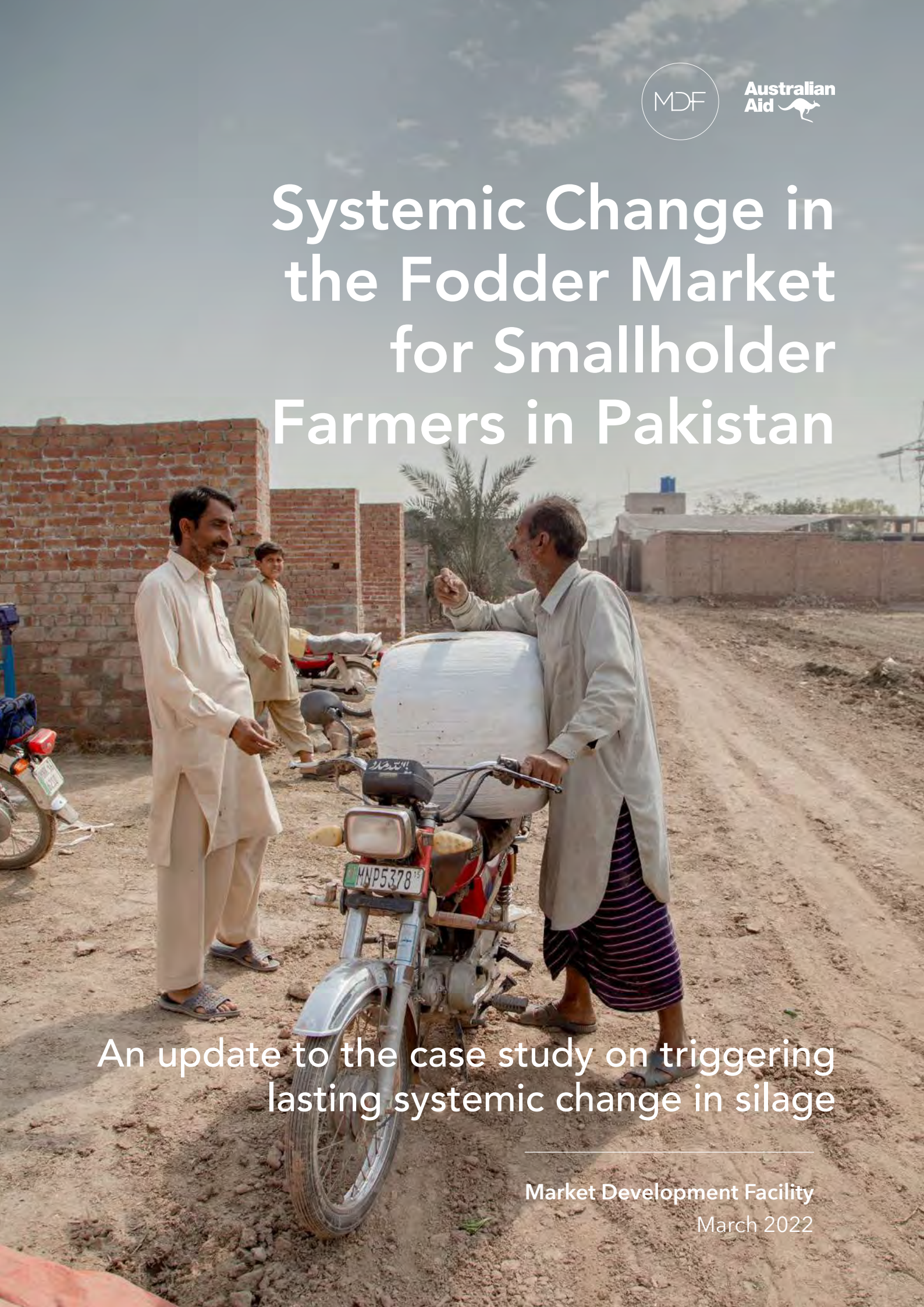

Systemic Change in the Fodder Market for Smallholder Farmers in Pakistan

An update to the case study on triggering lasting systemic change in silage

Market Development Facility

March 2022

Market Development Facility (MDF)

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

MDF connects individuals, businesses, governments and non-governmental organisations with each other and with markets at home and abroad. This 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 Trade (DFAT) and implemented by Palladium in partnership with Swisscontact.

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Abbreviations and Acronyms

DFAT	Department of Foreign Affairs and Trade
FAO	Food and Agriculture Organization
FTE	Full-time equivalent
GDP	Gross Domestic Product
KPK	Khyber Pakhtunkhwa
MDF	Market Development Facility
PLDDB	Punjab Livestock & Dairy Development Board
PKR	Pakistani rupee
SBP	State Bank of Pakistan
SME	Small and Medium Enterprises

Acknowledgments

Rachel Shah from the Springfield Centre wrote this version of the case study for MDF. It is an updated version of a case study published in 2017. Other members of the MDF team provided support for the case study development, including Abdullah Aziz Khan, Ajla Vilogorac, Ali Sarwar, Amna Shahid, Muhammad Farhan Akhtar, Muhammed Bilal and Rob Hitchins.

Many MDF team members have contributed to silage results from early development, including Adeel Sajid, Ali Javaid, Amna Awan, Asad Arshad, Fiza Salim, Izza Chaudhry Rania Nasir, Jon Marlow, Maryam Piracha, Momina Saqib, Muneeb Zulfiqar and Myla Babar.

Libby Owen-Edmunds researched and wrote the original case study, which drew on the experiences of MDF's country team as well as business partners and other organisations in Pakistan. The in-country research for the original case study involved a field trip to South Punjab to interview MDF partners and small farmers, site visits to MDF partners in Lahore, discussions with MDF Pakistan team members (business advisors, the results measurement team and senior management) and interviews with other organisations such as the Lahore University of Management Sciences, the Engro Foundation and the Punjab Livestock & Dairy Development Board. Semi-structured interviews were completed with seven business partners, ten smallholder farmers, ten staff and three other organisations.

Stella Pongsitanan managed the layout design, and Alice Fogliata Cresswell provided the final editing of the updated case study.

The fast read

MDF in Pakistan was part of a flagship, multi-country Australian Government program which aims to create additional employment and income for poor women and men in rural and urban areas through sustainable and broad-based pro-poor growth.

MDF is a system change program—instead of taking the traditional development approach of finding a problem and stepping in to solve it directly, it uses its resources to change how market systems work. The MDF Pakistan program closed in June 2020, but a small post-implementation team continues to monitor activities until May 2022. MDF first published a case study on systemic change in Pakistan's silage market in September 2017.

Pakistan is a large and well-established economy, but it faces many challenges in stimulating inclusive rural economic growth.

Despite modest growth, poverty is prevalent in 45 per cent of the population, reaching up to 90 per cent in remote rural areas. MDF Pakistan found that large firms were well connected to innovation, investment and export markets, yet they rarely entered remote rural areas. Conversely, small and medium enterprises (SMEs) that serviced large swathes of the rural economy were significantly disconnected from innovation, technical expertise and investment.

The rural dairy and meat sector presented a feasible opportunity for inclusive growth, as Pakistan has the fifth-largest livestock population globally, with small farmers (landless and small landholders) owning 80 per cent of the country's animals. In addition, over six million households in Pakistan have some livelihood dependency on livestock for milk or meat.

Numerous constraints inhibited livestock productivity.

Despite Pakistan's significant livestock population, its dairy and meat sector was not nearing its potential. Small livestock farmers lacked access to nutritious fodder, animal health and nutrition inputs, information about animal husbandry and finance. They were also disconnected from formal dairy and meat markets. MDF identified poor animal nutrition as a key constraint to livestock productivity. Its analysis showed that, regardless of improvements in other areas, farmers would see immediate improvements in animal yields if they used quality fodder. However, livestock needs for nutritious fodder outstripped supply by more than 70 per cent.

Silage is a highly nutritious and cost-effective fermented fodder made from maize (corn) that can rapidly increase productivity.

It offers far superior nutrition compared to other types of fodder available in Pakistan, significantly enhancing livestock milk yields and improving overall animal health. Small and landless farmers had few options for fodder for their animals, but silage seemed to offer a solution.

Despite numerous efforts over a decade, silage uptake remained limited.

Since 2006, the private sector, donor-funded programs and government departments have promoted the benefits of silage to commercial and small farmers. Although these efforts created some awareness among small farmers, they did not translate to a significant level of silage uptake. Silage was only available for purchase in large 300kg and 1,000kg bales that were cost-prohibitive for small farmers and difficult to transport. Furthermore, large bales were only available close to formal markets, mainly in South Punjab.

There was an urgent need for an innovative silage business model.

MDF's analysis identified an innovative business model that could address many prevailing problems: a handful of medium-sized farmers had become silage entrepreneurs. They were producing and selling 60kg silage bales to neighbouring small farmers. For the first time, silage was available in the right size, at the right price and with a distribution model for small rural farmers, albeit only in small pockets of the country.

MDF analysed why this solution had not been adopted more widely in the market and found that numerous supporting functions of the silage market were underperforming, preventing more mid-sized farmers from becoming silage entrepreneurs. For example, the machinery required to produce small-baled silage was difficult to procure and expensive. There were also no financial products to help farmers purchase the expensive machines. Additionally, most mid-sized farmers had never heard of the innovative business model and did not know how to produce quality silage. Therefore, there was limited demand for silage from small farmers because not enough information was available to demonstrate its value.

MDF developed a pilot initiative designed to target the market functions that had constrained progress to date.

A seed company—Corteva Agriscience (previously known as Pioneer Seeds)—had attempted a pilot of this innovation. However, it could not get many farmers to trial the model, as the small-bale equipment was prohibitively expensive and not readily available in Pakistan. In 2014, MDF partnered with Corteva Agriscience to pilot the model again. This time, MDF would support farmers to procure the machines, and Corteva Agriscience would identify mid-sized farmers who could become silage entrepreneurs and provide the necessary technical support.

MDF and Corteva Agriscience began the pilot in South Punjab, which presented the least risk and the greatest opportunity for success.

This pilot would allow MDF and Corteva Agriscience to test the model and monitor how it adapted to market dynamics before rolling out the innovation to regions with more challenging conditions. The pilot was expected to benefit MDF's target group by making silage accessible and affordable, resulting in higher milk and beef (meat) yields and an increase in the incomes of small livestock farmers. Furthermore, MDF anticipated that the business model would improve the income of the households that produced and sold silage maize to the new silage entrepreneurs. It would also likely positively impact the labourers' hired by the silage entrepreneurs to produce the small-baled silage.

The pilot was successful and led to sustained, small-scale, functional change.

The business model proved profitable, with the first silage entrepreneurs beginning to receive a return on their investment within the first year. Uptake by farmers was rapid, and demand quickly outstripped supply. Assessments showed that all farmers who started using silage saw increased milk yields: on average, using silage increased yields by about 1.5–4L per animal per day, equivalent to 20–55 per cent increases.[1] Some farmers also reported increased health and weight of meat animals. Each of the silage entrepreneurs employed four to five labourers, and many procured silage maize from other farmers.

The business model evolved differently in different regions.

As the uptake of 60kg silage bales increased among small farmers, silage entrepreneurs independently adapted and improved the initial business model. After positive trials of the 60kg bale, some landless and smallholder farmers continued to purchase them. However, other smallholder and mid-sized farmers stopped buying them and started making their silage. This shift created a business opportunity for silage entrepreneurs to extend the business model to include machinery rental and contract farming. Adaptations varied by region because of different market conditions, but the core model was successful across the board.

A sustainable and scalable solution to the lack of finance for machinery was needed for expanding the silage business innovation.

The farmers interested in becoming silage entrepreneurs needed to access affordable finance to buy equipment. They also needed access to the after-sales support for maintaining machinery on an ongoing basis. MDF partnered with Cattlekit, a Pakistan-based machinery company, and Bank Alfalah, one of Pakistan's leading private banks with a large agribusiness division, to introduce a loan product that mid-sized farmers could use to buy small-bale machinery at preferential interest rates. Cattlekit supported Bank Alfalah to offer preferential interest rates during the pilot, and Bank Alfalah strongly advocated a policy change with the State Bank of Pakistan (SBP).

The combined efforts of these two MDF partners resulted in SBP responding with a policy that enabled banks to extend loans for silage machinery at 50 per cent of the prevailing interest rates permanently. The uptake of the new loan product has been slow but is growing. MDF also supported Cattlekit in introducing a machinery rental offer to make equipment more accessible and affordable to many farmers while also encouraging trials for farmers with the potential to purchase their own equipment.

MDF experimented with improving distribution to scale up access to the 60kg silage bales.

MDF piloted an intervention with a medium-sized firm that had a distribution network. The firm had the capacity to produce small silage bales on a large scale and distribute them to areas where the small bales were not available and silage maize could not be grown. MDF also monitored other developments among distributors, including small-scale distribution mechanisms that emerged among silage entrepreneurs. It concluded that selling small silage bales directly to small farmers through a decentralised model was the most cost-effective and inclusive solution.

[1] Milk yield varies by region and is affected by breed, climate and other factors in addition to how nutritious fodder is. On average, small farmers were getting 6–8.5L of milk per animal per day before using silage.

MDF recognised the need for greater awareness about the silage business model to increase uptake.

MDF supported Cattlekit in hosting awareness-raising events with panellists from Cattlekit, Corteva Agriscience and Bank Alfalah, as well as local government officials and successful silage entrepreneurs. The events connected mid-sized farmers who might become entrepreneurs with experts who could answer their questions and guide them through the process of becoming silage entrepreneurs. The events, called 'silage baithaks', reached 1,300 farmers by June 2020. The overwhelming feedback has been that firms and farmers value the sessions, as they allow for hands-on contact with the machinery, informative presentations from experts and practical discussions.

MDF also supported Cattlekit in running a media campaign promoting the small-baled silage business model. Infomercials, a documentary and print media material were developed and are estimated to have reached over 15,000 farmers

The innovations have achieved significant systemic change.

Since MDF rolled out its first innovation in the silage sector in 2015, the key changes that have contributed to system-wide change over 2016–2020 include:

Milk yields have increased by 1.5–4L per animal per day, equivalent to **20 - 55%** increases in productivity.

Meat farmers who use silage have reported **increased health and weight** of meat animals.

51,800 small farmers have increased their incomes from improved livestock productivity.

An estimated **121** silage entrepreneurs are now producing small silage bales in six regions of Pakistan.

Approximately **5.5 million** 60kg silage bales have been sold to date.

Silage entrepreneurs have created **526** full-time equivalent (FTE) jobs.

Silage entrepreneurs buy over **94,000 tonnes** of silage maize crop annually.

2,550 households have increased their incomes through silage maize crop production.

The number of silage machinery importers serving the small-bale market has increased from just 1 firm in 2014 to **7 firms** in 2020.

There has been an increase in local industries—such as plastic film manufacturers and inoculant producers—targeting silage entrepreneurs.

Interventions in the silage market for farmers, workers and silage entrepreneurs have generated **USD21.6 million** in net income to date.

The MDF Pakistan program officially closed in June 2020, but some post-implementation work continues. The market functions that MDF targeted for change when it began work in silage (i.e. machinery, finance for machinery, information about producing quality silage, information about the benefits of silage and information about the innovative business model) have continued to perform without MDF support and show signs of adapting and evolving independently. Encouragingly, MDF has observed other independent changes that support the original silage innovations, such as changes in financial regulations and the availability of accessories for making silage. These spontaneous adaptations in different supporting functions suggest that the wider market system responds to and begins to support the innovations MDF introduced.

[2] Based on assessments from 2019, the last year in which maize crop was assessed in all regions. Assessments from 2020 record notable growth in this number in the regions assessed.

MDF has learned important lessons about what it takes to trigger lasting systemic change in a large economy.

1

Lesson 1:

Employ the full range of facilitation tactics to work with large firms.

Large economies offer the prospect of large-scale impact, but aid programs are only likely to achieve this if they form partnerships with the large national and multinational firms present in such economies. MDF identified players that were interested in pushing their commercial frontiers to capture 'bottom of the pyramid' markets, worked to understand what had prevented these players from introducing the innovation independently, developed an offer targeted to large firms' specific needs (which are rarely financial) and built credibility with potential partners by demonstrating a nuanced understanding of the market.

2

Lesson 2:

Do not underestimate the importance of small-scale and informal enterprises.

Programs that can connect large firms to SMEs to leverage their complementary strengths and incentives have the best chance of achieving sustainable, scaled change in a large, diverse economy. Large multinational and national firms rarely have an incentive to provide goods and services directly to customers that can only purchase in very small quantities and are widely dispersed across large areas. However, local SMEs do have an incentive for this market and have developed business models that enable them to serve it profitably. By building business relationships between these different segments of the private sector, SMEs can access technical expertise and innovation and pass it on to small farmers and other rural customers. They can also aggregate orders and manage logistics to make the rural market attractive to larger firms.

3

Lesson 3:

In a large economy with significant internal diversity, use a phased approach to introduce innovation and be prepared to adapt the model to serve different regions with different market dynamics.

MDF's experience shows that starting in an area where a pilot is most likely to succeed and taking a phased approach to adding locations can maximise learning and success. A phased approach helps develop a proof of concept to stimulate the interest of more cautious players in more conservative regions.

Additionally, such an approach gives the program and its partners time to monitor adaptations to the model and adjust the innovation to suit different markets.

MDF's rigorous research, targeted pilots, adaptive management and flexible but analysis-led design have paid off. Its work in silage has yielded significant and growing results.

Poverty and inclusion

- **38%** of the population live below the poverty line.
- In remote rural areas, poverty is dramatically higher (up to **90%**).
- About **64%** of farms are small (less than 5 acres).
- SMEs serve large swathes of the country outside the major urban centres but are significantly disconnected from innovation, expertise and investment.
- The small-scale segment of the agricultural sector largely lacks access to information and quality products.
- Women in rural and urban areas tend to engage less in public-facing economic activities due to cultural and religious norms.

Growth

- Despite modest growth, Pakistan lags behind its regional neighbours, such as India, China and Bangladesh.
- Foreign direct investment is low due to Pakistan's risk profile, but significant domestic funds are available for investment.
- The bottom-of-the-pyramid market is vast—about 40 million small farmers and over **600,000** mid-sized farmers—and potentially lucrative.

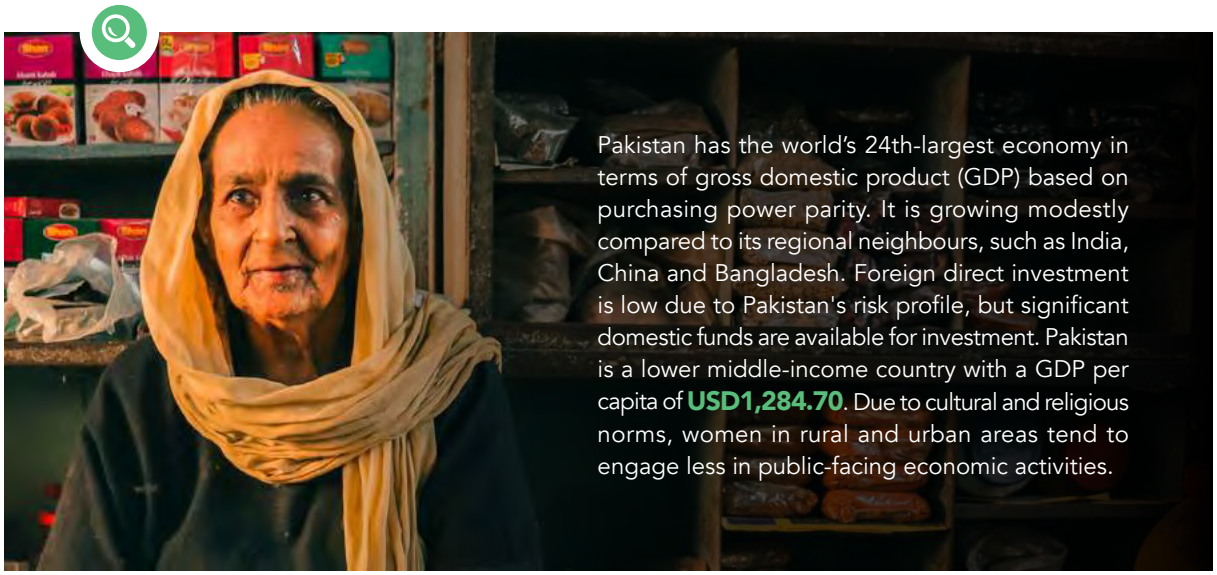
Key development challenges

- Inclusive rural and regional growth.
- Increasing export competitiveness by strengthening local ancillary services and supply chains.
- Broadening the entrepreneurial base to include innovative and regional entrepreneurs.
- Creating opportunities for women.

Why this case study matters for pro-poor economic development practitioners in large and well-established economies

> *When the poor at the bottom of the pyramid are treated as consumers, they can reap the benefits of respect, choice, and self-esteem and have an opportunity to climb out of the poverty trap.*

C.K. Prahalad,
The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits[3]



Pakistan has the world's 24th-largest economy in terms of gross domestic product (GDP) based on purchasing power parity. It is growing modestly compared to its regional neighbours, such as India, China and Bangladesh. Foreign direct investment is low due to Pakistan's risk profile, but significant domestic funds are available for investment. Pakistan is a lower middle-income country with a GDP per capita of **USD1,284.70**. Due to cultural and religious norms, women in rural and urban areas tend to engage less in public-facing economic activities.

Box 1: Pakistan's economy.[4]

[3] Prahalad, C.K. (2010). The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits. New Jersey: Pearson Education Inc., p. 125.

[4] The World Bank (2019). World Bank Open Data, 'GDP, PPP (current international $)' and 'GDP per capita (current US$) – Pakistan, India, Bangladesh, China.' Available at: https://data.worldbank.org/country/pakistan [accessed February 2021].

Pakistan is a large country with a well-established economy, presenting an opportunity for stimulating business innovation that leads to benefits for poor women and men. Pakistan has a population of more than 216 million, of which 63 per cent live in rural areas.[5] Thirty-eight per cent of Pakistan's population live below the poverty line; in remote rural areas, the proportion is dramatically higher—up to 90 per cent.[6] A vast number of SMEs serve large swathes of the country outside the major urban centres, but they are significantly disconnected from innovation, expertise and investment. Consequently, the small-scale segment of the agricultural sector—about 40 million small farmers and over 600,000 mid-sized farmers, making up the majority of the sector[7]—lacks access to information and quality products. The market at the bottom of the pyramid[8] is huge and potentially lucrative.

Despite the commercial opportunity the bottom of the pyramid represents, Pakistan's large, listed private companies that are well-connected to innovation, investment and international markets often do not penetrate into Pakistan's rural and remote areas. Their customers tend to be urban consumers or other formal businesses, as these wealthier market segments are also sizeable and easier to target. Firms wanting to expand their commercial frontiers and target bottom-of-the-pyramid markets cannot simply replicate the products and services that work well with wealthier market segments; they have to develop new business models.

This case study showcases MDF's experience in piloting and scaling innovative business models in silage production and distribution, which has greatly improved small farmers' access to nutritious animal fodder in rural Pakistan. This fodder access, in turn, has increased milk and meat yields and significantly impacted the livelihoods of 52,000 farmers—and results are continuing to grow.

Capturing systemic change in silage: **Version 1 and progress since**

This innovative business model connects small rural farmers, SMEs and large firms and enables all of them to increase their profits. The uptake of the model happened at such a pace that systemic changes in the silage market emerged just two years after the initial pilot. An earlier version of this case study published in September 2017 captured those changes.

This updated version includes the rest of the story, from the initial research phase through to the close of the MDF Pakistan program in June 2020 (with all major results recorded through December 2020). Close to seven years since the pilot innovation, MDF is sharing this updated case study hoping that other programs will build on its key insights and lessons learned on the path to triggering lasting systemic change in large and well-established economies.

[5] The World Bank (2019). World Bank Open Data, 'Population, total' and 'Rural Population (percentage of total population).' Available at: https://data.worldbank.org/country/pakistan [accessed February 2021].

[6] UNDP and OPHDI (2020). Global Multidimensional Poverty Index 2020. Available at: http://hdr.undp.org/sites/default/files/2020_mpi_report_en.pdf [accessed March 2021].

[7] More than 64 per cent of farms are less than five acres according to the Agricultural Census (2010).

[8] Prahalad, C.K. (2010). The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits. New Jersey: Pearson Education Inc., p. 125.

Introduction

MDF's approach

MDF is an Australian Government-funded multi-country initiative that promotes sustainable economic development through higher incomes for women and men in its partner countries. MDF connects individuals, businesses, governments and non-governmental organisations with each other and with markets at home and abroad. This collaboration enhances investment and coordination, allowing partnerships to flourish and strengthening inclusive economic growth. MDF is funded by DFAT and implemented by Palladium in partnership with Swisscontact. Currently, MDF operates in Fiji, Papua New Guinea, Sri Lanka and Timor-Leste and is expanding into three new countries in the Pacific. MDF operated in Pakistan until June 2020.

MDF's goal is to create additional employment and income for poor women and men in rural and urban areas through sustainable and broad-based pro-poor growth. MDF is a system change program—instead of taking the traditional development approach of finding a problem and stepping in to solve it directly, it uses its resources to change how market systems work.

When the sectors in which the poor are participating become more competitive and inclusive, these women and men stand to benefit through increased employment or entrepreneurship. As these benefits result from systemic changes, they last long beyond the end of the program and impact more poor women and men than MDF could ever reach directly.

MDF's approach, therefore, is to analyse the country's economy and identify the **sectors** in which large groups of poor women and men are already participating and then determine whether any of these sectors present feasible opportunities for a sustainable increase in incomes. MDF then assesses the **market systems** within the sector and the gaps in their functioning—i.e. why these market systems are not working at an optimal level. Usually, the answer to this lies in the various supporting functions within a market system. When **market functions** (e.g. access to information or access to finance) and rules (e.g. regulation or informal norms) do not adequately support the market system's competitiveness or inclusivity, it affects the overall system's performance. MDF then designs **interventions** to address these underlying root causes. This process leads to better performing functions, which leads to a better performing system and benefits for poor women and men in the sector.

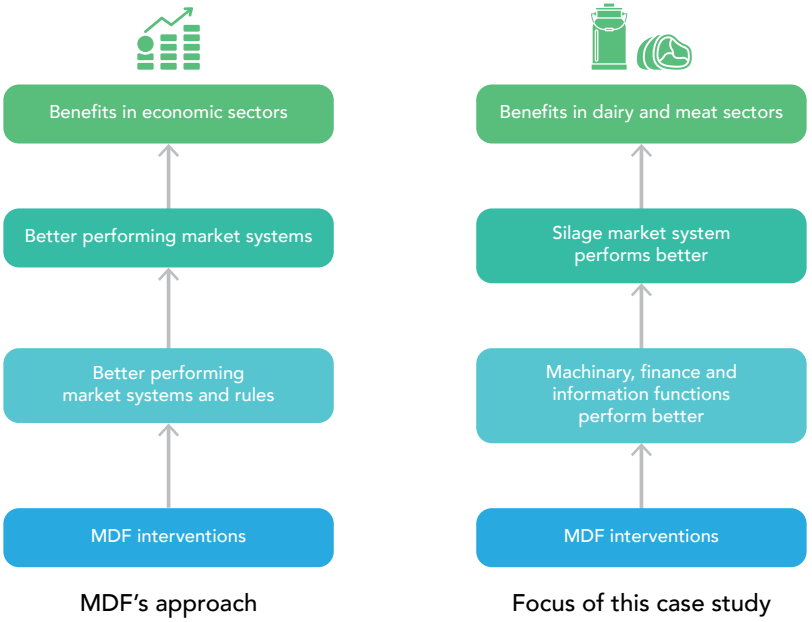
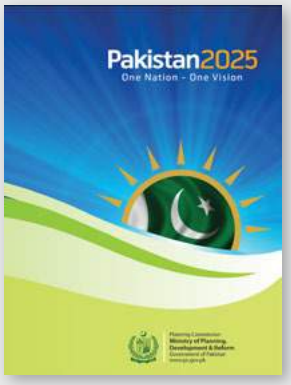


Figure 1: MDF's approach (left) and the focus of this case study (right)

In Pakistan, MDF worked in three sectors: dairy and meat, leather and horticulture. As of December 2020, MDF's activities had contributed to increased incomes for 257,000 women and men through the system changes triggered by interventions. Following the cessation of Australian development assistance to Pakistan and the consequent closure of the MDF Pakistan program in June 2020, MDF invested in a year of monitoring and results measurement to capture the sustainability and ongoing growth of the program's results. A full sustainability assessment of MDF's work in the silage market system will also be conducted in 2022. Based on the current trajectory and the likelihood that the market functions MDF has worked in will continue to mature, results from MDF's work in silage are expected to continue increasing.

MDF contributed to the goals of the Pakistani and Australian Governments



MDF's work in Pakistan aligned with the Government of Pakistan's Vision 2025, a key priority of which is achieving sustained growth in agriculture through various interventions in pre- and post-harvesting. Private-sector and entrepreneurial-led growth, gender empowerment, investment, innovation and capacity building through training and skills development are emphasised in Vision 2025.

Private sector development was also a central goal for the Australian aid strategy in Pakistan. All aid programs were required to consider private sector solutions as a first resort for addressing development problems, as MDF does.

Box 2: MDF contributions to government goals

The dairy and meat sector

> *Livestock contribute to three major pathways out of poverty by: increasing resilience; improving smallholder and pastoral productivity; and increasing market participation.*
>
> **International Livestock Research Institute, 2007**

Pakistan has the seventh-largest livestock population in the world.[9] Livestock products, including dairy and meat, account for 11.7 per cent of GDP and 60.6 per cent of the total value of agriculture.[10] Small or landless subsistence farmers, who own five or fewer animals in a mixed farming portfolio to diversify risks of crop failures and market fluctuations, hold 97 per cent of Pakistan's livestock population. Cattle provide regular income from milk and can be sold for meat in times of financial hardship, contributing to farmers' financial security. Over eight million households engage in livestock production and depend on it for 35–40 per cent of their income.[11]

Table 1: Livestock farmer types and characteristics[12]

Livestock farmer type	Land size	Percentage of total farms[13]	Herd size	Herd usage
Corporate farms (owned by large formal companies)	>50 acres	1%	>500 0.2% of total livestock population	• Fresh milk supply to the domestic market • Feedlots for beef export
Commercial	25–50 acres	3%	>25 3% of total livestock population	• Fresh milk supply to the domestic market • Feedlots for beef export

[9] Food and Agriculture Organization (FAO) (2019). FAOSTAT, 'Cattle, Live Animals (Production)' Available at: http://www.fao.org/faostat/en/ [accessed February 2021].

[10] Government of Pakistan (2020). Pakistan Economic Survey 2019-20, Chapter 2, pg.18. Available at: http://www.finance.gov.pk/survey/chapter_20/02_Agriculture.pdf [accessed February 2021].

[11] Ibid, pg. 35.

[12] Sources: Agricultural Census (2010); MDF Sector Assessment Report for Dairy-Meat and Leather (2015); MDF Pakistan Country Strategy; and MDF staff field assessments and key informant interviews (February 2017).

[13] Pakistan Bureau of Statistics (2010). Agricultural Census 2010. Available at: https://www.pbs.gov.pk/content/agricultural-census-2010-pakistan-report [accessed February 2021].

Livestock farmer type	Land size	Percentage of total farms[13]	Herd size	Herd usage
Medium	5–25 acres	32%	>5	• Milk production for own consumption and balance sold to the domestic market • Beef for domestic and feedlot markets
Small and landless	<5 acres	64%	Small: <5 Landless: 1–3 Both hold 97% of livestock population	• Milk production for own consumption and balance sold to the local informal market • Sale of livestock to the meat market for income in times of need

Despite its importance, the dairy and meat sector does not come close to achieving its potential. An estimated 80 per cent of all milk production in Pakistan comes from small-scale rural holdings with two or three milking animals.[14] At the time of MDF's initial assessment in 2014, most of these small farms achieved very low milk yields—approximately 6–8.5L per animal per day.[15] Meanwhile, demand for milk drastically outstripped domestic supply and was increasing due to a growing population and improving socio-economic conditions.[16] Imports were filling the gap, but formal milk processors preferred to source local fresh milk. In the absence of sufficient domestic supply, they reformulated imported milk powder instead.

The supply–demand gap presented an enormous opportunity for small farmers to increase their incomes by supplying more milk to formal markets. Still, MDF found that less than 5 per cent of the milk produced by small farmers in Pakistan passed through formal sales channels. The rest went toward domestic consumption or through informal sales channels to neighbours, relatives or middlemen (dhodi).

Meat production was predominantly a by-product of the dairy sector. Male cattle and culled dairy cows were sold for meat, and some farmers also kept goats and sheep for meat. Undernourished and unhealthy animals limited the income farmers could generate from meat. MDF found that informal butchers and roadside vendors dominated 95 per cent of meat processing and retailing. As with the dairy sector, the meat sector was seeing increasing involvement from formal processors that were seeking to expand their product ranges and quality to meet rising demand.

MDF selected the dairy and meat sector for its relevance, opportunity and feasibility. Despite very low productivity, farmers were already making money by selling milk and meat for dairy and meat products. In both formal and informal sales channels, the supply–demand gap presented a significant opportunity for poor farmers to increase their incomes if yields could be improved. The growing interest and investment of formal processors in the sector indicated that change might be feasible.

[14] FAO (2011). Dairy development in Pakistan, by Umm e Zia, T. Mahmood and M.R. Ali. Rome. Available at: http://www.fao.org/3/al750e/al750e.pdf [accessed March 2021], pg. 1, citing Social Sciences Institute NARC, 2003.

[15] This estimation is based on MDF assessment numbers from Punjab, Sindh and KPK. Note that the Government of Pakistan (2009, cited in FAO, 2011, p. 2) reports considerably lower average milk yields.

[16] In 2003, an FAO-sponsored study indicated that the gap between production and consumption was approximately 3.5 million tonnes. The study forecast that this gap would widen over time, reaching an estimated deficit of 55.48 million tonnes in 2020. See FAO (2011) pg. 3.

Understanding the constraints to increasing livestock productivity

MDF wanted to understand why the opportunity in the dairy and meat sector was not already being capitalised upon. MDF's market analysis identified several market functions that constrained livestock productivity and prevented farmers from increasing their incomes.

Fodder

A lack of quality fodder was a serious problem. MDF estimated that supply met only 30 per cent of potential demand.[17] Fodder is seasonal, and green fodder, which landholding farmers can grow themselves, was only available for four to seven months of the year. When green fodder was not available, farmers used fodder alternatives low in nutrition, such as rice straw, wheat straw or leftover pieces of bread, resulting in undernourished animals and low milk and meat yields.

Animal health and nutrition inputs

To maximise yields, farmers need health products for their cattle (such as medicine and de-wormers) and nutritional supplements to complement quality fodder. Suppliers of these products tended to target large commercial farms because they did not see sufficient commercial opportunities in selling to smallholders distant from larger towns. Consequently, most health and nutrition inputs were not widely available.

Information about animal husbandry

There were not many reliable ways of accessing information about improving livestock productivity in rural areas. The sales teams of milk processors and input suppliers tended to target larger farmers, and government extension services were extremely limited. Most farmers, therefore, lacked knowledge about the husbandry practices that could improve productivity. The situation was worse for female farmers, who did not have direct access to extension services and were not usually able to purchase inputs themselves due to cultural and societal norms.

Aggregation and market linkages

Except in the few areas where formal firms had established milk collection centres and processors, small farmers did not have access to formal channels for their produce. This isolation meant that poor farmers lost opportunities to supply milk and meat to more lucrative markets and were also disconnected from information about the quality standards required. These factors undermined their incentives and ability to invest in quality fodder, animal health and nutrition products, and better animal husbandry practices that could improve livestock productivity.

[17] Based on MDF interviews and assessments.

Finance

Farming households rarely had access to formal financial services. Only 16 per cent of Pakistan's adult population had a formal bank account, and only 23 per cent had access to formal financial services.[18] Access was worse for rural populations and women. Small farmers relied on informal finance from family and friends or agricultural traders. To honour their obligations, farmers sometimes made sales at suboptimal prices or took a second loan to pay off the first loan. Most farmers used informal finance to plug shortfalls rather than investing in improving productivity.

MDF's analysis identified poor animal nutrition as a critical constraint to livestock productivity. If farmers could access and use quality fodder, they would see immediate improvements in yields, irrespective of the condition of the other constraints. MDF concluded it needed to understand why the fodder market system was not working for small farmers and whether this constraint could be feasibly addressed.

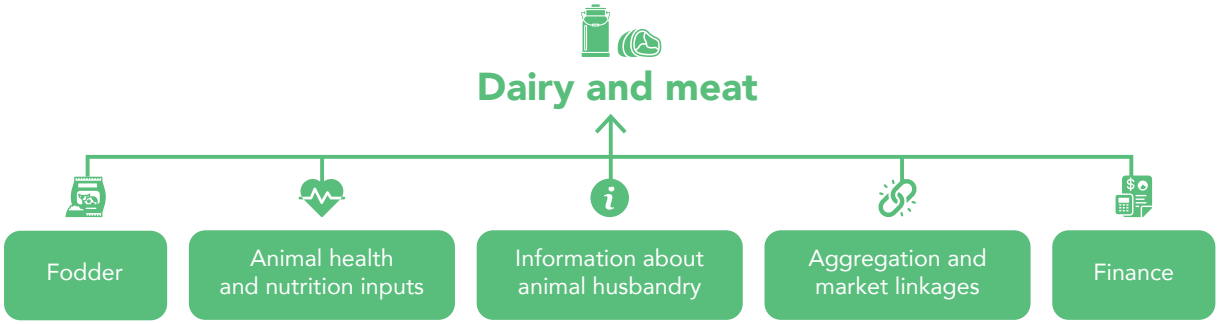


Figure 2: The constraints to increasing livestock productivity

[18] According to SBP's access to finance study results from 2015. See press release here: https://www.sbp.org.pk/press/2015/Survey-16-Dec-2015.pdf and '100 Day Agenda' here: http://www.finance.gov.pk/NFIS.pdf. Other surveys suggest even lower levels of financial inclusion at the time; see: https://www.cgap.org/blog/interpreting-financial-inclusion-numbers-pakistan. The situation has since improved; see: https://www.thenews.com.pk/print/518832-state-bank-says-unique-bank-accounts-reach-63-9-million-in-pakistan.

The fodder market system

MDF found that small and landless farmers had few options for nutritious fodder for their animals. Smallholders allocated part of their land to grow green fodder, providing their animals with sufficiently nutritious fodder for four to seven months of the year. In some areas of Pakistan, green fodder is scarce all year due to poor terrain and climatic conditions, making the problem even more severe. Landless farmers were often allowed to cut green fodder from the farms where they were labourers. Otherwise, they typically had to traveled 2–4km to gather fodder from public land. For the rest of the year, small and landless farmers relied on rice and wheat straw, cottonseed cake and even leftover pieces of bread to feed their animals. Straw has almost no nutritional value, and leftovers are often infected with fungus, harming animal health.

Other nutritious crop-based fodder for livestock includes Rhodes grass, ryegrass and alfalfa. These crops can provide 5–8 cuts of fodder per year for farmers with land. However, at the time, seeds were only available in large packs, which were not suitable or affordable for small farmers. Furthermore, these fodders were in the early introduction phases. Many farmers had not yet heard of them, and it would take time and effort for awareness, trust and understanding to grow and enable wider adoption.

Silage was one of the solutions to Pakistan's fodder shortage commonly promoted by the private sector, government departments and aid organisations. Silage is a highly nutritious and cost-effective fermented fodder. Its purchase cost is about the same as straw, but it is far superior nutritionally. Consistent use of silage can enhance milk yields by up to 4 litres per animal per day and help meat animals reach their genetic growth potential by improving overall animal health.

Silage can be made from maize, which is commonly grown in rural Pakistan and which farmers have an incentive to grow as it sells for more than traditional cash crops. Farmers can achieve two to three crops of silage maize per year, as the growing time is 75 to 90 days. While silage maize is grown and harvested from February to October, once fermented, it can be stored in bunkers or bales for long periods, making it available at any time of the year.

After extensive analysis of the fodder market system, MDF recognised that silage was the fodder that could most feasibly provide a solution for the largest number of small and landless farmers.

Table 2: Problems in the fodder market that silage addresses

Problems	Solutions provided by silage
Quantity Gap in supply of fodder (estimated 70 per cent supply–demand gap)	☑ Silage can be produced from maize, a commonly grown and familiar crop in Pakistan. Increased production of silage would reduce the fodder supply gap.
Timing Fodderless months (4–7 months per year)	☑ After fermentation, silage can be stored for long periods and can be available as fodder year-round.
Quality Farmers use low nutrition alternatives in fodderless months	☑ Silage is highly nutritious compared to straw, leftovers and other low-cost alternatives.
Price Alternative nutritious fodders can be expensive	☑ Silage costs about the same as straw—and even less in some regions

Most of MDF's work in fodder was in the silage market system, but MDF also intervened to improve farmers' access to other nutritious crop-based fodders

MDF partnered with **Farm Dynamic Pakistan** to popularise other nutritious fodder crops (such as Rhodes grass and ryegrass) and sell seeds for these fodders in small packets that are more affordable for small farmers.

MDF partnered with **Green Diamond** to make alfalfa haylage more accessible and provide farmers with better information about its production and use.

Why had a decade of interventions failed to increase uptake of silage?

For over a decade before the start of MDF Pakistan, the private sector (Nestlé and Corteva Agriscience), government (PLDDB) and donor-funded programs (USAID and DFAT) had promoted the benefits of silage to corporate, commercial and some small farmers. However, these efforts concentrated on Punjab with little to no outreach to other regions of Pakistan. By 2014, these combined efforts in silage promotion had created nascent levels of awareness among small farmers but had not translated into a significant level of uptake. Several factors prevented small farmers from accessing silage; combined, these removed almost all incentives for small farmers to purchase and use silage.

Size

Silage was predominantly sold in large (300kg and 1,000kg) bale sizes. After opening, a silage bale needs to be consumed within three days. Small farmers with less than five animals cannot feed such large bales within this time.

Capital

Large bales are expensive for small farmers. They do not have the capital to buy 300kg or 1,000kg bales.

Risk

There is a significant level of production and financial risk involved in trialling silage for the first time. Paying USD15 for a 300kg bale is well outside a small farmer's acceptable risk margin. The conservative mindset of most farmers exacerbates this perceived risk.

Distribution

By 2014, silage was available in just 3 per cent of agricultural nutrition outlets—the majority in South Punjab. Only markets close to formal milk processing centres sold silage, such as those run by Nestlé and Friesland Campina.[19]

Transport

300kg and 1,000kg bales are impractical for small farmers as large bales require machinery such as forklifts and trucks to transport. Small farmers usually have a bicycle or a motorbike for transporting farm inputs and cannot afford to pay for additional transportation.

Raising awareness of silage and its benefits was not enough. MDF recognised that the existing incentives for small farmers to purchase silage were not sufficient to trigger a lasting behaviour change.

[19] Friesland Campina (previously called Engro Foods) is one of Pakistan's largest and fastest-growing food companies. For more information, see: https://frieslandcampina.com.pk/.

The innovation: a new business model for silage

MDF's analysis had uncovered signs of an innovative business model that addressed many of the existing problems in silage: a handful of mid-sized farmers had become silage entrepreneurs producing small 60kg silage bales and selling them to farmers.

The innovative business model targeted small farmers, offering a silage bale at the right size and price, through a distribution model to suit their needs with the proper marketing.

Size

60kg
(transportable and practical for farmers with fewer than five animals)

Price

Approximately
USD3.40[20]
per bale
(similar cost to straw and within a small farmer's margin of risk)

Distribution model

Produced in rural areas by medium and large farmers; easily accessible to small farmers, i.e. available for sale within a 2–10km radius of their farm or home

Marketing model

Promoted to smallholder and landless farmers by silage entrepreneurs through outreach events and other marketing activities

This business model had the right incentives for mid-sized farmers who could increase their profits by starting a silage business and small farmers who could buy silage locally at an affordable price and feed it to their undernourished animals to increase yields.

[20] Currency conversion is at 2021 rate (1 PKR = 161.7843 USD).

Why had this solution not already emerged at scale in the market?

Before 2014, it is estimated that only 11 silage entrepreneurs were producing 60kg bales in Pakistan. The innovative business model seemed to be a win-win solution, so why had it not already emerged at scale in the market? MDF's assessment of the fodder market showed that several underperforming functions had prevented more mid-sized farmers from becoming silage entrepreneurs.

Machinery

Producing small-baled silage requires several machines (a chopper/harvester, a tractor, a trolley, a baler capable of making small bales and a wrapper). At the time, there were a limited number of silage machinery suppliers in Pakistan, and they targeted corporate and commercial farmers, importing machinery suited to producing large bale sizes.

In 2013, Pakistan's largest seller of maize seeds, Corteva Agriscience (operating as Pioneer Seeds at the time), realised that farmers were ready to purchase small bales of silage and had attempted to link potential silage entrepreneurs with machinery providers. Corteva Agriscience wanted to promote silage adoption to stimulate sales of maize seeds. Despite approaching several machinery suppliers, it struggled because small-bale equipment was not readily available in Pakistan, and the investment for importing individual machines was too high for entrepreneurs who would be left with an expensive machine and no access to after-sales maintenance services or spare parts.

In the same year, a Pakistan-based machinery company, Cattlekit, also saw the potential of small-baled silage and began importing single-row harvesters but initially made few sales. The machines were expensive, and awareness was low among farmers.

Finance (for machinery)

The machinery cost was the most significant constraint for mid-size farmers who wanted to produce and sell silage commercially. Entrepreneurs would need significant capital to invest and obtain financing at affordable rates. Some entrepreneurs declined to borrow from financial service providers for religious reasons, preferring to pay cash.[21] For those prepared to take a loan, there were no suitable equipment finance products available.

Information about the innovative business model

Mid-sized farmers who might become silage entrepreneurs were not well informed about the potential market for small-bale silage or the profitable opportunity that such a model offered them (the business case).

[21] *Riba*, which is usually interpreted to include interest on loans, is prohibited in Islam.

Information about producing quality silage

Several components of production can affect the quality of silage, including choosing the appropriate seed for the season, sowing patterns, the exact timing for harvesting and balking or bunking the maize, and techniques for fermentation and storage. Learning to produce quality silage is not straightforward, especially for new silage entrepreneurs. Corteva Agriscience had been providing this information to farmers through field representatives since 2008, recognising that it could lead to improved seed sales. However, beyond Corteva Agriscience's efforts, few sources of technical information were available to potential entrepreneurs.

Information about the benefits of silage

Small farmers tend to be conservative and use traditional livestock practices without an incentive to do otherwise. Although various awareness campaigns had promoted the benefits of silage, there had been little demonstrable evidence of its value.

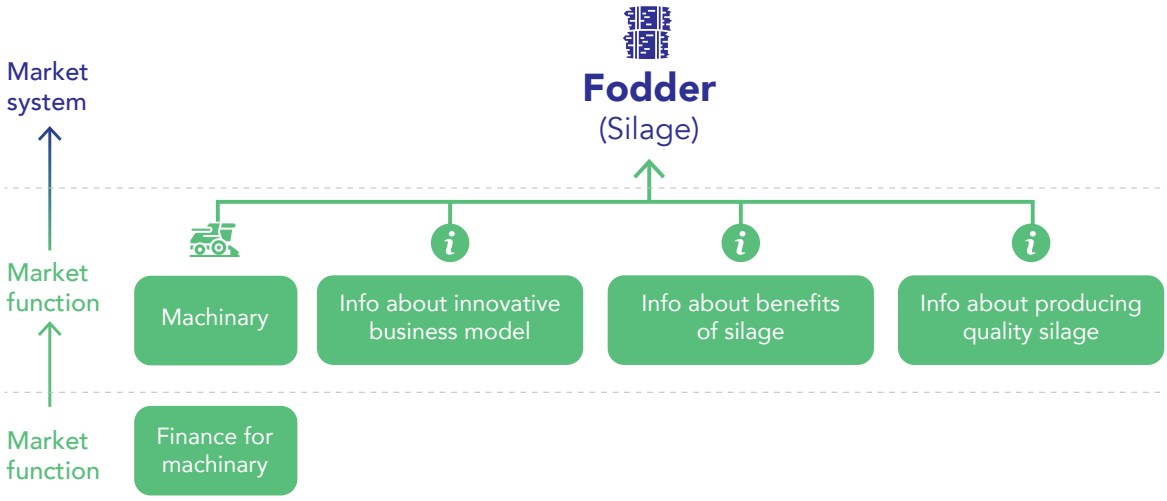


Figure 3: Key underperforming market functions that were constraining the performance of the silage market system

Gender-based division of labour

On most small livestock farms in Pakistan, women manage and feed the animals while men visit markets, purchase inputs and sell products. As silage was not available in rural areas and women rarely travelled to markets in other areas, there were few mechanisms for women to access information about how to use silage or about its potential benefits. This lack of accessibility further reduced demand for silage among small farmers and likely reduced its efficacy in those rare instances when small farmers did try it.

Of these functions and rules, MDF's assessment showed that the most critical were machinery, finance for machinery and information about the innovative business model. MDF recognised that if it were to pilot the innovative business model and expand it to scale in the fodder market system, it would need to address these underperforming functions.

Designing a pilot to address identified constraints

As of 2014,
following its approach, MDF had:

Selected a sector that was relevant to poor women and men in rural Pakistan and in which it had identified a feasible opportunity to increase incomes.

Analysed the constraints that were preventing that sector from working well for poor women and men.

Identified the underperforming systems that caused key constraints, one of which was the fodder market system.

Analysed constraints and opportunities in the fodder market system, which led to identifying silage as a possible solution to many of the problems leading to undernourished animals.

Identified the underperforming functions—most critically, machinery, finance for machinery and information about the innovative business model—that had prevented this innovation from emerging at scale in the market.

Analysed what was preventing farmers from buying silage (and why a decade of interventions had failed to address these problems) and identified a nascent innovation that addressed these constraints—a new business model for producing and selling silage.

MDF's analytical process had yielded a sound understanding of how the silage market system worked—or didn't work—and had introduced the program to key market actors. It had identified a possible innovation that could address existing constraints in the silage market system, which was based on commercial incentives for entrepreneurs and farmers. MDF's analysis had revealed the root causes (underperforming functions of the silage market system) that had prevented this innovation from spreading.

MDF realised that any designed pilot, to be successful, would have to provide potential silage entrepreneurs with information, as well as machinery or financing for machinery. If achieved, this would enable a wider uptake of the business model, supply farmers with silage (which would improve yields) and lead to small farmers making more money from selling milk and meat.

MDF does not provide direct assistance unless there is a way for that assistance to stimulate sustainable changes. Therefore, designing a pilot that addressed these constraints meant finding actors in the market system who, with the right support, had the incentive and capacity to trial and later maintain the innovation. A pilot that successfully demonstrated the efficacy and benefits of the innovative silage model could catalyse systemic change.

The obvious choice for the pilot at the time was Corteva Agriscience. Corteva Agriscience is a world-leading developer and supplier of advanced plant genetics, providing high-quality seeds to farmers. It also provides agronomic support and services to help increase farmer productivity and profitability. Corteva Agriscience is Pakistan's largest seller of silage maize seeds, and its seeds are known for their quality and yield.

Since 2008, Corteva Agriscience had been offering farmers technical information about the process of making quality silage and had watched the market evolve from bunkered silage to baled silage in large sizes. In 2013, Corteva Agriscience realised that small farmers were ready to purchase small bales of silage and attempted to link potential silage entrepreneurs with machinery providers, recognising that if silage uptake grew, so would silage seed sales. However, Corteva Agriscience struggled; despite approaching several machinery providers, the small-bale equipment was not readily available in Pakistan, and the investment in importing machinery was significant for an individual entrepreneur. Corteva Agriscience was stuck. Its core business was seeds and genetics, not machinery, and it was not prepared to further invest in addressing the dramatically underperforming machinery function.

Early in 2014, MDF contacted Corteva Agriscience as a potential partner. At first, the Corteva Agriscience team was sceptical as it had already tried piloting this business model. Furthermore, it had seen little effect over a decade of development programming in the dairy and meat sector.

However, MDF's approach had provided it extensive knowledge of the silage market and a strong sense of what was feasible, lending credibility to its proposal. MDF proposed that if the Corteva Agriscience team identified farmers with the financial and business capability to become silage entrepreneurs, MDF would co-finance the purchase of a set of machinery with the entrepreneurs. MDF would also support the entrepreneurs in raising awareness among small farmers in their locale about the usage and benefits of silage.

Corteva Agriscience's role would be to disseminate information about the business model to farmers by identifying potential silage entrepreneurs, the farmers with silage maize seeds, technical information about quality production and linking them with maize farmers as needed.

If the pilot phase provided proof of concept, MDF and Corteva Agriscience would work to involve a financial service provider to extend affordable credit to aspiring silage entrepreneurs. This credit provider would serve as an ongoing source of finance for machinery, sustainably replacing MDF's pilot role.

Table 3: Division of responsibility between MDF and its partners for the first pilot

MDF	Corteva Agriscience	Silage entrepreneurs
• Evaluate and form partnerships with entrepreneurs selected by Corteva Agriscience • Provide financial support to entrepreneurs of up to 50 per cent of capital costs • Support entrepreneurs in organising outreach to small livestock farmers in targeted areas and creating awareness about silage use and benefits • Identify a financial service provider to take over MDF's initial role in equipment finance	• Identify farmers willing and capable of becoming silage entrepreneurs • Provide technical information to support silage entrepreneurs in setting up business • Provide technical information on silage production • Monitor silage entrepreneurs' activities to ensure they follow good practices • Support entrepreneurs in developing linkages with silage maize producers • Support MDF and entrepreneurs with raising awareness among small farmers	• Provide at least 50 per cent of capital costs and cover all other costs, including operational costs • Purchase and set up all machinery essential to silage making • Procure quality maize for silage production • Follow good practices in silage production • Produce 60kg bales and make them available for sale to small livestock farmers in targeted areas year-round • Raise awareness among small livestock farmers of the use and benefits of silage

Corteva Agriscience was interested in MDF's proposal. It wanted to sell more maize seeds to farmers in Pakistan, and MDF wanted to improve the availability of nutritious fodder for small farmers by popularising the small-bale silage model. Corteva Agriscience and MDF recognised that, together, their efforts could achieve a win win outcome. Corteva Agriscience and MDF formed a partnership with a memorandum of understanding outlining roles and responsibilities and establishing that no funds would be exchanged between the two organisations.

MDF partnership video:
Corteva Agriscience
Click to play video

The initial pilot design introduced an innovation: a viable business model for mid-sized farmers to produce and sell small bales of silage to small farmers within their locale year-round. The design precisely targeted four of the five underperforming functions that MDF had identified, with only the machinery function not targeted directly. Since Corteva Agriscience had first attempted to promote the small-bale model, Cattlekit had begun to import quality machinery suitable for producing silage in small bales. Another firm, Agritech, commenced sales of locally manufactured small-bale silage machinery. With the contributions of these two firms, the machinery function appeared to be developing.

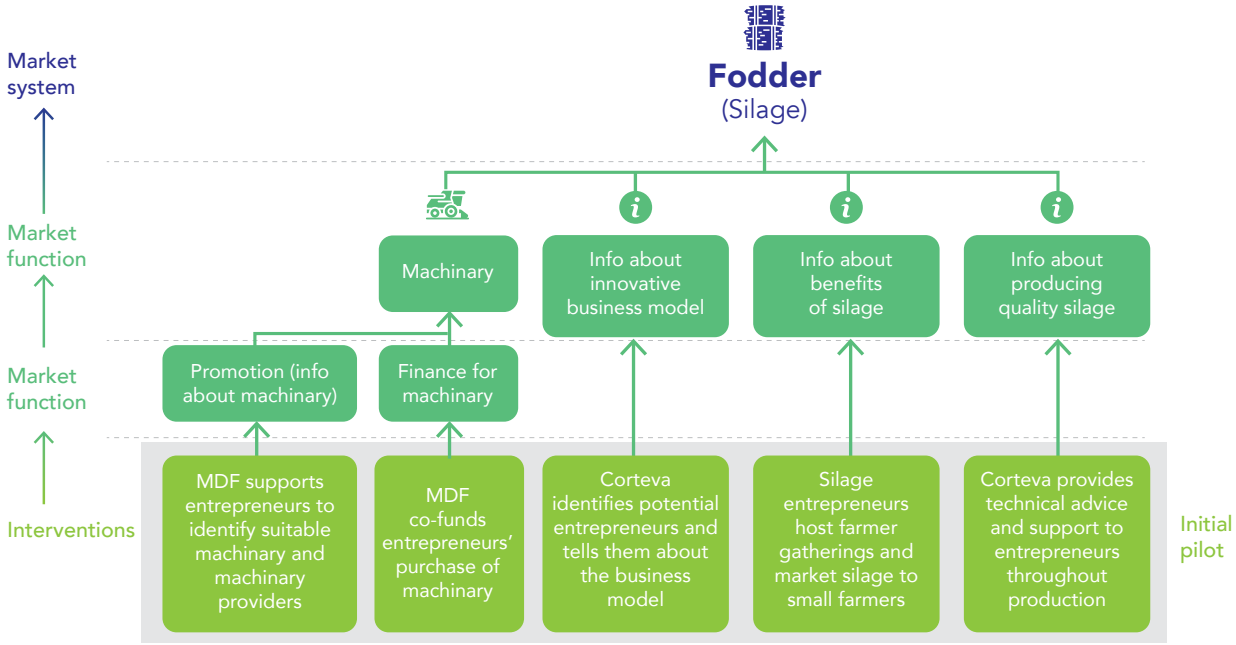


Figure 4: Intervention activities in the first pilot precisely targeting the underperforming functions MDF had identified

Critical success factors of a partnership

'Win-win' visions

A partner's definition of success is likely to differ from MDF's, but partners should understand what MDF is doing and have a shared vision for a 'win win' scenario.

Relevant capacities

Understand what capacities partners bring to the partnership and why they are needed. Equally, understand what capacities the program offers and the perceived (or real) value to the partner.

Flexibility

The very flexible nature of the market systems approach means that the original goal posts are likely to shift as assumptions are challenged. Businesses or organisations that are not prepared to be flexible do not make good partners.

Trust

Without taking the time to build trust with partners, there is a strong chance that the partnership may not flourish. Organisations need to prove credibility and potential to add value to other potential partners (especially large private sector firms) by sharing knowledge of the sector. This could be done informally or through sector assessments, results of pilots, financial models etc.

Champions

Identifying at least two champions within the partner organisation is key to ensuring commitment to the initiative. Having more than one champion reduces the risk and increases the outreach.

Promote your business sense

In developing countries, large private sector firms have often seen many development programs fail and can be sceptical about development-funded initiatives. Potential private sector partners want to know that you have a strong business sense, understand their incentives and are realistic about what is feasible.

Box 4: Critical success factors of a partnership

A phased approach to roll out the innovation

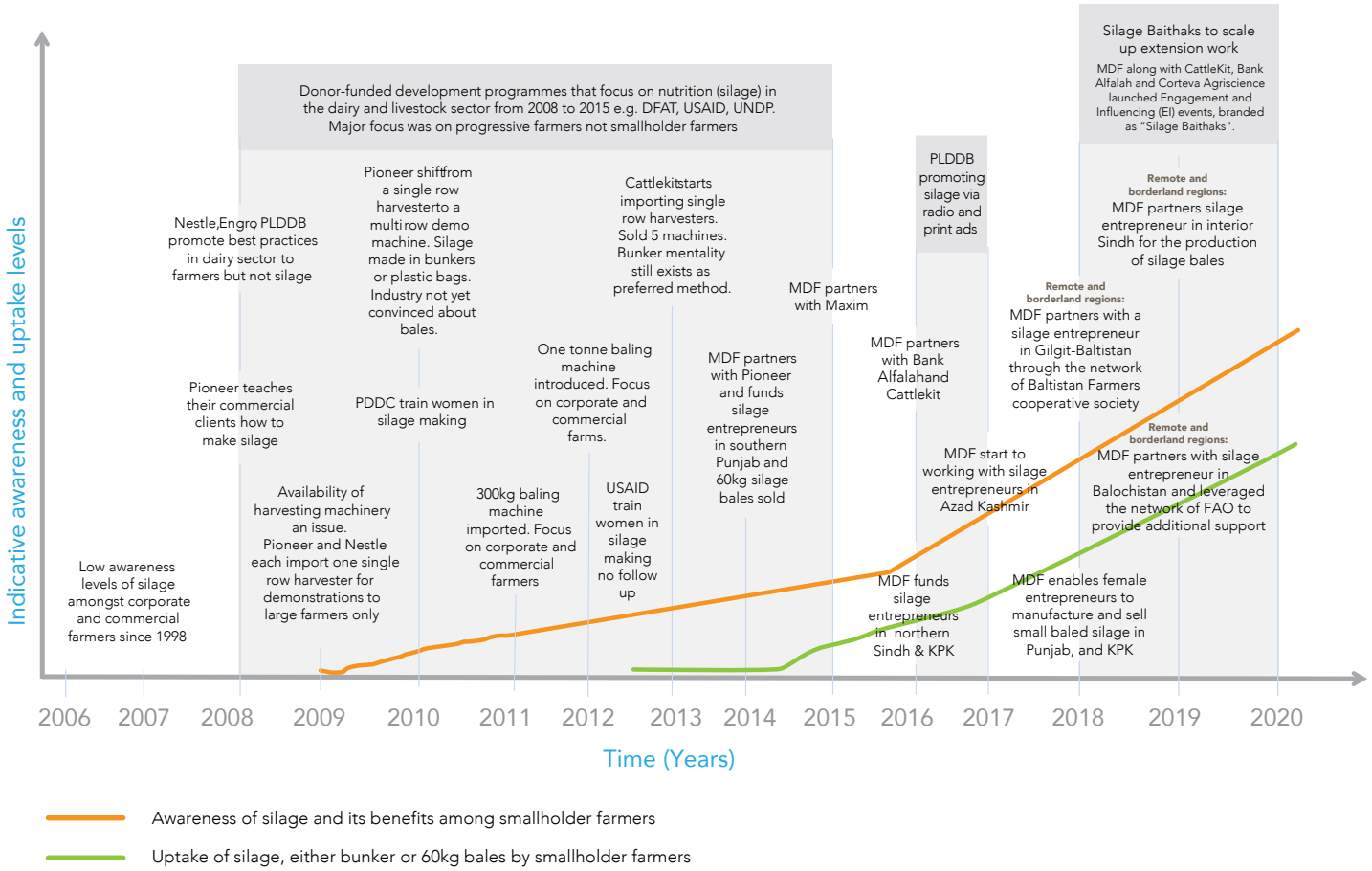


Figure 5: A phased approach to roll out the innovation

MDF and Corteva Agriscience agreed that a phased approach would be the most commercially and practically effective way to pilot the business model (see Table 4). They chose to pilot in only one area initially to allow a more concentrated focus of attention and resources. This focus would also protect them against significant losses if the pilot did not work and eliminate conflicting feedback that might result from piloting in multiple regions. Achieving success in one region would also give them a more substantial evidence base for encouraging adoption in more challenging regions.

MDF and Corteva Agriscience chose South Punjab as the pilot region because it had a high concentration of small and mid-sized farmers, good conditions for growing silage maize and, importantly, generally higher awareness of the benefits of silage than other regions. Farmers in Punjab province tend to own more animals than farmers in other regions and have a reputation for being more progressive (i.e. more likely to adopt innovations). The province also has a higher concentration of formal and informal milk markets than other regions, giving Corteva Agriscience and MDF confidence that it would be easy for farmers to sell additional milk once yields began to increase. Overall, South Punjab presented the least risk and greatest opportunity for success. Starting there would allow MDF and Corteva Agriscience to test the efficacy of the model and monitor how it adapted to market dynamics before rolling it out to other regions.

The first four phases

In Phase 1 (South Punjab), the pilot was expected to benefit MDF's target group by:

- Increasing the incomes of small livestock farmers by making silage accessible, which when fed to undernourished animals provides better nutrition and therefore increases yields of milk and meat for farmers to sell
- Increasing incomes of households that produce and sell silage maize to the new silage entrepreneurs
- Increasing incomes of labourers by creating new employment opportunities to support the production of 60kg bales.

MDF initially projected that, in South Punjab, each silage entrepreneur would sell 60kg silage bales to between 50 and 100 small farmers in their vicinity. It also projected that silage entrepreneurs would employ two or three full-time workers to operate the production facilities and a further ten workers as casual labour during the harvest and baling season.

Corteva Agriscience took a pragmatic approach to selecting mid-sized farmers who might be silage entrepreneurs in the pilot, drawing on their extensive farmer network for farmers who:

- Had the **financial capacity** to invest in the business, with sufficient cash reserves to cover operational costs, especially during the startup phase
- Had **minimal risks** such as health issues or high levels of debt that could impinge on the business
- Were **highly influential** in terms of their circle of influence and existing networks of potential customers
- Had **prior knowledge of silage**
- Had a good **understanding of the dynamics of dairy and meat sector**
- Were located in areas where they can achieve **significant outreach to small farmers**
- Had the **vision and capacity** to cater to local smallholder farmers' demand for silage
- Showed **enthusiasm** for the business model, yet also understood the realities of starting

Having piloted in South Punjab, monitored the results and learned how the model adapted to market dynamics there, MDF and Corteva Agriscience then rolled the innovation out to other regions with different—and often more challenging—market conditions. Phase 2 took the model to Northern Sindh, where farmers are more dispersed and tend to have larger landholdings. In Interior Sindh, there were also many landless farmers who produced primarily for subsistence and sold any excess yield informally. These factors meant MDF and Corteva Agriscience did not expect the commercial incentives to be as strong in Northern Sindh as in South Punjab.

Phase 3 of the pilot introduced the innovation to Khyber Pakhtunkhwa (KPK), where local conditions made it more difficult to produce silage locally. Silage is produced in two seasons in Punjab and Sindh but only in one season in KPK. Much of KPK relies on milk produced in Punjab.

Phase 4 worked to introduce a distribution model by supporting entrepreneurs on the border between Azad Kashmir and Punjab who could distribute small silage bales in Azad Kashmir.

Roll-out to female entrepreneurs

Recognising the particular challenges women have in accessing information about the benefits of nutritious fodder such as silage, MDF worked with Corteva Agriscience to identify three women to become silage entrepreneurs. Through a tri-party arrangement, these entrepreneurs worked closely with Corteva Agriscience to grow hybrid maize for silage production. One of them also employed female extension workers to promote and sell silage bales to smallholder farmers—particularly other women—in the region. MDF's technical partner, the Australian Centre for International Agricultural Research, trained the silage entrepreneurs and livestock farmers on silage through workshops and field days.

MDF partnership video:
Female silage entrepreneur
Click to play video

Roll-out to remote and borderland regions

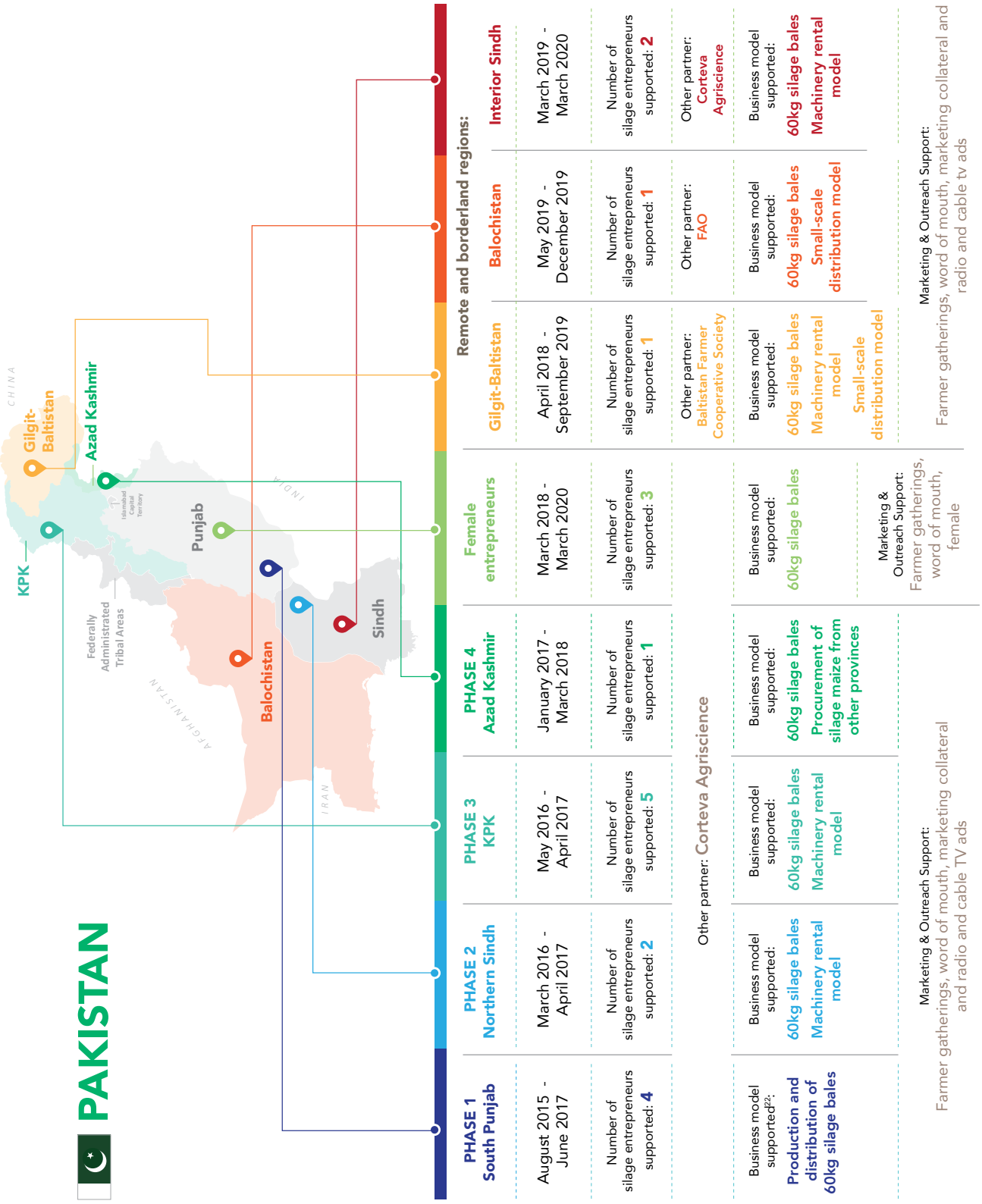
After establishing the viability of the silage entrepreneurship model, MDF had built the credibility, visibility, reputation and experience to begin trialling the model in remote regions with smaller markets.

In 2018, a member of the Baltistan Farmer Cooperative Society in Gilgit-Baltistan approached MDF to request assistance in establishing the first mechanical production of silage in the region. Gilgit-Baltistan is a mountainous region of northern Pakistan, marked by long winters, poor irrigation and small, fragmented landholdings. Corteva Agriscience did not have any direct presence there and had little incentive to invest, given the small landholdings. However, the Baltistan Farmer Cooperative Society had heard about MDF's work, leading to its interest. MDF decided to partner with a farmer who had been making silage manually, supporting him to set up a silage and machinery rental business. The aspiring entrepreneur also wanted to try distributing small silage bales through sales points, leveraging his network in the Baltistan Farmer Cooperative Society.

Another region, Balochistan, is fairly conservative and with many large farms, including government-managed farms. Small farmers in the area also have small herd sizes—on average, two animals per farmer. There is little production of silage maize in Balochistan, and therefore minimal production of silage. Through MDF's relationships with other donors, MDF was introduced to an aspiring silage entrepreneur who wanted to adapt the model to produce small silage bales with maize crop grown in Punjab and distribute them to farmers in Balochistan. MDF partnered with this farmer to set up his small silage business, Talha Enterprises.

Corteva Agriscience and MDF also agreed to expand the model established in Northern Sindh to Interior Sindh. In Interior Sindh, as in Northern Sindh, farmers are dispersed but tend to have larger herd sizes of 10–15 animals per farmer. Additionally, the land is not very fertile; at the time, yields tended to be low, and there were very few government extension services. Corteva Agriscience and MDF wanted to expand the model to regions disconnected from the more developed markets within the rest of Sindh, making Interior Sindh an appropriate option. Through Corteva Agriscience's network, three farmers in Interior Sindh received support for establishing silage and machinery rental businesses.

Table 4: MDF adopted a phased approach to roll out the business model



[22] MDF and Corteva Agriscience monitored adaptations in early pilots (see 'Results of the pilot') and adapted their support accordingly.

Results of the pilot and roll-out: sustained, small-scale functional change

Adoption

Initial results from the pilot in Punjab were promising. Four mid-sized farmers were offered support to become silage entrepreneurs, and three of them adopted and have since sustained the innovation. They were able to produce more than 1,400 tonnes of silage, of which they sold about 75 per cent and used the rest for their own animals. Selling that amount equates to having served approximately 285 farmers in the first year—comfortably within MDF's projections.

Uptake by small farmers was rapid. Each entrepreneur hosted between two and four gatherings to promote silage, with 30 to 50 farmers attending each. After the first year, entrepreneurs reported that they no longer needed to promote silage because word-of-mouth information about the quick, visible increase in yields that silage delivered was causing demand for small-bale silage to outstrip supply.

Farmers who purchased silage typically prioritised feeding it to dairy animals as they could get faster returns on investment, though some did mix it in meat animals' feed too. Assessments showed that all farmers who started using silage saw increased milk yields. On average, they saw an increase of 1.5–4L per animal per day, equivalent to 22–55 per cent increases in productivity—a significant change for small farmers. Additionally, it took only seven days on average to start seeing improved yields. Farmers who fed silage to meat animals also reported improved animal health and weight gains, although it was not possible to quantify results.

Each of the entrepreneurs employed four to five labourers. Entrepreneurs also procured silage maize from other farmers, providing those farmers with an income boost. In the first year, the three silage entrepreneurs cultivated an additional 70 acres of maize for making silage and procured an additional 20 acres of maize from other farmers.

MDF partnership video:
Silage entrepreneur

Click to play video

Watch Amir talk about the early signs of success of his 60kg silage bale business and the additional services added.

MDF partnership video:
Silage entrepreneur

Click to play video

Meet one of MDF's first silage entrepreneurs, Abou Sofyan. Hear him talk about how MDF has helped kick-start his 60kg silage bale business.

Adaptation

MDF monitored the pilot closely to spot any adaptations that were made to the innovation in response to market dynamics. Adaptations can signify ownership by market actors and be a sign that the innovation is becoming embedded in a market system. They can also highlight areas where the intervention strategy may need adjustment before attempting to scale up the innovation. MDF identified three types of adaptation: 1) landholding farmers started producing their own silage, 2) silage entrepreneurs started renting out their machinery and 3) some silage entrepreneurs introduced contract farming to procure maize.

Landholding farmers started producing their own silage

Over time, different behaviours emerged between landless farmers and landholders. Landless farmers continued purchasing silage bales after a successful trial, as did some smallholders. But other smallholders and many mid-sized landholders started with trialling the product by purchasing bales and then commenced making silage for themselves in bunkers.

Unexpectedly, silage entrepreneurs also observed demand for 60kg bales from larger farmers who used small bales to fill their own silage supply gap.

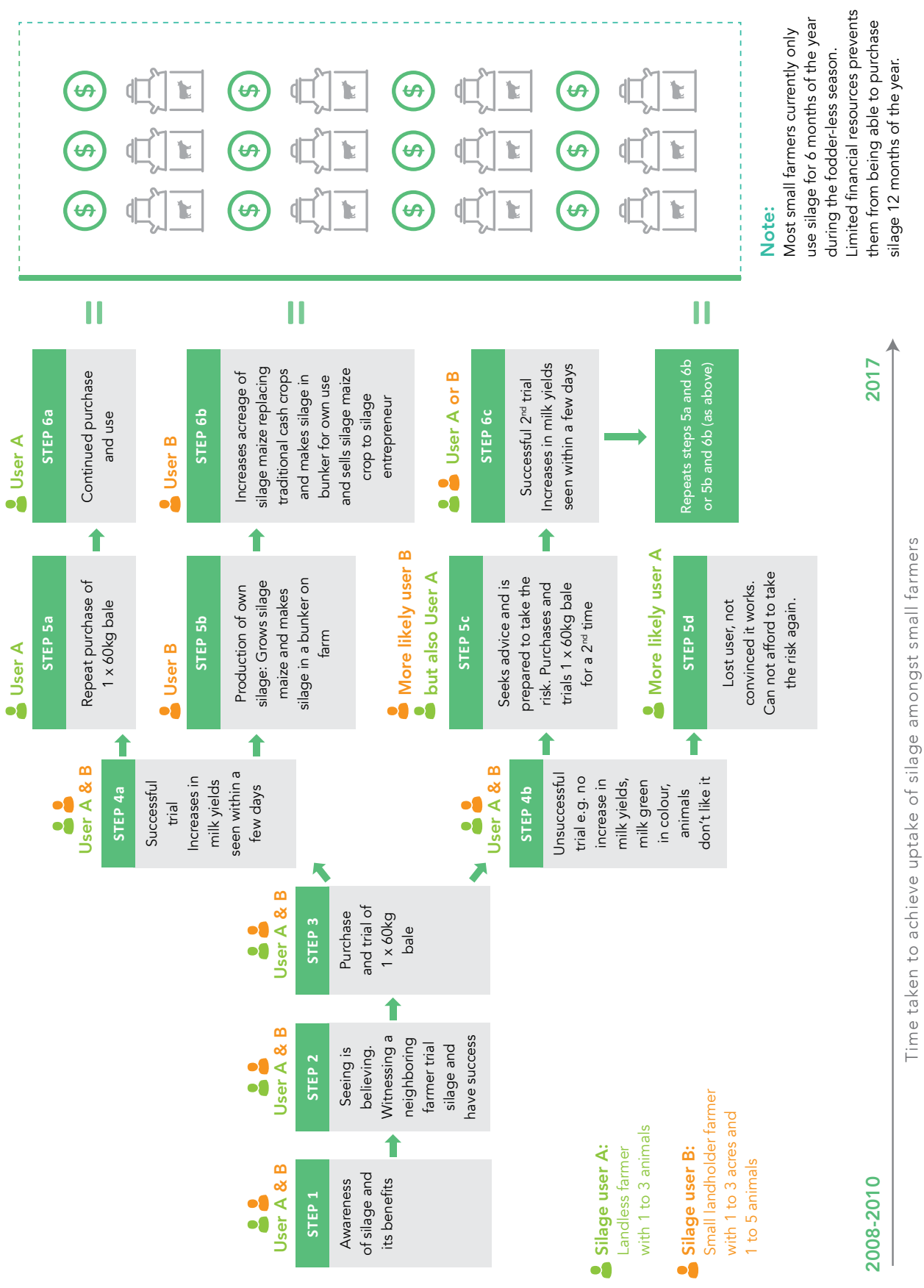


Figure 6: : Behaviour of landless and small and medium landholder farmers in the uptake of silage in Pakistan

Silage entrepreneurs started renting out their machinery

Silage entrepreneurs realised that their silage harvesting equipment stood idle and did not generate revenue after they had completed harvesting their own silage crop. Meanwhile, neighbouring landholders were manually harvesting their new silage crops. All three silage entrepreneurs capitalised on this opportunity, adding machinery rental as an additional service to the business model. This offer was taken up by landholders who wanted to harvest the silage crop mechanically and then produce silage in bunkers for their own consumption and, in some cases, by farmers who wanted to harvest and bale the silage for commercial purposes such as a silage business. The machines allowed some farmers to produce and sell silage rather than just maize crop, thereby enabling them to capture the value addition themselves and increase their incomes. Given the high demand for silage, silage entrepreneurs who rented their machinery were not overly concerned with the potential competition. In the first year of the pilot alone, 82 farmers rented machinery to produce silage; MDF estimates that farmers used rented machines to produce an additional 1,280 tonnes of silage. This revenue stream represented between 15 and 40 per cent of business revenue for silage entrepreneurs.

Some silage entrepreneurs introduced contract farming to procure maize

To increase production, entrepreneurs expanded the acreage devoted to silage on their farms and procured silage maize crops from neighbouring small and medium landholders. Over time, sales increased so significantly that silage entrepreneurs had to procure greater proportions of maize crops to meet demand. By 2019, silage entrepreneurs were procuring nearly twice as much maize from other farmers as they were growing themselves.

Although contract farming is still an emerging concept for most farmers in Pakistan, some entrepreneurs began contracting small and medium landholders to grow silage maize crops for them. Those who introduced this model sourced silage maize from an average of three farmers per entrepreneur in South Punjab.

Growing demand for silage maize was good news for small farmers, as farmers growing silage maize can earn 10–20 per cent more selling it to producers than they can typically earn on other cash crops.

Results from rolling out the model in other regions

Given the positive results in Punjab, MDF and Corteva Agriscience continued with their plans to roll out the innovation to other regions. The results and adaptations in these regions varied considerably, as expected.

In **Northern Sindh**, the results were strong. The program supported two entrepreneurs, of which one adopted and sustained the model; the second sold his machinery to another aspiring entrepreneur. The entrepreneurs were able to sell their silage without much investment in farmer gatherings, and production rates were high for each entrepreneur due to larger landholdings. However, the rates of silage maize crop procurement were much lower than in Punjab. There are proportionately more landless small farmers in Sindh than in Punjab, making rural dairy farmers more interested in buying baled silage than in renting machinery to produce their own silage in bunkers. It was also less feasible to rent out machinery due to vast distances between farmers, causing little uptake (only one farmer in the first year) in machinery rental despite availability. On average, farmers in Sindh used less silage per animal and fed animals silage for fewer days a year, resulting in silage entrepreneurs having more customers buying smaller amounts. Consequently, yield increases per farmer were lower.

The pilot in **KPK** performed well. Five silage entrepreneurs received support from the program, four of whom adopted the innovation. These four entrepreneurs conducted 114 farmer gathering days among them to raise awareness of the benefits of silage. The gatherings were very effective, and the entrepreneurs sold all the silage they produced (beyond the little they used themselves), reaching about 470 farmers in the first year. As with other regions, they found investment in promotion was not necessary after the first year. Yield increases in KPK were lower than in other regions, but farmers using silage reported that they gained nearly an additional month of milking from their dairy cattle per year. Just under 80 per cent of the farmers using silage sold the additional milk; the rest consumed it themselves. As with other regions, demand for silage outstripped supply. A different machinery rental model emerged in KPK where farmers brought their own maize crop to the entrepreneur who produced silage for them on site. Machinery rental started slowly (25 small farmers and five large farmers in the first year) but then grew rapidly (to 190 small farmers by the third year).

One entrepreneur near the border of Punjab and **Azad Kashmir** adopted the innovation, but he did not manage to establish a distribution model that would penetrate Azad Kashmir. Instead, he sold silage to farmers closer to home. Sales started slowly but grew significantly, with just six farmers benefitting from buying and using silage in the first year, 16 in the second year and 79 in the third year. The entrepreneur also created 23 FTE jobs for labourers in the first year; this grew to 33 FTE jobs by the third year.[23]

Only one of the three women who received support to become a silage entrepreneur still operates; she conducts her business through her son (who is public-facing), while she and the female extension workers she hired promote silage to a network of female farmers.

[23] Of these, three were full-time permanent positions and the rest were seasonal workers.

In **Gilgit-Baltistan**, early assessments[24] suggest that there is a lot of demand for silage, as local weather and landholding patterns make fodder production difficult. The silage entrepreneur who received support is still operating and has expanded production from about 500 bales per year to about 2,500. He was able to leverage the Farmers' Cooperative network and has established eight sales points as well as direct sales. The machinery rental model has also been successful; he rented out machinery to approximately 90 farmers in the second year, charging USD1.85–2.15 per bale for a service that includes all machinery, operator labour and consumables such as inoculants.

In **Balochistan**, the one silage entrepreneur who received support has sustained the innovation, has procured maize crop from Punjab as well as growing some himself, and intends to grow more in Balochistan if the business continues to grow and the conditions permit. Thus far, early indicators suggest that a large percentage of his sales have gone to large government-managed farms, in part because of his close connections to the dairy department of Balochistan.

In **Interior Sindh**, all three silage entrepreneurs have sustained the innovation. Intervention monitoring also shows that the silage entrepreneurs have invested much of their own capital in promoting silage to farmers in the region. As with Balochistan, a higher percentage of sales are to larger farms than they were in Punjab. This tendency has the advantage of increasing the visibility of commercial silage production as a viable business model in a region with less awareness about the benefits of silage than in Punjab, though it has also slowed small farmers' access to silage.

[24] An assessment of the results from the more recent interventions in Gilgit-Baltistan, Balochistan and Interior Sindh is ongoing.

Expansion of the innovation

Addressing finance for machinery

The program achieved sustained, small-scale, functional change in the fodder market, largely in the specific areas where it ran the pilot. MDF recognised that achieving sustained functional impact at scale required a sustainable solution for promoting and financing machinery. During the pilot, MDF had supported silage entrepreneurs in sourcing machinery and co-funded up to 50 per cent of the costs of purchasing machinery. This support was not a sustainable or scalable solution. Sometimes, in order to scale up one innovation, it is necessary to introduce another innovation, as was the case here.

The innovation:
An affordable loan product for machinery

Farmers who wanted to become silage entrepreneurs rarely knew where to buy suitable machinery; few were able to afford the machinery even if they could source it, and there were no suitable financial products to assist them. The market needed a way for farmers interested in becoming silage entrepreneurs to access finance for machinery at affordable rates, independently source and purchase machinery, and access ongoing after-sales support and maintenance.

During the pilot, some entrepreneurs had bought machines from local manufacturers that sold them at cheaper rates than imported machines. However, these machines were not of the same quality as imported machines, and the manufacturers did not provide any after-sales services or support. Some entrepreneurs imported machinery themselves but again suffered from a lack of after-sales services.

Many of the entrepreneurs that MDF partnered with bought their machines from Cattlekit, a Pakistani company that imports quality farming equipment for the dairy industry. Cattlekit had been the first firm in Pakistan to import a 60kg silage bale wrapping machine and a 25–50kg vacuum packaging machine. It also provided after-sales services to its customers. Cattlekit wanted to sell more small-bale silage equipment, was willing to invest in reaching more farmers and understood that limited access to finance constrained demand for its products. Therefore, Cattlekit and MDF decided to work together to find a financial service provider that could provide aspiring entrepreneurs with a flexible, affordable loan to buy Cattlekit's machinery.

The partners approached three banks, but all three lacked the appetite to develop a financial product for mid-sized farmers. However, Cattlekit had an excellent business relationship with Bank Alfalah, one of Pakistan's leading private banks with a large agribusiness division. Traditionally, Bank Alfalah had targeted corporate and commercial farmers; but it was interested in expanding its client base. Cattlekit agreed to contribute a substantial guarantee fund to allow the banks to temporarily offer silage entrepreneurs preferential interest rates on loans to purchase machinery. This would allow Bank Alfalah to test whether it could penetrate a new segment of the market without excessive risk.

Cattlekit, Bank Alfalah and MDF formed a tripartite agreement to introduce an affordable equipment finance product that would enable mid-sized farmers to purchase imported agricultural machinery. MDF's goal for this innovation was to increase the access and affordability of finance for machinery, thereby replacing its role in the pilot and unlocking a sustainable mechanism to enable the silage innovation to move to scale (Figure 7).

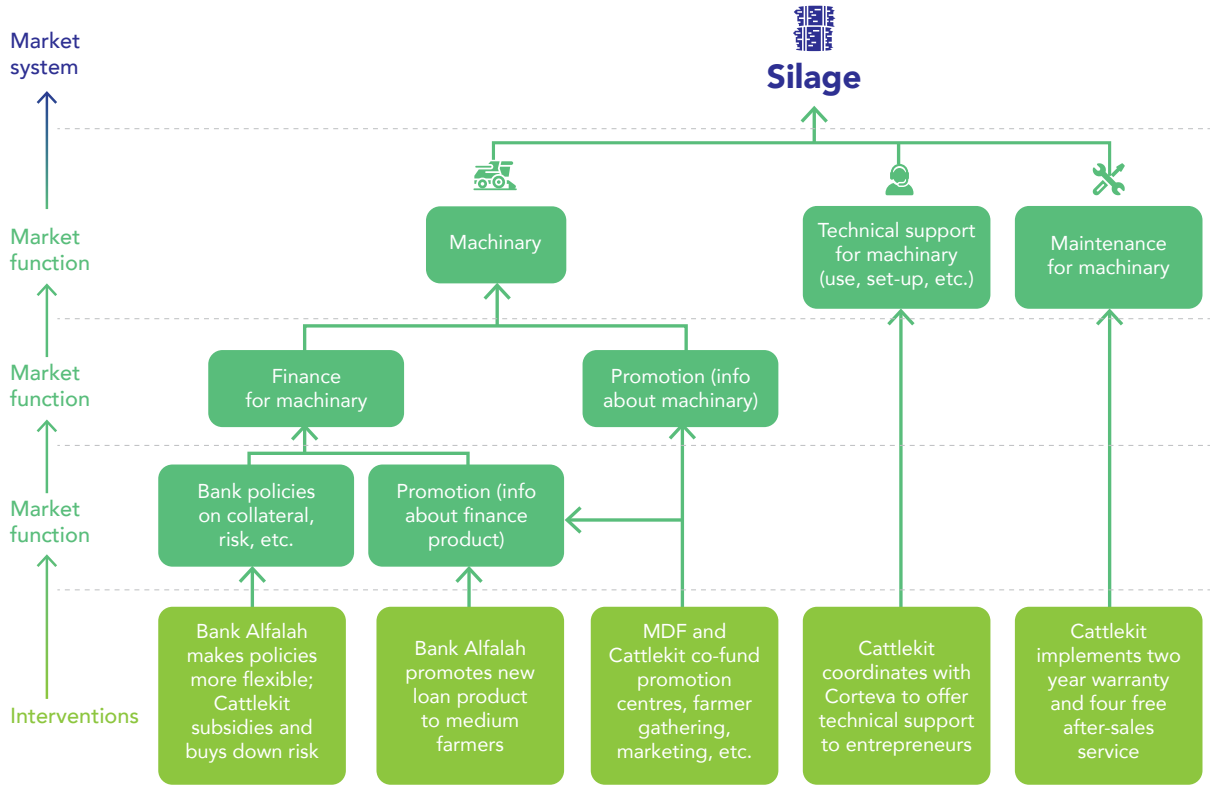
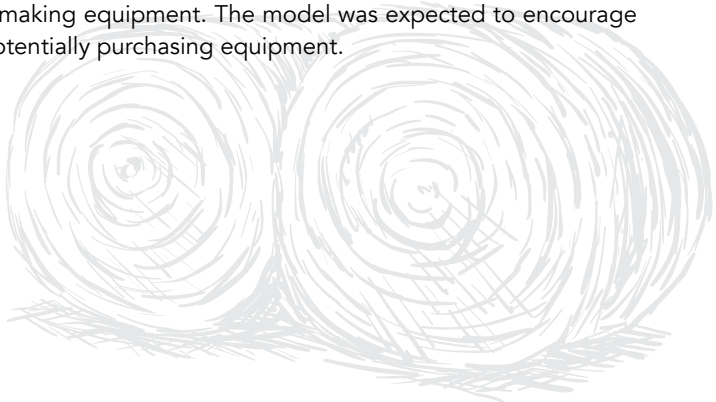


Figure 7: To design the intervention, MDF and its partners focused on the constraints surrounding machinery that affected the production and sale of silage; the innovation addressed the underperformance of the 'promotion' and 'finance for machinery' market functions and replaced MDF's role in the pilot

Table 5: Division of responsibility between MDF and its partners for the expansion phase

MDF	Cattlekit	Bank Alfalah
• Support Cattlekit in hosting several farmer gatherings and exhibitions to raise awareness about the financial product and the commercial viability of the small-bale silage business model • Co-fund the establishment of Cattlekit promotion centres where machines can be displayed, farmers can access technical advice and Cattlekit can maintain inventories of spare parts	• Provide a guarantee fund to Bank Alfalah to reduce lending rates (9.5% interest rate instead of the 14–15% market rate at the time) • Offer a buy-back scheme to mitigate the risk of farmers defaulting on loans • Offer a two-year warranty and increase the standard of two free after-sales services to four for customers purchasing machinery using the loan, conditional on the entrepreneur being in good standing with Bank Alfalah • Establish four promotion centres in South Punjab • Promote the financial product and silage business model, including hosting farmer gatherings • Coordinate with Corteva Agriscience to offer machinery technical support to new silage entrepreneurs	• Develop and promote the financial product • Make collateral requirements more flexible and better-suited to farmers • Offer preferential interest rate (with support from Cattlekit)

MDF also initiated a second intervention with Cattlekit, supporting it in introducing a rental offer from one of its promotion centres in Punjab to meet the high demand for machinery rentals. This model would enable farmers to avoid the costs and risks of a loan or buying equipment outright. It could therefore make equipment available, accessible and affordable to more farmers, helping meet the rising demand for silage and silage-making equipment. The model was expected to encourage farmers to conduct a trial followed by potentially purchasing equipment.



Results

Early launch activities for the loan product were well attended, and Cattlekit's first promotion centre received many inquiries in its first month. Despite this initial interest and the adaptations Cattlekit and Bank Alfalah made, uptake has been slower than expected. Approximately ten farmers have taken out loans to purchase machinery and started silage businesses to date.

Several factors have contributed to low uptake. While there were many enquiries, entrepreneurs were hesitant to apply for the loan. Sometimes their relatives persuaded them that they should not buy expensive, imported machinery, or that taking a loan was not Islamic. Some entrepreneurs who operated using the contract farming model wished to apply for loans as a group, which the bank did not permit. Others applied and were rejected as they had not met all the requirements.

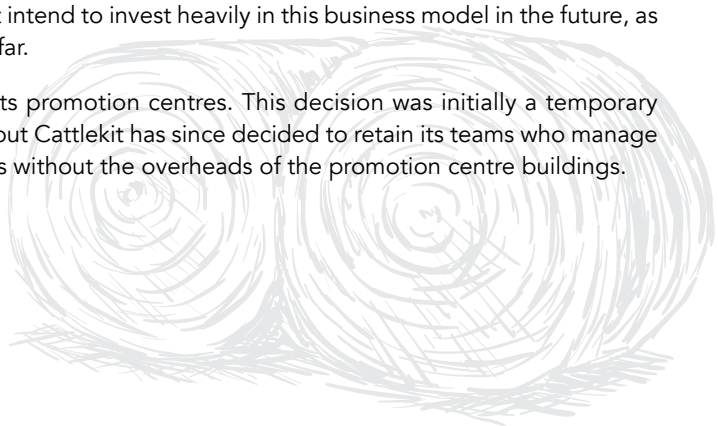
To address these problems, Bank Alfalah adapted the loan product to comply with the principles of Islamic finance and make group applications possible. Cattlekit also began assisting farmers with their applications at the promotion centres and then forwarding the applications to Bank Alfalah. However, the adaptations made have not yet been sufficient to overcome farmers' reluctance to use what is still a new and unfamiliar product. The loan process remains cumbersome for many farmers, particularly if they have to wait for the land record management authority in order to use their land as collateral. It will likely take time for awareness and trust to grow.

Expansion of the silage business model has far outpaced the adoption of the new loan product, with at least 57 new entrepreneurs starting businesses independently in Punjab, as well as nine in Sindh and five in KPK. This suggests that farmers are finding a way to finance the purchase of machinery without relying on the loan product. Nonetheless, there are irrefutably many farmers who are unable to purchase new machinery without access to finance. Thanks to a policy change by SBP, Bank Alfalah—and all banks—are now able to offer preferential interest rates to silage entrepreneurs to buy machinery permanently (see 'Finance Regulations' below). The rates supported by this policy change allowed Bank Alfalah to offer the loan at 50 per cent of the prevailing interest rates—even better rates than those offered in the initial pilot. While slow, there is a trend of increasing uptake, and Bank Alfalah and Cattlekit remain enthusiastic about promoting the product.

Cattlekit has also formed a partnership with JS Bank to offer a similar affordable loan product for silage and agricultural machinery under this policy. This is a recent development and, so far, JS Bank has yet to approve any farmers for loans. However, the pressure that SBP has put on banks to invest more in agriculture has caused other banks to approach Cattlekit with interest in offering similar products.

Cattlekit started offering machinery for rent in 2020. In its first year, about 15 farmers rented choppers; these farmers were mostly small and medium manufacturers of silage for personal consumption. A further 15 farmers rented balers; these farmers were generally selling silage commercially. In Cattlekit's view, demand for choppers is likely to decrease with time, while demand for balers is likely to increase. Although profitable, Cattlekit does not intend to invest heavily in this business model in the future, as it has not driven machinery sales thus far.

Cattlekit has also closed all three of its promotion centres. This decision was initially a temporary response to the impact of COVID-19, but Cattlekit has since decided to retain its teams who manage enquiries, sales and after-sales services without the overheads of the promotion centre buildings.



MDF partnership video:
Cattlekit
Click to play video

MDF partnership video:
Bank Alfalah
Click to play video

Addressing information about the business model

Beyond machinery and finance for machinery, a key aspect of expanding the silage innovation was providing information about the business model itself. Thus far, Corteva Agriscience and Cattlekit had been promoting the model through small farmer gatherings or on a one-on-one basis. Some entrepreneurs discovered the model by observing the new businesses in action. However, given the scale of the demand for silage among Pakistan's small farmers, there was a need to further increase awareness about the business model.

MDF considered different media and approaches for spreading information, including television, print media, social marketing campaigns and engagement events, and decided to take a two-pronged approach. First, MDF wanted to introduce an innovation that would spread information about the business model through direct engagement between potential entrepreneurs and the stakeholders who could support them in establishing a business. After discussion with its partners, MDF decided to support Cattlekit in hosting engagement and influencing events with panellists from Cattlekit, Corteva Agriscience and Bank Alfalah, as well as local government officials and successful silage entrepreneurs. The events would connect medium farmers who might become entrepreneurs with experts who could answer their questions and guide them through the process of becoming silage entrepreneurs. The events were called 'silage baithaks'.

Second, MDF co-funded a media and social media campaign about the silage business model with Cattlekit. This campaign involved developing and airing a detailed documentary on silage production, infomercials to be aired on television and social media about the potential benefits of becoming a silage entrepreneur, and print advertisements promoting silage entrepreneurship. All of the materials aimed to generate mass awareness of the business model.

The key innovation:
Silage *baithaks*

MDF decided to facilitate silage baithaks after more than three years of work in the silage market system. During that time, it had proven that the silage entrepreneurship model worked; established credibility, visibility and networks within the private sector; and generated notable interest in the model from potential entrepreneurs. It would have been difficult—if not impossible—to motivate private sector partners to collaborate on such events at an earlier stage of the program.

Sustainability was at the forefront of MDF's thinking when it collaborated with its partners to design silage baithaks. MDF could not play an intensive role if the events were to continue after the program ended. Therefore, it was agreed that Cattlekit and Corteva Agriscience would be responsible for identifying and sending invitations to key community members. Each event had between 150 and 200 carefully selected invitees.

MDF and Cattlekit jointly hosted most of the silage baithaks. They began with an opportunity for participants to view and ask questions about Cattlekit's machinery, which was on display, followed by a two-hour information session. Each panel member gave a ten-minute presentation on their respective area of expertise—from growing a quality maize crop to acquiring the appropriate machinery to packaging techniques. A substantial portion of the event was set aside for the audience to ask questions about how to establish and operate a silage business. Each event concluded with a lunch as a networking opportunity for participants, presenters and organisers to make personal connections. Following the event, attendees, panellists and business partners could follow up with each other using the event registration details, fostering ongoing engagement between local sales teams and potential entrepreneurs.

Silage baithaks were flexible events that targeted content to local audiences by using local language or discussing specific local factors such as weather or landholding sizes. In a session in Sindh, a local government official joined the panel to share information about the provincial government's subsidy scheme for farm machinery appropriate for silage businesses.

Results

The program team conducted the first round of silage baithaks between January and May 2018. By the closure of the program in June 2020, it had held eight events. Five of these were in Punjab, one in KPK and two in Sindh. The estimated outreach of all events was about 1,300 farmers.

Participants reported satisfaction with the events. The sessions provided a level of personal interaction lacking in other forms of outreach and enabled attendees to hear local silage entrepreneurs' experiences firsthand and ask them practical questions. The sessions increased awareness of the business model and built the credibility of Cattlekit, Corteva Agriscience and Bank Alfalah with potential entrepreneurs.

MDF's partners were very satisfied with the response from the events, reporting good follow-up and increased sales after the events. For example, by June 2018, the total number of followers for Cattlekit's Facebook page increased by more than 500 per cent. This online engagement and increased awareness translated into a nearly 60 per cent increase in sales. Events proved to be an important source of market feedback for the firms.

Cattlekit and Corteva Agriscience have continued hosting engagement and information events independently in existing and new areas since MDF Pakistan closed. Since June 2020, Cattlekit has organised another four silage baithaks, with 15–25 participants at each, and is committed to continuing hosting these gatherings, albeit at a smaller scale.

This campaign has not yet undergone assessment as it is a relatively recent innovation. It is projected to benefit over 7,500 farming households.

MDF partnership video:
Silage Baithak Highlights
Click to play video

Addressing distribution

To scale up the production of 60kg silage bales and broaden geographical outreach, MDF piloted an additional innovation with a well-established medium-sized firm with an existing distribution network. The intention was to produce small silage bales in greater volume and then distribute them to areas where small bales were unavailable and farmers were unable to grow silage maize.

One company, Maxim International, had already conducted a feasibility study on producing 60kg silage bales at scale but lacked sufficient capital to proceed. Maxim International's key strength was its network of 140 distributors and 500 dealers across the country, in addition to 92 per cent of its nutrition business being with small farmers. As a pilot, MDF agreed to assist Maxim International in finding out more about the feasibility of distributing small silage bales and offset some of its initial financial risks. MDF continued to monitor other developments in distribution, including the emergence of small-scale distribution mechanisms among silage entrepreneurs.[25]

Results

Maxim International faced a number of challenges in producing and distributing small silage bales. The partnership with MDF lasted just under a year, during which Maxim International faced delays in importing silage machinery and problems sourcing sufficient maize silage. These problems resulted in Maxim International having to pay a premium price for maize. Despite these obstacles, it sold an estimated 20,000 60kg bales in the first year and has continued to produce and distribute small-baled silage.

MDF observed several other organisations that invested in producing and distributing small-bale silage:

- In December 2015, the Engro Foundation ran a four-month pilot using Engro Foods' milk processing centres to sell and distribute 60kg and 300kg silage bales in 200 villages across Punjab. The Engro Foundation provided a fund for a 60 per cent credit facility for small farmers wanting to purchase silage bales. The pilot was successful, and Engro opened a facility a few years later for producing 60kg silage bales under the name Feedsol.
- In May 2016, the Government of Pakistan invested in PLDDB to produce and distribute more than 120,000 60kg silage bales per year from four production facilities. Because the demand for silage is so high, the subsidies for these bales did not have an overly distortive effect.
- In 2016, Matra Asia started manufacturing 60kg bales in bulk.
- ICI Pakistan, which MDF partnered with to support the uptake of animal health treatments among smallholder farmers, has also started producing silage.
- Some silage entrepreneurs experimented with distribution, with some success in Gilgit-Baltistan and Balochistan at the local level.

MDF concluded that selling small silage bales to small farmers works best and is most cost-effective in a decentralised model, largely because of spoilage; silage quality is hard to maintain in a centralised production and distribution model. Instead of investing further in developing the distribution function, MDF refocused its attention and resources on continuing to scale up the initial model.

[25] See 'Roll-out to remote and borderland regions' above.

Results: growing scale and system-wide impact

The headlines

Milk yields have increased by 1.5–4L per animal per day, equivalent to a **20 - 55%** increase in productivity.

Meat farmers who use silage have reported **increased health and weight** of meat animals.

51,800 small farmers have increased their incomes from improved livestock productivity.

An estimated **121** silage entrepreneurs are now producing small silage bales in six regions of Pakistan.

Approximately **5.5 million** 60kg silage bales have been sold.

526 FTE jobs were created by silage entrepreneurs.

Silage entrepreneurs buy over **94,000 tonnes** of silage maize crop annually.[26]

2,550 households have increased income by producing silage maize crops.

The number of silage machinery importers serving the small-bale market has increased from just 1 firm in 2014 to **7 firms** in 2020.

Local industries targeting silage entrepreneurs with their products and services have experienced growth, including plastic film manufacturers and inoculant producers.

USD21.6 million in net income were generated through interventions in the silage market for farmers, workers and silage entrepreneurs.

[26] Based on assessments from 2019, the last year in which this was assessed in all regions. Assessments from 2020 record notable growth in this number in the regions assessed.

MDF targeted supporting functions of the silage market system to change the availability and use of fodder. The supporting functions MDF targeted are now performing better, improving the way the silage market system works. As the provision of nutritious fodder to small farmers has improved, livestock productivity has increased, meaning that farmers can make more money from their participation in the dairy and meat sector.

Encouragingly, MDF has observed changes in other market functions (which it did not directly target) emerging to support its introduced innovations. This observation is important because it suggests that the market is starting to respond independently—and positively—to the innovations that MDF and its partners introduced. It also indicates that wider system change is happening and that the changes that MDF facilitated are becoming more resilient.

Changes in supporting functions of the silage market system

There are two ways system changes typically happen in supporting functions:

1 Some functions change due to innovations that the program introduced to target them. It is essential to ensure that this type of change is sustainable and not dependent on program resources.

2 Other functions change in response to what has happened in targeted functions. Spontaneous adaptations in different supporting functions suggest that the wider market system is responding to and beginning to support the innovations introduced through the program interventions.

Both types of changes occurred in the silage market system.

Seeds and production information

Since the first pilot in 2015, Corteva Agriscience has continued to promote the small-bale silage model to its farmer network and provide production information to new silage entrepreneurs through its field representatives. Its efforts have paid off, as silage seed sales have increased dramatically and account for an increasingly large proportion of its business each year.[27] The most recently available data[28] indicates that 44 per cent of its silage seed sales were for use in 60kg bales.

Another prominent seed company, Monsanto, also started promoting its seeds for silage (rather than just for maize) to entrepreneurs in KPK. Numerous local seed companies have also begun selling silage seeds to farmers.

[27] In 2017, silage seed sales accounted for 8 per cent of Corteva Agriscience's total business, up from just 1 per cent in 2014. More recent percentages are not available.
[28] From 2017.

Machinery

MDF did not intervene directly to improve the level of choice and competition available in the machinery function, deciding instead to partner with Cattlekit, the only importer retailing machines suitable for making small silage bales. However, the increasing demand for machines that other interventions stimulated has prompted other firms to target mid-sized farmers with machinery suitable for small-bale silage.

There are now three segments of the market: firms that import machinery from China or Turkey (including Cattlekit, Ravi Agric and Western Agri Products), firms that manufacture similar small-bale machinery locally (such as Agritech Engineering) and mechanics or small local businesses that manufacture very basic machinery for a fraction of the price (and quality).[29] While this machinery market remains thin, there has been a veritable explosion of commercial activity targeting mid-sized farmers with suitable machinery relative to the state of the market before MDF's intervention. For example, there are now seven silage machinery importers in Pakistan, a notable increase since 2014. Cattlekit has also seen significant growth for small-bale silage machinery; its equipment sales have increased by 60 per cent, and it has expanded its product range. Additionally, the market is becoming more competitive. Following Cattlekit's lead, several importers now sell vacuum packaging machines as more efficient alternatives to balers. These trends suggest expansion will continue in the coming years.

Finance for machinery

Bank Alfalah presented a paper on its loan product at a conference organised by SBP. SBP praised Bank Alfalah for launching this financial product and asked other banks to devise similar products for farmers. Since then, JS Bank has partnered with Cattlekit to launch a similar product, and other banks have expressed interest in doing the same. In late 2019, the Sindh Enterprise Development Fund—a program of the provincial Government of Sindh that aims to promote mechanisation in farming—also provided a subsidy to five banks (including Bank Alfalah) to promote lending for agricultural machinery. Bank Alfalah has extended USD0.33 million to six individuals through this scheme, including two women.

SBP also clarified that loans for silage machinery were eligible for preferential interest rates used to channel money into priority sectors, including agriculture. Previously, it was not clear whether this scheme could apply to the capital costs of businesses providing goods and services to small farmers. The clarification meant that potential silage entrepreneurs were eligible for preferential interest rates, allowing Bank Alfalah to eventually offer the loan product at a very attractive 6 per cent (or 50 per cent of the prevailing interest rates), subsidised by the Central Bank. Thus, the loan product was even more affordable than in the pilot.

This change to regulations happened independently from (but was stimulated by) MDF's interventions. It is a sign of systemic change, making the initial innovation more sustainable and scalable. The policy clarification makes it feasible for banks to offer preferential rates without access to a guarantee fund (sustainability) and the banks to follow in Bank Alfalah's footsteps (scalability).

[29] Medium to large companies such as The Four Brothers Group and Nestlé also offer embedded machinery rental services, but this offer is only accessible to their suppliers.

Accessories

In 2014 and 2015, the only plastic wrapping films available for 60kg silage bales—a key component of the bale production—were imported.[30] Since late 2015, local companies, including Circle International, Ravi Agric and IJ Plastic, have started manufacturing quality plastic bale wrapping and promoting their products to silage entrepreneurs, showing that they believe this is a significant and growing market.

In addition, Corteva Agriscience and a few other agri-inputs businesses have launched a new product, silage inoculants, to assist farmers in maintaining quality silage and accelerate the fermentation process. Cattlekit has also added accessories such as ropes and blades to its product list.

Changes in the core of the silage market system

Of the 19 silage entrepreneurs supported through the pilot interventions, 15 have sustained the innovation to date. More than 100 entrepreneurs have adopted the innovation independently from MDF and are now running profitable and growing businesses selling silage in small bales to farmers. Many have adapted the business model to suit their circumstances and market conditions—hence the emergence of the machinery rental and contract farming models.

Consequently, the fodder market system in the dairy and meat sector has improved its performance considerably. Small farmers can now access quality, nutritious fodder at affordable prices. Silage bales sell for about USD0.06 per kg, with some variation depending on the season and region. This price is similar to—and in some regions, lower than—the prices farmers were previously paying for straw, which has negligible nutritional quality. Furthermore, the price of silage has remained stable over several years. Importantly, silage has been able to fill the gap of 'fodderless seasons' caused by the lack of green fodder for many months of the year.

Silage entrepreneurs are making a good return on investment, in many cases reinvesting the profits into their businesses. Some entrepreneurs have purchased additional machinery to increase production or further develop a machinery rental business. Some have increased production by leasing land to expand the acreage of maize silage crop production. With machinery rental and silage sales, entrepreneurs' incomes have increased considerably, from a minimum of USD40,000 in lower-production regions to over USD82,826 in the high-production regions.

Achieving the adoption of silage entrepreneurship by women has proven difficult, although the roll-out to female entrepreneurs in the last two years may be too recent for results to have appeared. While silage entrepreneurship with men took off quickly in Punjab, women have more obstacles to overcome in procuring maize crops, spreading awareness and making sales due to their lower participation in public spheres.

Despite the program's success thus far, vast unmet demand remains among the estimated 3.7 million small farmers in Pakistan. The silage innovation is now self-sustaining and growing. As other supporting functions (such as machinery and finance for machinery) increasingly improve their performance, increasing numbers of farmers will gain access to silage at a rapid rate.

[30] These plastic films were provided by Baletite (http://www.silotite.com/product/baletite).

Impact on farmers

MDF expects its interventions in fodder to benefit approximately 82,000 small livestock farmers by the end of 2022. As of December 2020, nearly 52,000 have already benefited from silage innovation.

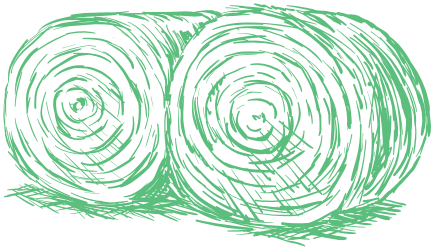
Landless farmers

Landless farmers living within a 10–20km radius of a silage entrepreneur now have access to 60kg bales of silage year-round, which is particularly beneficial in the fodderless months. Landless farmers use the additional income earned from increased milk yields to purchase more silage bales, invest in additional livestock assets or purchase essential household items.

This change is especially important for women in landless farming households, as it significantly reduces the time they spend sourcing green fodder and the burden of the manual labour involved. On average, small-bale silage can save a woman up to 14 hours a week, increasing her time for other household duties and childcare as well as engagement in paid employment on neighbouring farms.

Watch this video and learn about the benefits of 60kg silage bales for three landless farmers.

Click to play video



Small landholders

The introduction of 60kg bales has provided the stimulus for small landholders to trial silage and subsequently start making their own. The silage entrepreneurs' machinery rental model has given small landholders access to machinery that enables them to make bunker silage in their vicinity. The savings from making bunker silage versus purchasing 60kg silage bales is about USD0.02-0.03 per kg. As the demand for silage bales has increased, small landholders have also increased their incomes by producing silage maize for silage entrepreneurs. Many small landholders have replaced traditional cash crops with a more profitable option. The extra income earned from increased milk yields and a more valuable cash crop is usually invested into additional livestock assets and essential household items.

Mid-sized farmers

Small-baled silage has also had an impact on mid-sized farmers. For some mid-sized dairy farmers, the 60kg bale sourced from silage entrepreneurs has filled a gap in their silage needs as and when required. Like small landholders, mid-sized farmers can grow silage as a cash crop, either to produce silage for their own consumption or to sell to silage entrepreneurs. Many mid-sized farmers rent machinery from silage entrepreneurs to produce their own silage (in bunkers) or sell commercially (in bales).

Having greater visibility of the model in the regions where the program introduced it has encouraged further investment by mid-sized farmers with similar characteristics to those with which MDF partnered. Over 100 farmers in six regions have now invested in small-bale machinery of their own and have increased their incomes by becoming silage entrepreneurs.

Lessons: what it takes to trigger lasting systemic change in a large and well-established economy

> *Had MDF not been around, silage would be 10 to 50 years behind where it is now. MDF's activities have enabled the market to get to where it is quickly.*

Moneeza Ahmed,
The Engro Foundation

1 Lesson 1
Employ the full range of facilitation tactics to work with large firms

Large economies offer the prospect of large-scale impact, but aid programs are only likely to achieve this if they form partnerships with the large national and multinational firms present in such economies. Forming such partnerships requires a deep understanding of the market and its players, as well as support that targets large firms' specific needs.

To identify suitable partners, MDF looked for large firms interested in pushing their commercial frontiers to capture bottom-of-the-pyramid markets, had already made independent efforts to do so and understood the need to adapt their business strategy to penetrate different markets. It also sought potential partners with widespread reach, as these players could capture learning from easier-to-reach regions such as South Punjab and transfer it to work in other regions. MDF identified partners through market analysis and approached them with targeted offers; a generic offer (e.g. a challenge fund) would not have enabled MDF to build the partnerships it did.

It was critical to understand why the firms with the above characteristics had not already introduced the innovation independently. A lack of finance was rarely the problem; large firms such as Corteva Agriscience have a strong logistical and financial capacity. Instead, they usually lack knowledge about how to adjust their goods and services to engage with smaller or more informal enterprises, either as customers or suppliers, and how to form linkages to enable them to serve those markets. Therefore, the program's offer needed to target those specific needs.

Not all partnerships involve money. The partnership between Corteva Agriscience and MDF did not involve an exchange of funds. Corteva Agriscience needed a way to unlock the machinery constraint that had thwarted its initial attempt to roll out the silage entrepreneurship model—not finance. Similarly, Cattlekit, not MDF, lowered Bank Alfalah's risk in launching a new product, with MDF supporting Cattlekit with promotion and the development

of a new rental model. A range of facilitation tactics are available to market system development programs; had MDF confined itself to standard co-funding mechanisms instead of analysis-driven, targeted facilitation tactics for its larger private sector partners, it would not have been able to achieve what it did.

An aid program in a large economy has to build credibility with the large firms it would like to partner with, many of whom are sceptical of development agencies, as Corteva Agriscience was. Developing a targeted offer goes a long way, but building trust also requires demonstrating a nuanced understanding of the market, its constraints and what is likely to be feasible. Sometimes, a program will need to demonstrate effectiveness before larger firms pay attention. For example, MDF's success in working with small silage entrepreneurs stimulated the interest of bigger firms such as Maxim International, Engro Foods and ICI Pakistan in manufacturing and distributing 60kg silage bales.

2 Lesson 2

Do not underestimate the importance of small-scale and informal enterprises

Large firms are well connected to formal markets and technical expertise, whereas SMEs are well connected to the rural economy. Large firms can contribute large-scale financial and logistical capacity to a partnership, while SMEs can contribute their experience in serving the vast, messy markets outside urban centres and the business models that enable them to do so p rofitably.

Programs that recognise the importance of small-scale and informal enterprises and can connect large firms to SMEs to leverage their complementary strengths and incentives have the best chance of achieving sustainable, scaled change in a large, diverse economy. Large multinational and national firms rarely have an incentive to provide goods and services directly to dispersed customers that can only purchase in very small quantities, but local SMEs do. They can reach the vital 'last kilometre.' In many cases, as with silage, a decentralised business model is necessary to reach the market segment most disconnected from an innovation. By building business relationships between these different segments of the private sector, SMEs can access technical expertise and innovation and pass it on to small farmers and other rural customers while aggregating orders and managing logistics to make the rural market attractive to larger firms. The relationship between silage entrepreneurs (SMEs) and Corteva Agriscience and Cattlekit (larger firms) has enabled small, dispersed farmers to access silage.

Innovations also often rely heavily on a large support industry that SMEs provide. For example, Corteva Agriscience and Cattlekit provided imported quality silage seeds and machinery, but silage entrepreneurs relied on local farmers that produced maize crops from the seed, local labour and ancillary goods and services from mechanics, plastics manufacturers and a range of other SMEs. In a large economy, it is common for informal and semi-formal domestic enterprises to support and sustain an imported innovation.

3 Lesson 3

In a large economy with high internal diversity, use a phased approach to introduce innovation—and be prepared to adapt the model to serve different regions with different market dynamics

In countries with diverse regions that have the potential to benefit from innovation, choosing where and in how many locations to pilot new business models can be daunting. MDF's experience shows that starting in an area where a pilot is most likely to succeed and taking a phased approach to adding locations can maximise learning and success. It is easier to move into more challenging regions once an initial pilot is relatively mature and once the program and partner understand the model better. It is also important to develop a proof of concept to stimulate the interest of more cautious players and in regions that are more conservative.

A phased approach also allows a program to work with its partners' incentives. Firms have no incentive to launch a product in a hard-to-reach market when more accessible, higher-potential regions remain untapped. A phased roll-out to decreasingly accessible regions allows a firm to expand its commercial frontiers in a way that makes business sense while also building its capacity to serve bottom-of-the-pyramid markets in the process.

Perhaps most importantly, a phased approach gives the program and its partners time to closely monitor adaptations to the model and adjust the innovation to suit different markets. Large economies tend to be characterised by internal diversity. Different regions have different market dynamics, making systemic change happen in different ways and at different paces. As MDF's experience shows, facilitating benefits for a population as large and diverse as that of the small farmers in rural Pakistan requires adapting business models to suit different segments of that population. Phasing the roll-out allows close monitoring of why and how players adapt the innovation to their context. This learning can then translate into other regions, with scaling up commencing in one region while piloting is still ongoing in another region.

Conclusion

This case study has shown that achieving lasting systemic change in a large and well-established economy is possible.

MDF's approach has yielded significant—and growing—results. By doing robust research and developing a rich understanding of the whole market system, MDF understood what solutions were feasible and presented the best opportunities for increasing incomes. It was also able to understand why previous interventions had failed. With this understanding, it built credibility with key players who had developed a reasonable scepticism about development interventions in agriculture.

MDF formed partnerships with large firms and SMEs alike, supporting business relationships between these different segments of the private sector. By connecting large firms' technical, financial and logistical capacity with SMEs' ability to reach widely dispersed rural customers, MDF facilitated the roll-out of a profitable business model. This model then enabled small, dispersed farmers to access nutritious silage and increase their incomes.

MDF took a phased approach to pilot the innovative business model for producing and selling silage in small bales. MDF and its partners monitored the first pilot closely, learning and adapting as it rolled out to new regions. This observation allowed MDF to build on the adaptations that emerged organically in the market, such as the machinery rental model.

After achieving proof of concept, MDF dug deeper, working with different partners to promote innovations in supporting functions such as the promotion of machinery, finance for machinery and information about the business model itself. This promotion was necessary to expand the uptake of the original innovation and ensure that change would be sustainable.

MDF has demonstrated that an aid program can have a large-scale impact in large economies by:

Identifying a sector that is relevant to the livelihoods of millions of poor people.

Selecting a market system that represents an untapped opportunity, such as a sufficiently large market segment to be of financial interest to the private sector.

Introducing an innovation that can feasibly address underlying constraints and lead to lasting systemic change.

Leveraging the complementary interests and capacities of large firms and SMEs.

Monitoring adaptations and adjusting the innovation for roll-out to different markets.

In Pakistan, MDF achieved such impact through small-bale silage.

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