develop a product range, change packaging, improve processing, and secure distributors and buyers. The firm's previous experience as the official market researcher for sugar in Barbados helped to negotiate pricing and product volume with distributors.

The official launch took place in October 2019. FSC also started shipping sugar products to New Zealand in the same month. By December 2020, Fiji was receiving regular monthly orders from New Zealand for an average of 30 tonnes a month.



Market reaction

Using the market research conducted for New Zealand, FSC targeted neighbouring PICs. These countries were traditionally markets for low-quality sugar, but FSC was able to enter them with its newly value-added, branded product.


In less than eight months following the initial launch, FSC was able to increase exports from 1,000 tonnes to over 6,000 tonnes, most of which went to PICs. In addition to the increased sales to eight new markets, FSC confirms that the higher-quality, branded sugar has achieved significantly higher premiums than bulk raw sugar.

Although only 1.6 per cent of the sugar produced in Fiji is sold to these new markets, the increase from 1,000 to 6,000 tonnes indicates the potential for FSC to grow the sales of this new product. FSC estimates that it can increase annual sales to PICs and New Zealand to 15,000 tonnes. However, scaling up will require maintaining stringent quality control measures in sugar production and packaging, as well as penetrating additional markets beyond New Zealand and PICs.

Quick facts


Additional
number of markets
acquired

8


Additional income
generated from
employment

USD 10,000

from additional positions created
within the new business model


Total tonnage of premium,
branded sugar sold
to new markets

6,000 tonnes

(from the initial pilot of 1,000)

Note: All above figures are as of January 2020.

¹⁷ Windward Commodities connects commodity producers to global and regional consumer markets. The company develops and manages profitable brands and sustainable supply chains that create jobs and increase incomes in sectors including sugar, coffee, chillies and bananas, as well as natural resources such as oil and aluminium.

 Ratoon Crop 0.9ha
Harvested September 2014
Total Tons: 68
TpHa: 75

 AGLIME TREATED PLOT
0.9ha
15 X 25kg bags Aglime Applied
20 Bags Blend C

Systemic Change and Inclusive Impact on the industry and farmers



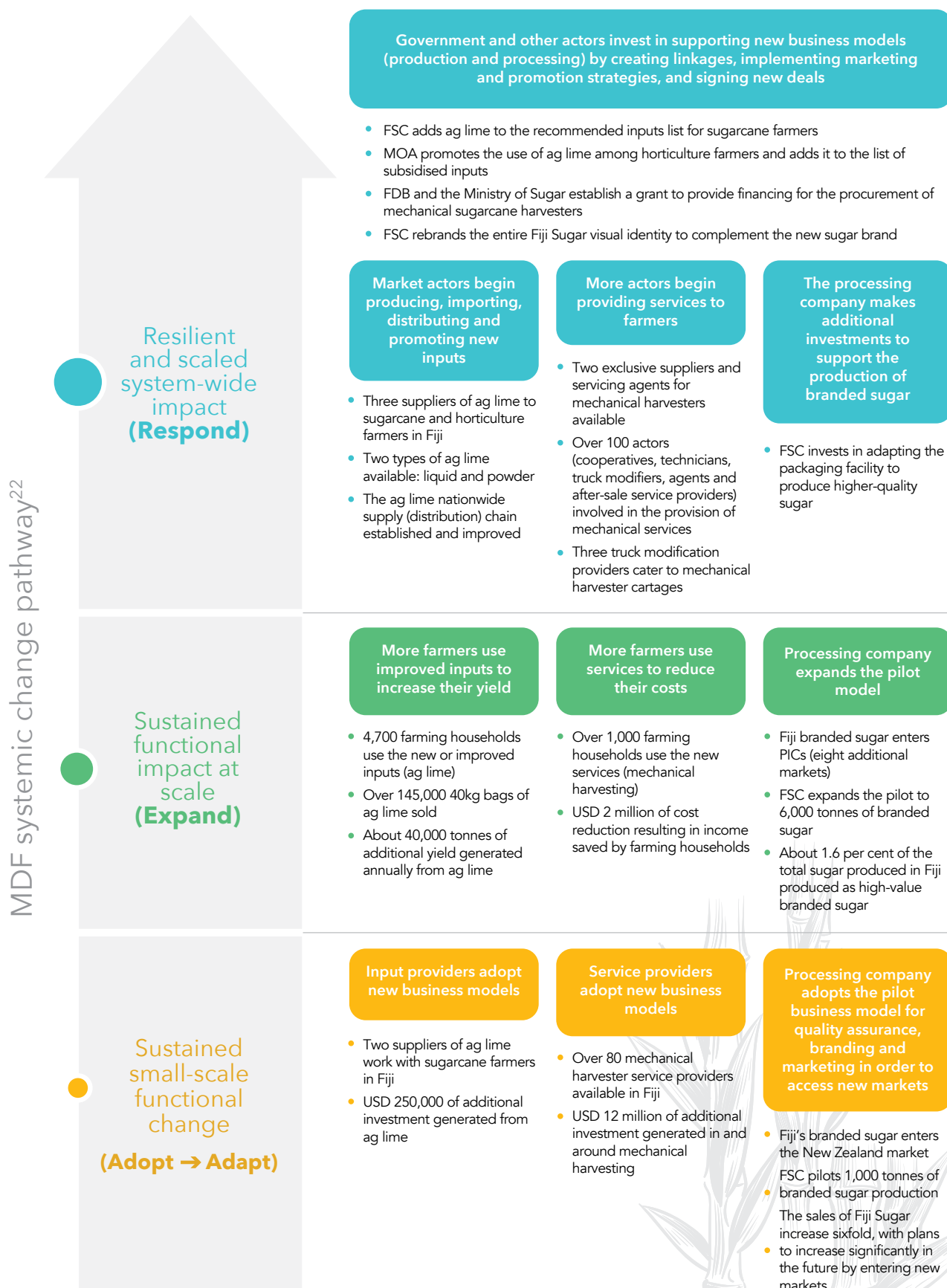
MDF bases its definition and measurement of systemic change on the Adopt-Adapt-Expand-Respond framework.^{19,20} In the sugar industry, MDF witnessed that systemic change does not unfold neatly or predictably, and measuring variations is not a linear process. Broader systemic change acts differently across the MDF portfolio. In thin markets, such as the Pacific, reaching only the first level of systemic change could be a significant achievement. In most places where MDF works, significant systemic change requires government involvement.

Below is a stylised, three-tier structure illustrating how MDF measured systemic change in the sugar industry. After identifying the target and interconnected systems and applying its vision of change, MDF measured the changes within each of the innovations. Following a pragmatic measuring approach,²¹ MDF tracked the changes beyond these innovations to understand which adjustments were taking place in the interconnected systems. Tracking placed a particular focus on the stakeholders linked to the sugar industry, such as logistic providers, hardware companies and farmer cooperatives. MDF assessed how different actors adapted to the evolving circumstances, as well as how the changes in the interconnected systems relate to and enhance the changes in the targeted system. With these findings, MDF leveraged its learning to implement additional innovations and improve existing ones to ensure change at the market system level.

¹⁹ Adopt-Adapt-Expand-Respond: A Framework for Managing and Measuring Systemic Change Processes (Nippard, D., Hitchins, R. and Elliott, D., 2014). <http://www.springfieldcentre.com/wp-content/uploads/2014/06/2014-03-Adopt-Adapt-Expand-Respond-Briefing-Paper1.pdf>

²⁰ Annual Report (MDF, 2019). <https://marketdevelopmentfacility.org/wp-content/uploads/2020/05/MDF-Annual-Report-2019-web.pdf>.

²¹ A Pragmatic Approach to Measuring System Change (Miehlbradt, A., Shah, R., Posthumus, H. and Kessler, A., 2020). <https://www.springfieldcentre.com/a-pragmatic-approach-to-measuring-system-change/>



²² The infographic includes figures as of December 2020.

By supporting innovations in inputs, mechanisation and product quality and marketing, MDF helped trigger systemic change that enabled Fiji's sugar industry to become more competitive and transition into new markets. This effort has helped reverse the long-term decline in the sugar industry, in which farming and processing productivity were decreasing, costs were increasing, and Fijian sugar was struggling to compete in bulk raw sugar markets. Without these innovations, the future of this important industry would have remained uncertain.

Any single, isolated innovation would have been unlikely to trigger a shift in industry performance. Instead, the innovations were co-dependent. The sequence of these innovations also appears to have been important; the introduction of ag lime was a pragmatic, achievable entry point from which MDF could gain traction and credibility with the industry and build momentum for further innovations and wider change.



Systemic change required the commitment, investment and behavioural change of FSC and key industry stakeholders, including the Ministry of Sugar and the Sugar Tribunal. Changes in other functions and rules have supported the scaling up and sustainability of the main innovations. These changes included adding ag lime to FSC's inputs list, coordinating mechanical harvester allocation and providing cane replanting grants. Such changes have inspired confidence, encouraged healthy competition and enabled the widespread uptake of innovations across the country. Ancillary business opportunities have also emerged in wholesaling and retailing of inputs, agricultural mechanisation and transportation.

Changes in Fiji's sugar industry are still nascent but there are encouraging signs of sustainability and resilience. New actors have entered the market (e.g. two additional ag lime suppliers and distributors and 80 additional mechanical harvesting service providers), and new adaptations have occurred (e.g. liquid lime and improved trucks for sugarcane transport). Innovations are spreading beyond sugar and triggering wider changes in the agriculture sector. Businesses providing additional agricultural inputs and services related to soil health have emerged. One ag lime distributor-retailer, a hardware firm, recognised the wider demand for agricultural inputs

and expanded its wholesale and retail operations. With start-up support from MDF, the firm now imports other agricultural inputs (such as seeds) and distributes its products through strategically selected retailers. Another agricultural retailer has added liquid lime to the inputs it supplies nationwide.

The ag lime innovation has prompted a focus on soil health among key agricultural stakeholders, leading to the introduction of related products. As ag lime grows in popularity throughout the country, private sector providers have begun offering soil testing services. FSC and its statutory bodies have started distributing other forms of the product in addition to the original ag lime product introduced by MDF's partner. They have also started using media platforms to encourage other 'green' ways to improve soil health.

Fiji's sugar industry is becoming increasingly professional; despite being a small player in global markets, its ability to compete internationally has improved. Its premium, branded products have reached eight new markets. Sugars of Fiji is building brand recognition and commanding higher prices in more lucrative markets. FSC is exploring opportunities to expand its presence in existing markets, enter new markets and sell to domestic consumers.



COVID-19 and the Fijian sugar industry

COVID-19 has affected all sectors of the country's economy, including the sugar industry. At the recent meeting of the International Sugar Organisation Council, Fiji's Prime Minister, Mr Voreqe Bainimarama, shared that global border restrictions and narrowed distribution channels have dealt a blow to Fijian sugar exports.


The movement to secure regional trade is even more important in the current circumstances. It aligns with the government's priority to improve access to regional and international markets for Fijian goods and services. It also enables the country's key sugar industry to generate credibility and revenue during the global pandemic and the resulting economic contractions.






Inclusive impact on farming households

Quick facts


Total number of households benefitting from sugar innovations

6,000


Total additional income generated

USD 16 million


Value of additional market transactions

USD 5 million

Note: All above figures are as of January 2020.

MDF's intervention has resulted in significant inclusive benefits. The use of ag lime has increased farmers' yields by 30–50 per cent (from an average of 68 tonnes per hectare to 85 tonnes per hectare per farming household). The average savings per farming household have reached USD 1,000/year since the introduction of mechanical harvesters.

As a result of the cane replanting grant, ag lime inputs and mechanical harvester services, 60 per cent of farmers interviewed by MDF over the past three years have confirmed the expansion of their productive land, increased replanting ability and enhanced soil quality. Farmers are now motivated to stay in the sugarcane sector because they are confident that they can harvest their entire cane yield.

MDF applied its Women's Economic Empowerment framework²³ to ensure that the innovations introduced involved and benefitted women. MDF's approach is to identify the business case for inclusivity, recognising that enhanced competitiveness and inclusivity must coincide if changes are to be durable and widely beneficial.

Women play several integral roles in Fiji's sugar industry. As a household crop, much of the work involved in harvesting sugar takes place on the family farm. Traditionally, women must provide food for labourers, apply fertiliser, hoe soil and participate in financial decision-making. The latter is particularly important, as MDF's innovations have expanded yields, reduced harvesting costs and increased income for the whole household.²⁴

In recent years, women have taken on a larger share of manual harvesting to compensate for Fiji's shortage of agricultural labour. The average farming household processes around 200–300 tonnes of sugarcane yearly, which takes over 30 days to harvest manually over five



Has machinery displaced agricultural labour?

For three years, MDF monitored whether mechanisation adversely displaced manual agricultural labour. Sugarcane farmers in Fiji were already experiencing labour shortages due to the rural to urban drift and ageing farming population, resulting in decreased annual harvesting. MDF found that displacement had not occurred because mechanical harvesters are only used on flat land; manual labourers are still used to harvest hilly or semi-hilly tracts of land. Mechanisation has also created jobs in machinery fabrication, distribution, sales and maintenance, increasing potential family income.

months. During these months, women are not only required to labour in the cane fields but also provide food for labourers. Their workday typically starts at 4 a.m. and extends late into the evening. Mechanical harvesting has drastically reduced the work burden on women. Mechanical harvesters shorten the average harvesting time to just three or four days, saving labour time and limiting the supporting tasks conducted solely by women. In interviews with MDF, all female household members identified the positive impact of mechanical harvesters on their productivity and overall well-being. These benefits included having time to work on other crops and activities, starting their workday later and finishing earlier, and being able to take breaks during the day.

²³ Inclusivity explainer: WEE at MDF <https://marketdevelopmentfacility.org/wp-content/uploads/2021/05/Inclusion-at-MDF-Explainer-1-WEE1.pdf>

²⁴ Beyond Income (MDF, 2018). www.marketdevelopmentfacility.org/wp-content/uploads/2019/07/Beyond-Income-FINAL.pdf



Before, we would get tired. In the morning, we would have to make tea. At lunchtime, we would sometimes have to cook for around 10 people. There is much less work now with the mechanical harvester

Rohini Lata,
Sugarcane farmer





Empowering vulnerable farmers with quality inputs

Five years ago, an unfortunate farming accident left life-long sugarcane farmer Harindra Deo partially blind. Attempts to correct his vision loss with laser treatment only exacerbated the problem, resulting in permanent blindness in both eyes. Now 54 and still working in agriculture, Harindra shared his story with MDF.

Harindra has been cultivating sugarcane and cash crops for 35 years at Drasa Seaside, a large farming area near Nadi. Sugarcane is the main source of income for his family. Despite his vision loss, Harindra still checks the soil, pulls weeds, plants seeds, and prepares fertiliser for spraying with the assistance of his son and grandson. However, soil acidity was adversely affecting his yield.

MDF's innovation to increase the accessibility of effective soil inputs has had a significant effect on Harindra's production.

In 2019, the difference was even more pronounced; his farm produced 150 tonnes of sugarcane, generating an additional USD 581 for his household.

Most farming families in Fiji rely on agriculture as their only source of income, making them particularly vulnerable to natural disasters and potential health issues. In the face of such uncertainties, MDF's intervention has helped farmers build financial strength and resilience. The extra income Harindra gained from using ag lime has enabled him to repair the flood damage to his house, pay his grandson's medical school fees and bolster his modest savings.



I first started using ag lime in 2017 on three acres of replanted sugarcane. Within the first year, I was able to harvest 120 tonnes, whereas I would usually only get 100 tonnes.

Harindra,
Sugarcane farmer.





Mitigating environmental deterioration and climate change

MDF's innovations have begun to mitigate the environmental damage caused by past industry practices. Sugarcane grows best in soil with a pH range of 5.5–6.5. MDF's research revealed that heavy fertiliser use and intensive farming practices had significantly lowered soil pH levels; over 43 per cent of the soil in sugarcane-growing areas in Viti Levu and 90 per cent of the soil in Vanua Levu was found to have pH levels below 5.5, resulting in reduced nutrient uptake and stunted plant growth.



I limed ratoon, because land is so salty here, my crop would not have survived at all without ag lime.

Gajin Chand,
Sugarcane farmer

The introduction of ag lime has returned natural alkaline elements to the soil, rebalancing its pH levels. This innovation promotes soil microbial activity by increasing the availability of nutrients, allowing air and water to permeate the soil and improving soil stability. Farmers in Vanua Levu have confirmed that adding ag lime to land that had become unproductive, particularly in low-lying areas, has restored soil balance and enabled them to farm the land anew. Farmers and the private sector have shared that approximately six litres of liquid lime, or 25 bags (40kg) on one hectare, increase the soil pH by an average of 1.4 points.

The introduction of new mechanical harvesters has also contributed to improving soil health and productivity. The existing heavy harvesters cause soil to compact, leading to cane damage and reduced regrowth. The

new, smaller machines do not cause soil compaction or damage, and farmers have confirmed that the new harvesters have increased sugarcane ratoon growth in subsequent seasons. Unlike manual harvesting and the new machines, the old, larger harvesters have damaged the soil and led to poor ratooning.²⁵ The new machines have also proven more efficient than manual harvesting. Due to the increased precision and low-cutting of sugarcane with mechanical harvesters, some farmers have experienced a rise in germination from ratoon crop of around 25 per cent compared to manual harvesting.

International evidence has also shown that newer, lighter harvesters are significantly more fuel-efficient. Movement to harvesting decreases the emission of greenhouse gases by up to 40 per cent, as it reduces the need to burn sugarcane prior to harvest.²⁶



However, track-mounted harvester machine damaged my cane, and 20 tonnes worth of wastage is due to that machine. Then I approached CJS to harvest the remainder of my field.

Hari Narayan Singh,
Sugarcane farmer

²⁵ Strategic Plan 2014–2020 (Sugar Research Institute of Fiji, 2018). <https://srif.net.fj/wp-content/uploads/2018/11/SRIFSAP.pdf>

²⁶ Fuel Consumption of a Sugarcane Harvester in Different Operational Settings (Ramos, Lancas, Lyra and Sandi, 2016). http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-43662016000600588

References

- FBC News (2021). Mills Upgrades to Improve Sugar Quality. Obtained from <https://www.fbcnews.com.fj/news/mills-upgrades-to-improve-sugar-quality/>
- FSC (2019). 2019 Annual Report. Obtained from <http://www.parliament.gov.fj/wp-content/uploads/2020/09/99-Fiji-Sugar-Corporation-2019-Annual-Report.pdf>
- Fiji Sun (2019). Labour Shortage a Factor in the Decline of Fiji Sugar Production. Obtained from <https://fijisun.com.fj/2019/02/12/labour-shortage-a-factor-to-the-decline-of-fiji-sugar-production/>
- Firth, S. (2006). Globalisation and Governance in the Pacific Islands. ANU E PRESS, The Australian National University, p. 193.
- Food and Agriculture Organisation (1996). Fiji sugarcane. Obtained from <http://www.fao.org/3/x0513e/x0513e19.htm>
- MDF (2018). Beyond Income. Obtained from www.marketdevelopmentfacility.org/wp-content/uploads/2019/07/Beyond-Income-FINAL.pdf.
- MDF (2019). Annual Report. Obtained from <https://marketdevelopmentfacility.org/wp-content/uploads/2020/05/MDF-Annual-Report-2019-web.pdf>
- Miehlbradt, A., Shah, R., Posthumus, H. and Kessler, A. (2020). A Pragmatic Approach to Measuring System Change. The Springfield Centre. Obtained from <https://www.springfieldcentre.com/a-pragmatic-approach-to-measuring-system-change/>
- Nippard, D., Hitchins, R. and Elliott, D. (2014). Adopt-Adapt-Expand-Respond: A Framework for Managing and Measuring Systemic Change Processes. The Springfield Centre. Obtained from <http://www.springfieldcentre.com/wp-content/uploads/2014/06/2014-03-Adopt-Adapt-Expand-Respond-Briefing-Paper1.pdf>
- ProAnd Associations Australia Pty Ltd (2013). Aglime for Fiji. Obtained from https://issuu.com/marketdevelopmentfacility/docs/aglime-for-fiji-_mdf
- Ramos, Lancas, Lyra and Sandi (2016). Fuel Consumption of a Sugarcane Harvester in Different Operational Settings. Obtained from <https://www.scielo.br/j/rbeaa/a/GGFH7zShQ6MD8j7n3tbBGYf/?lang=en>
- Rípoli, T.C.C., Molina, W. and Rípoli, M.L.C. (2000). Energy Potential of Sugar Cane Biomass in Brazil. Obtained from https://www.researchgate.net/publication/26365356_Energy_potential_of_sugar_cane_biomass_in_Brazil
- Singh, A. (2020). Fiji's Sugarcane Farmers Will Benefit from Diversifying. Devpolicy Blog. Obtained from <https://devpolicy.org/fijis-sugarcane-farmers-will-benefit-from-diversifying-20200226/>
- Sugar Research Institute of Fiji (2018). Strategic Plan 2014–2020. Obtained from <https://srif.net.fj/wp-content/uploads/2018/11/SRIFSAP.pdf>
- The Australian Centre for International Agricultural Research (2011). Identifying Pilot Sites and Research Methods for soil Health Research in the Pacific Region. Obtained from http://era.daf.qld.gov.au/id/eprint/2671/1/ACIARfr2011_03_10038_Smith.pdf
- World Data Atlas (2019). Sugar cane yield (hg per ha) in 2019. Obtained from <https://knoema.com/atlas/Fiji/topics/Agriculture/Crops-Production-Yield/Sugar-cane-yield>

