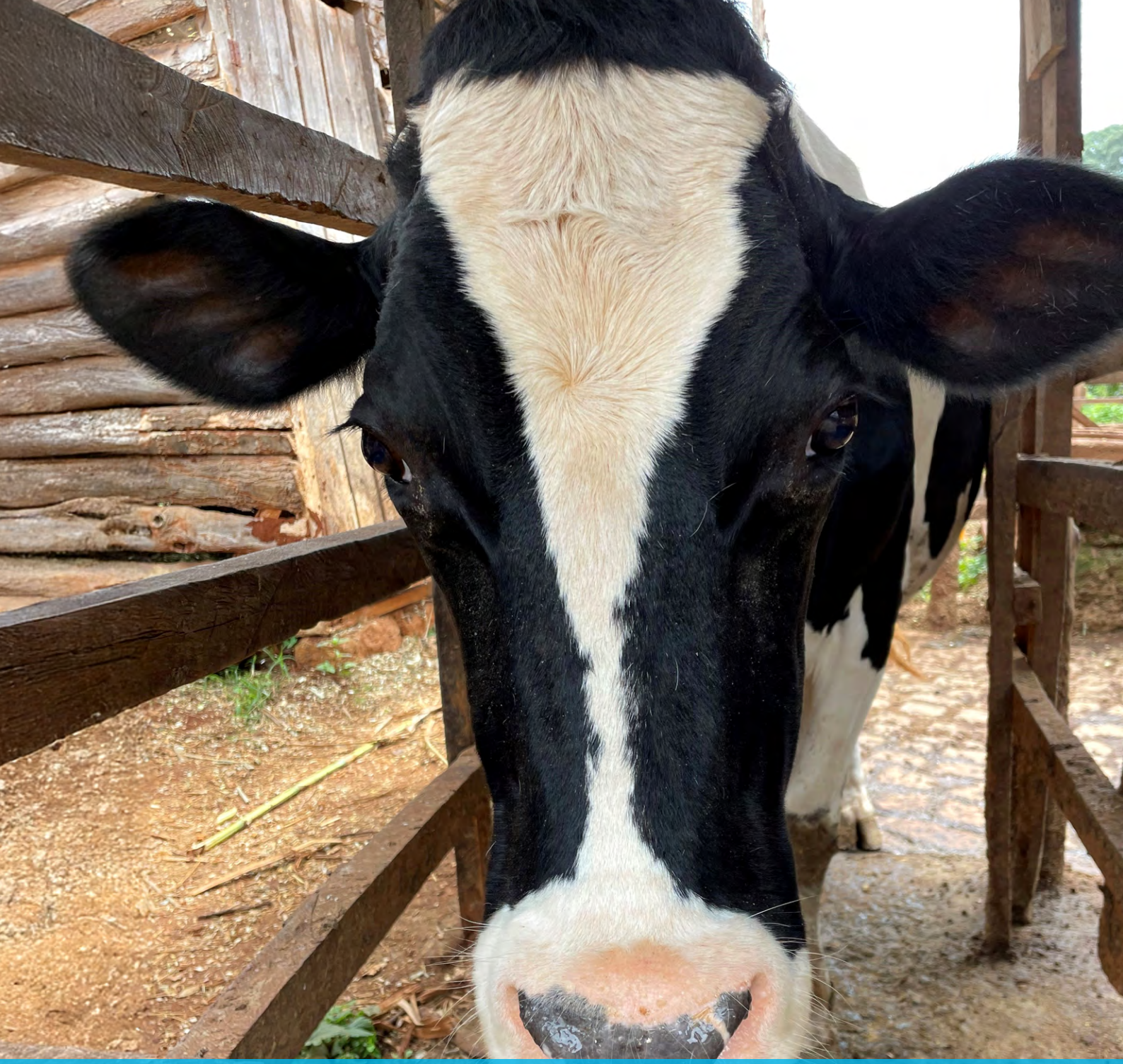

Dairy Hub Handbook

Supporting self-sufficient dairy sectors around the globe

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PROTECTS WHAT'S GOOD

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Executive summary

Purpose of this handbook

This handbook has been developed as a comprehensive introduction and overview of Tetra Pak's Dairy Hub model. It seeks to offer a deep understanding of why these projects are needed, the challenges they address, and the benefits they offer to individuals, communities and society as a whole.

The text that follows covers a number of pressing global issues: from food security and sustainable food systems to nutrition and economic development. Our aim is to shed light on the ways that, internationally, dairy value chains[i] are deeply interconnected with these issues. By doing so, we hope to demonstrate the potential of the Dairy Hub model to offer a practical solution for some of the most important challenges of our time.

What is a "Dairy Hub"?

Our purpose: strengthening dairy value chains

We empower smallholder farmers to improve their livelihoods by building sustainable and profitable dairy farming businesses, connecting them to processors, and providing technical expertise to foster a reliable local milk supply that ensures access to formal markets.

A Dairy Hub project is a value-adding offering for Tetra Pak customers. Dairy Hubs are collaborative initiatives intended to help dairy processors in emerging regions secure a stable, long-term supply of quality milk. We have developed a "Dairy Hub model" that considers all of the interconnected systems that influence the value chain, including the total natural ecosystem of the dairy farm, the broader regional community around the farm and the national dairy industry in the country in question.

Through this systems-level approach, the Dairy Hub model connects smallholder dairy farmers with dairy processors in their countries. In this way, we create the


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possibility for farmers to sell all the milk they produce, morning and evening, all year round, to a dairy processor, thereby becoming part of the formal milk market. The model enables processors to provide farmer suppliers with international best-practice standards and expertise in the form of practical technical assistance, training, tools and documentation. The farmers learn from the successful experiences of other farmers, through the reference farm methodology that has shown to be the most effective way of creating long term change. In some cases, the projects may also involve setting up appropriate cooling infrastructure and technology[ii].

Around the world, there are many development programmes dedicated to giving smallholder farmers the resources to improve their production. What makes our Dairy Hub model unique is that it is based on a market-driven strategy. The focus is on making sure farmers get more profit out of every litre they produce, rather than strictly emphasizing increased yield alone. This is the core of the model: building a relationship between farmers and processors that ensures all milk will be purchased, providing the farmers with a guaranteed source of income.

For dairy processors, implementing our Dairy Hub model offers a reliable way to secure a stable supply of higher quality, locally produced milk. But the benefits of the model go far beyond the day-to-day transaction between farmer and processor. By taking a systems-level approach, the model gives smallholder farmers access to formal market structures. This, in turn, enables greater long-term profitability for all stakeholders, empowering communities with improved social and economic opportunities. As a result, the projects contribute to building sustainable value chains within global dairy production[iii].

Who is this handbook for?

The success of dairy value chains depends on a wide range of stakeholders, including dairy farmers, dairy processors, agricultural support organisations and consumers. These stakeholders can be focused on a variety of topics: from national economic policy to agriscience, livestock care, social welfare, food security and more. This handbook is intended for anyone who is invested in the advancement of self-sufficient and sustainable dairy value chains, as well as those interested in the many ways a robust dairy industry can contribute to national and regional economic development.

The following chapters may be of particular interest to:

- **Dairy processors** looking for an increased, stable and long-term supply of domestically produced, high-quality milk
- **Policymakers and regulatory bodies** looking for proven frameworks that support local food production and economic development
- **Governmental and inter-governmental agencies** focused on projects to support regional and local agriculture development
- **NGOs** working in the areas of food security, agriculture, sustainability and economic growth
- **Implementing agencies** focused on providing training and practical support to smallholder farmers

The impact of Dairy Hubs

The first project implementing our Dairy Hub model was inaugurated in 2011. Since then, Dairy Hubs have helped improve the lives of smallholder farmers around the world, while simultaneously contributing to a more reliable supply of high-quality milk in their local markets.

Figures from the Dairy Hub model 2011–2024:

29 **Dairy Hubs in regions around the world**

84,500 **farmers have delivered milk to dairy processors as part of a Dairy Hub project**

of which

99% **(i.e. 83,900) are smallholder farmers**

1,214,000 **litres of milk delivered daily through Dairy Hub projects**[iv]

- **International development aid agencies or donors** who can partner in the projects and support with funding
- **Banking and financing institutions** offering loans and/or other financial instruments that are focused on developing the local agricultural sector.
- **Dairy farmers** who are interested in supplying milk to a dairy processor and receiving training and advisory services.

About Tetra Pak

Tetra Pak is a world-leading food processing and packaging solutions company. Along with Sidel and DeLaval, we are part of Tetra Laval – three industry groups focused on technologies for the efficient production, processing and packaging of food.

At Tetra Pak, we are committed to making food safe and available, everywhere, and we promise to protect what's good: food, people and the planet.

We firmly believe that being able to access safe and nutritious food should be considered a right, not a privilege. This purpose is fundamental to driving our business decisions and the work we do together with customers all around the globe.

These same purpose and values have also been the force behind the development of the Dairy Hub model. Today, the growing global population faces many challenges, including hunger, food insecurity, malnutrition and inefficient agriculture. Much of the milk produced in the world moves through informal value chains that neither provide farmers with a reliable access to income nor protect consumers from unsafe milk.

To help address these challenges, our aspirational goal has been to ensure dairy processors can receive a steady supply of safe, quality milk. At the same time, we work to promote more productive practices that enable stable markets and improved livelihoods for the smallholder farmers who deliver that milk.

Tetra Pak Food for Development

In our view, building sustainable food value chains is the most effective way of tackling challenges related to food security and nutrition. This, in turn, requires collaboration between all stakeholders and across all sectors.

The development of partnerships is key to our systems-level approach.

While the focus of most Dairy Hub projects is coordination between dairy processors and our dairy development experts, building a broader collaborative ecosystem is important to their success. Public sector actors and private companies – as well as NGOs when applicable – work together to scale-up and support

smallholder production. Consequently, we can support our customers and collaborate with relevant stakeholders, ensuring a robust value chain that drives social and economic development. It's a win-win solution for all parties, tackling challenges related to food security and nutrition.

The development of the Dairy Hub model has been an effort of Tetra Pak Food for Development. Food for Development is an initiative within Tetra Pak devoted to driving development of sustainable dairy and food value chains around the world. This has included collaboration on a range of programmes designed to support greater accessibility of safe nutrition: from dairy development to school nutrition programmes.

As with Food for Development's other efforts, the Dairy Hub model is a product of our cooperation with customers, international development aid agencies, funding organisations and NGOs all over the world, as well as national governments in some cases. Working together, our aim is to contribute to sustainable food value chains while addressing the global challenges associated with food security and nutrition globally.

A note on the material used in this handbook

The information used in this document is based on data from real-life Dairy Hub projects as well as Tetra Pak's vast experience collaborating with stakeholders across the dairy value chain. Where additional external sources have been used, citations have been provided to clarify the origin of the source with web links, where available. The information provided here is accurate and up to date, to the best of our knowledge, as of the time of writing.

The content of this handbook deals with topics related to global social, economic and agriculture development. New research on these matters is regularly published, and we are deeply invested in following the latest findings in these areas. If you have questions on any of the topics covered in this document, or if you would like to learn more about our work at Food for Development, please do not hesitate to contact us.

Find out more about Dairy Development and our work with Dairy Hub projects.

Tackling global challenges

Human consumption of dairy became common with the widespread domestication of milk-producing animals some 10,000 years ago. As a food that is rich in calories, protein and other nutrients, milk has played a historic role in advancing social development. It continues to do so today[v].

Today's growing global population has put more focus on critical issues such as food security, hunger and malnutrition, and inefficient agriculture. Simply put: the need for sustainable food systems has never been greater (see definition, below). The dairy sector is well placed to address such challenges, as an established, accepted and wide-spread industry.

This chapter will explore the role of milk and the dairy industry in some of most critical challenges facing our planet today: from securing a supply of nutritious foods for a growing population, to the development of more sustainable food systems and the ongoing climate crisis.

Dairy's role in global nutrition

The importance of milk cannot be overstated. On an average day, dairy consumption is a source of 5% of the energy, 10% of the protein and 9% of the fat for the global population. This means that milk represents the fifth-largest provider of energy and the third largest provider of protein and fat for human beings[vi].

As well as providing a significant portion of the world's macronutrients, milk products are also a vital source for essential micronutrients like calcium, magnesium, selenium, riboflavin, pantothenic acid (vitamin B5) and cobalamin (vitamin B12). All of these play an important role in ensuring health and reducing malnutrition among vulnerable populations[vii]. Furthermore, when heat treated and filled in aseptic packages or made into a powder, milk products can have a long shelf-life and be distributed without the need for refrigeration, allowing people to access that nutrition in easier, more convenient ways.

> **Milk is a primary food staple for the world's population of more than 7 billion people. Scores of malnourished and food-insecure children across the world receive crucial nutrients from milk.**
>
> **Ban Ki Moon**
> Former Secretary General, United Nations
> *Speaking to the IDF World Dairy Summit in 2018*[viii]

Were the dairy industry to vanish, the planet would face dangerous levels of malnutrition, stunted development, nutritional deficiencies and a host of other health problems, particularly among young children. In terms of economics, there are around one billion people whose livelihoods are in some way supported by the dairy industry[ix], 600 million of whom live on 133 million dairy farms around the world[x]. Simply put: dairy has much to offer for both the health and wellbeing of the world's population.

Enabling nutritional development

In order for the dairy sector to play a vital role in the health and food security of a country's population, milk needs to be available and accessible, and the people who need it must be aware of its nutritional benefits and how to consume it safely. Here are some key questions to ask:

Milk availability:

Is milk locally produced? If not, why not?

- **Milk production:** focus on farm management, records and profitability, support services (such as extension services), and farm inputs.
- **Biosecurity:** ensure that biosecurity is centrally managed at the government level. There should be a national strategic biosecurity plan in place, and it should be actively implemented and monitored. ***This cannot be emphasised enough***. Biosecurity management is the foundation of all improvements in milk production. If not done well, a new influx of disease can arrive, destroying any gains.
- **Collection & distribution:** formalise the milk distribution sector to make collection, testing, processing, packaging, and logistics available, ensuring that milk is adequately distributed and available for purchase.

Milk accessibility:

Is the milk available and affordable for everyone? If not, why not?

- **Economic conditions, policy changes and consumer preferences** collectively determine production costs, distribution efficiency and market demand, which in turn influence milk accessibility and affordability.
- **Is the market working** well enough to provide milk as a vital source of nutrition for all people?
- **Can dairy provide a vital source of nutrition for vulnerable groups** through, e.g., social feeding programmes?

Milk awareness:

Are people aware of the nutritional benefits? If not, why not?

- **Societal understanding:** do parents understand why dairy is important for the health of their children?
- **Governmental understanding:** do policy-makers understand why dairy is important?
- **Education and awareness programmes:** nationwide campaigns can educate the public about the nutritional benefits of milk and its role in a healthy diet. This could involve collaborations with health professionals, schools, and media outlets.
- **School feeding programmes:** integrate milk into school feeding programmes to instil healthy habits from an early age, providing milk at subsidised rates or for free.

Increasing milk consumption and production

At a strategic, national level, increasing the consumption and production of milk requires a comprehensive systems-level approach. This will entail leadership and resources from the government and a keen awareness of what local market conditions demand. In other words, change must be driven from the bottom-up – and managed from the top-down.

The future of global food systems

It's no secret that our planet needs an urgent shift in the production, processing and distribution of food. The numbers speak for themselves. Over a third of global greenhouse gas (GHG) emissions are generated by food systems[xi]. Around the world, 2.4 billion people struggle to get regular access to sufficient food[xii], while at the same time more than a third of all food is lost or wasted[xiii]. In short, the impact that food systems are having on the planet is putting the future of those very same food systems – and the human population that relies on them – at risk[xiv].

At the root of many of these challenges is the reality that much of today's food production is deeply reliant on resource-intensive agricultural practices (in farming) and resource-intensive industrial practices (in food processing). In addition to the production of GHG, use of agri-chemicals, energy, water, and land has also resulted in a loss of biodiversity[xv]. New practices are therefore needed which can contribute to the sustainability of global food value chains.

Here, it is worth considering what exactly "sustainability" means in this context. According to the Food and Agriculture Organization of the United Nations (FAO), a sustainable food system is one that is:

Economically sustainable: enterprises are profitable for all stakeholders across every part of the value chain.

Socially sustainable: the food produced offers benefits for society broadly, such as food security that ensures healthy and nutritious diets for everyone.

Environmentally sustainable: production and consumption of the food has a positive or neutral impact on the planet and our natural resources[xvi].

For dairy production, this means balancing profitable farming practices with reduced environmental impact. This can include, for example, increasing the efficiency of milk production and water usage, as well as improving animal welfare and feed management. Another aspect involves minimising food loss, and therefore wasted resources, at all stages of the supply chain. This requires improved farm mechanisation, infrastructure, transportation and storage methods, as well as education and training. A focus on farm profitability is key, together with knowledge and competence building.

The transformation of our global food systems is an ongoing process that needs collaboration and coordinated efforts among all relevant stakeholders: including national governments, supranational organisations, businesses, farmers, consumers and more. It will take continuous improvement and innovation, along with a shared commitment to fostering a healthier, more equitable and environmentally responsible approach to food and beverage production.

CASE STORY

Bangladesh

Between 2011 and 2013, dairy processor PRAN Dairy, together with Tetra Pak Food for Development, started the first two Dairy Hubs in northern Bangladesh. Between 2014 and 2017, with UNIDO as the implementing partner and SIDA as the donor, PRAN continued and implemented three additional Dairy Hubs covering a total of 12,800 farmers.

Outcome (2011-2013):

143% average increase in milk yield, from 4.45 to 10.8 litres per cow per day (reference farms)

144% average increase in smallholder farmer income (reference farms)

1,950% increase in milk collection in the area of the first Dairy Hub, from 2,000 to 41,000 litres month (total farms)

In 2021-2024 Tetra Pak signed a new agreement with PRAN Dairy to set up an additional two Dairy Hubs covering another 1,800 smallholder farmers in the south of Bangladesh.

Outcome (2021-2024):

Milk collection: increase from **3,600 to 19,000** litres per day (total farms)

42% increase in average milk production, from 27 to 38 litres per farm per day (reference farms)

56% increase in average income (reference farms)

Addressing the climate crisis

As with many industries, the climate crisis is putting pressure on the dairy sector to reduce its environmental impact. Stakeholders across the value chain need to adopt new practices, which may require significant changes to current farming and production methods as well as today's infrastructure. The challenge is twofold. The dairy sector must decarbonise while securing its nutritional, economic, and social viability. At the same time, the industry must also adapt to increase resilience in the face of climate change, including being ready for the effects of extreme weather events such as floods and droughts.

Data from the FAO indicates that the global dairy sector contributes approximately 2.7% of total anthropogenic greenhouse gas (GHG) emissions. In a given year, dairy farming generates as much as 1.7 Gt of atmospheric greenhouse gas (GHG) emissions, of which over 58% are from enteric fermentation[xvii].

However, it is crucial to note that almost three-quarters of dairy-related GHG emissions come from emerging economies[xviii].

In many cases, significant reductions can therefore be made by modernising so-called "informal" dairy markets (see more on this topic in the following chapter).

In other words, improving knowledge and skillsets and instituting proven best practices in emerging countries can play a big role in decarbonising the dairy industry on a global level. Key areas where emissions can and should be reduced along the value chain relate to enteric fermentation, manure management and disease prevention[xix], as well as fuel and electricity consumption in feed production, processing, and transportation.

A future for farmers

The overwhelming majority of food consumed around the world today originates from family-run farms. By some estimates, family farms account for as much as 80% of the world's food supply[xx]. The survival of these farms hinges on:

- **Profitability**
- **Access to finance**
- **Political policy and regulations**
- **Land rights**
- **Livestock and biosecurity**
- **Access to expert knowledge** from outside sources (universities, training institutes, farmer organisations, etc.)
- **The passing of experience** from one generation to the next in perpetuity

The average age of farmers is increasingly worldwide[xxi], and this older population has now become one of the most pressing issues currently facing global agriculture[xxii]. As experienced farmers become older, and farm profitability is increasingly squeezed, fewer young people are

choosing to enter the profession. If not addressed, this imbalance will result in knowledge being lost and a lack of operational continuity in farming, which may lead to major disruptions in global food production and distribution[xxiii].

Today's challenge is that, globally, younger generations are struggling to see a future in farming where they can be profitable enough to support a decent life and to raise a family. Their concerns underscore the importance of the first point in the FAO's definition of a sustainable food system – that it must be economically beneficial at all levels of the value chain. If the children growing up on family farms do not believe they can make a living in the profession, they will choose other careers. As we will explore in more depth in the next chapter, any discussion of sustainable dairy practices must therefore begin with a focus on farm profitability.

Dairy and the UN Sustainable Development Goals

At the 2016 International Dairy Federation (IDF) World Dairy Summit, the IDF and the FAO signed the Dairy Declaration of Rotterdam, committing to the sustainable development of the dairy sector[xxiv]. The Declaration, which was jointly renewed and re-signed in Paris in 2024, underlines the key role that the sector has to play in achieving the Sustainable Development Goals (SDGs) of the UN 2030 Agenda. The SDGs address economic, social and environmental sustainability, and require commitment and cooperation between all stakeholders.

The connections between the dairy sector, people and the environment are many. The dairy sector offers tremendous potential for realising the SDGs, and engagement around the SDGs provides a pathway to fostering partnerships, sustaining the benefits of agriculture and strengthening the contribution of the sector to sustainable food security and nutrition.

The need for formalised dairy markets

Smallholder farmers are the lifeblood of global agriculture. Defined by the FAO as those who oversee less than 10 hectares of area[xxv], such small-scale producers are responsible for as much as one-third of all the world's food[xxvi]. Without their hard work, our global food systems would collapse.

Despite their critical role, however, smallholder farmers face immense difficulties. They generally operate at subsistence levels, with limited access to technical knowledge, commercial opportunities or formal market structures. In fact, many of these farmers' greatest struggles stem from the fact that they are forced by circumstance to sell their produce within so-called *informal markets*.

An informal economy is any trade situation that lacks government or regulatory oversight, meaning there are no standards for quality control and no protections for the consumer or the producer. In the context of the dairy sector, an informal market is one in which consumers purchase raw, loose milk either directly from a farmer or through an intermediary "milk hawker" in a marketplace. These informal markets account for nearly a quarter of all milk sold around the world. According to the International Farming Comparison Network (IFCN), 58% of the planet's milk is sold to dairy processors, 18% goes to household consumption, and 24% is sold in the street[xxvii].

The production and consumption of unregulated and unprocessed milk has ramifications far beyond the farmers themselves, impacting factors from nutritional quality and public health, to animal health and welfare and the overall environmental footprint. From a national economic standpoint, an informal market also means that there will be no tax income from the sale of milk, which, in turn, limits public sector resources for providing citizens with social services.

We will now take a look at the challenges that informal markets create: both for smallholder dairy farmers and their farms, as well as for the various other systems with which they interact. This latter category includes the local community that relies on the farms for food, the national dairy industries and even global supply chains. In assessing these challenges, we will also explore solutions for formalising dairy economies, the benefits that formal markets can provide to stakeholders across the dairy value chain, and how we can support economic empowerment for smallholder farmers.

The challenges of informal markets

As a vital part of the dairy value chain, it's important that more attention be paid to smallholder farmers and their day-to-day challenges. Understanding those challenges clarifies the ways that they impact not only the farmers themselves, but also the food systems that depend on them. Through this understanding, we can also begin identifying potential solutions for bringing smallholder farmers into formal market structures.

Public health challenges

Informal milk distribution opens the door for significant risks to both the quality and safety of dairy products. Both the World Health Organization (WHO) and the United States Centres for Disease Control and Prevention (CDC) warn against the consumption of unregulated loose milk, due to it being highly susceptible to contamination from multiple sources[xxviii]. Lack of regulatory oversight also increases the risk of milk adulteration, which creates further public health challenges in many countries.

This threat to public health is one of the biggest challenges of the informal dairy market. Raw milk that has not undergone pasteurisation or any other form of heat treatment can carry a

host of dangerous bacteria and food-borne diseases. These include E. coli, Salmonella and Listeria, which can cause severe gastrointestinal problems, leading to death in many cases.

Zoonotic diseases – where a disease is transferred from animals to people – are a serious additional concern. One typical example is mycobacterium bovis, which causes bovine tuberculosis in cattle. The bacteria can pass to people via raw, unpasteurised milk, leading to tuberculosis and subsequent chronic respiratory problems – and even death. As recently as 2019, tuberculosis accounted for as many as 2% of all global deaths[xxix].

Many food safety issues in the informal market are connected to the collection and transport of raw milk from farms to consumers. This often involves poor quality storage containers that are not food-grade approved and that are difficult to clean and sanitise completely.

There can also be significant logistical challenges, especially in rural areas with inadequate infrastructure, including poor quality roads, lengthy distances between farms and markets, or limitations in transportation options (motorbikes or bicycles, ox or donkey carts, wheelbarrows, walking, etc.). Taken together, these challenges can delay milk delivery. When not stored in the proper (stainless-steel) containers and cooled in a timely manner[xxx], bacteria and other microbes can multiply, spoiling or negatively impacting the nutritional quality of the milk.

The informal market can also make it difficult for consumers to fully understand the severe health risks that raw milk may pose. Without formal policies and oversight, there may be an absence of quality standards and certifications that can otherwise guide consumers. The public, lacking education about the danger of purchasing raw milk, may not have the knowledge to avoid health hazards, leading to rapidly spreading disease.

Many food safety issues in the informal market are connected to the collection and transport of raw milk.

Economic challenges

Smallholder farmers also face significant economic challenges due to their position in an informal market. With a lack of clear standards and no authoritative oversight bodies to evaluate the quality of products, it is much more difficult for farmers to establish the value of their own goods. This results in an absence of cost transparency and price stability. As a result of informal intermediaries purchasing their milk, farmers may be subject to fluctuating prices and income volatility, especially during seasonal periods when milk is abundant.

In fact, the informal dairy market leads to a number of economic drawbacks for farmers – with very few advantages. As noted in the previous section, a lack of cooling infrastructure combined with poor hygienic practices leads to a high risk of milk spoilage. For the farmer, spoiled milk means product losses, which translates to lost income. Farmers also have limited market information about, for example, trends that can help them in their planning. Lastly, the inability to access lines of credit and other forms of financial support create a further challenge for stabilising and growing their economic activities.

Improving milk quality and food safety

Due to infrastructure and distribution challenges worldwide, ultra-high temperature (UHT) processing and packaging technology has played a vital role in providing people all over the world with access to safe, nutritious milk. In addition to extending shelf-life without the need for preservatives, the UHT process and packaging technology eliminates harmful bacteria and pathogens while maintaining the milk's nutritional value.

Improving milk quality on a large scale, as part of the transition from an informal to a formal dairy market, requires a comprehensive approach that considers all of the interconnected systems across the value chain. Actions taken must consider the impact that each of these systems can have on milk quality, as well as how the systems influence one another. Recommended measures include, but are not limited to:

- **Healthy cow management:** optimal livestock health through vaccination and disease control maintains healthy dairy animals to prevent the transmission of zoonotic diseases through milk.
- **Strict hygiene protocols on farm:** use of food-grade equipment, proper hygiene and cleaning helps to prevent contamination.
- **Animal feed monitoring:** checking feed is important to ensure it contains no harmful substances that could negatively impact milk quality and safety.

- **Sanitised, food-grade approved milk storage:** use of appropriate stainless-steel containers (rather than, e.g., plastic jerry cans) helps prevent bacterial growth and contamination.
- **Rapid cooling:** transferring milk to cooling tanks as soon as possible after milking inhibits bacterial growth and preserves quality.

EXAMPLE:

Diseases transmitted from animals to humans (zoonotic diseases)

The introduction of formal market structures can, over time, help to mitigate some of the biggest public health challenges associated with informal dairy markets. A key example is the risk of zoonosis such as bovine tuberculosis. Solving such challenges requires the implementation of stricter standards ***throughout the entire dairy production chain***. This takes place in stages:

1.

Milk ceases to be sold directly from farm to consumers and is instead transported from farms to processors. Processing facilities use heat treatment like pasteurisation along with aseptic packaging technology to eliminate harmful bacteria that can cause tuberculosis or other diseases in humans.

2.

As a market matures and becomes more organised, regulations and oversight come into effect that further reduce the risk. Governments introduce centrally managed disease strategies, with mandatory testing for tuberculosis in cattle. Infected animals are isolated, and they are no longer used for milk production.

3.

Increased enforcement and inspection over time can eradicate the presence of tuberculosis or other diseases in a country's cattle population, ensuring that diseases cannot again spread to the human population via contaminated milk.

- **Rigorous testing at the point of collection:** early detection of, e.g., high bacterial counts, somatic cell counts, antibiotic residues or other contaminants facilitates the identification and removal of problematic milk.
- **Safe processing:** heat treatment processes, such as pasteurisation or UHT treatment, effectively eliminate harmful bacteria and pathogens and extend milk's shelf-life without compromising taste or nutritional value.
- **Strict quality-control measures in processing plants:** further testing after pasteurisation ensures that milk and dairy products meet the highest quality standards.
- **Advanced sanitation in processing plants:** Proper analysis identifies potential contamination risks at every processing stage. Additionally, advanced cleaning technologies and sanitisers maintain a rigorously clean environment to ensure food safety.
- **Aseptic processing and packaging:** aseptic packaging technologies prevent spoilage, extend shelf life and enable ambient distribution, ensuring the milk is safe for consumption and the risk of harmful bacterial growth is minimised.
- **Continuous training throughout the value chain:** education and knowledge sharing for stakeholders across the value chain ensures that everybody understands best practices for production, handling and food safety to maintain quality standards and minimise contamination risks.
- **Education campaigns for consumers:** informing consumers about the benefits of processed and packaged milk helps increase understanding and demand for safe, nutritional products with a long shelf life.
- **Collaboration between stakeholders:** government bodies, milk producers, dairy processors and researchers must be properly aligned to set and enforce industry standards and best practices.

CASE STORY

Nicaragua

Between 2012 and 2018, Tetra Pak Food for Development collaborated on a joint venture with dairy processor Centrolac to bring the Dairy Hub model to Nicaragua. The project reached 650 farms in total, through 60 reference farms.

Outcome:

81% increase in average milk yield during a 12-month period in the Acopaya region, from 3.2 litres to 5.8 litres per cow per day (reference farms)

124% increase in average calf weight gain, from 107 to 240 kg, after 12 months (reference farms)

81% increase in the quality of milk rated as Grade A, as compared to 6.4% at baseline (total farms)

Formalised markets drive economic development

Formalising the dairy economy is not simply a matter of increasing the production of higher quality, safer milk. As we have seen, the informal market is something that has a negative, wide-reaching impact across society: from the farms and the communities they serve to the national economy. In other words, the need for formal dairy markets is therefore closely tied to broader questions of economic development at the local, regional and national level.

In contrast to informal markets, the formal dairy sector provides many opportunities for smallholder farmers. Here, farmers can enter into contracts to supply their milk to dairy processors – effectively transforming them from a subsistence farmer to a small business owner. This enables farm profitability, making it easier for farmers to invest and plan for future growth. It also helps create access for investments, loans and partnerships that can provide the necessary capital for mechanisation and expansion. Furthermore, dairy processors can take advantage of periods of abundant milk production by producing long-shelf-life products, thereby evening out seasonal differences and being able to process during times of over-supply and sell in times of shortage.

And the economic benefits of a formal market extend far beyond just the farms themselves. As the stability of the dairy market increases, and with it farm profitability, new jobs are created on farms, at processors and throughout the entire sector. In this way, success for smallholder farmers encourages the long-term viability of the domestic dairy sector. In addition to benefits at the local level, improved milk quality and increased production can create export opportunities to strengthen the national economy as well.

A focus on farm profitability

For a formal market to gain acceptance, it needs to be economically viable for all stakeholders. This starts with a focus on farm profitability, with farmers receiving a fair market price in return for a stable supply of milk. When farmers understand how new practices contribute to improved profitability for their farm, they are more likely to commit to those practices and, in doing so, lay the groundwork for a formal dairy market.

Many discussions of profitability focus primarily on the price of a product, but it is important to note that it is not the price of milk alone that determines farm profitability. It is also a question of production cost and the margin realised on each litre of milk produced. This is why it is so critical to implement best practices, such as improved record keeping, that have a direct impact on lowering those production costs and thereby increasing profit margins.

Of course, the first people to benefit from a focus on farm profitability will be the farmers themselves.

With a more stable income source, farmers can get out of "survival mode." They will be able to more confidently provide for their families, ensuring food is always on the table and their children can receive an education.

Ultimately, however, this focus can positively impact the broader communities around the farm. A financial boost enables farmers to invest in better farming practices, modern technologies and improved animal welfare, which in turn fosters agricultural development. This stimulates socio-economic uplift, as the farmers can contribute more to the local economy by creating job opportunities within an increasingly prosperous agricultural sector.

As the farmers' income increases, they are more able to spend on goods and services in their communities, further stimulating local and national businesses. Studies have shown that nations with a thriving dairy sector have more vibrant economies with better community services. In fact, a well-performing dairy sector can raise both average family income and the

Why focus on farm profitability?

Focusing on farm profitability is more than just a focus on farm profitability. By lifting up small-holder farms, you increase food security at a household and national level. Ultimately, such an approach can support the economic development of families, communities and entire nations. Some of the benefits can be seen right away, others only become clear over time.

Immediate benefits

- ↑ Milk production on farm
- ↑ Formal milk processed
- ↑ Family welfare
- ↑ Agricultural best practices
- ↓ Family-level poverty
- ↑ Farm employment
- ↑ Farmers' standard of living
- ↑ Better quality farm inputs
- ↑ Knowledge and competence
- ↑ Family nutrition, health, medical and education

The information in this table is based on several collaborative workshops with Dairy Hub processors in Uganda, Rwanda and Kenya. It has been validated by experience in Dairy Hubs and shown to be relevant for countries around the world.

Long-term benefits

- ↑ National GDP
- ↓ Community unemployment
- ↑ Farm, and dairy processor investments & expansion possibilities
- ↑ Steady incomes
- ↑ Long-term planning and growth
- ↑ Public trust in dairy sector
- ↑ Health and education of communities and nations
- ↑ Family nutrition and health
- ↑ Research and development
- ↑ Sustainable industry
- ↑ Community and national development
- ↑ Trust in the dairy business

national GDP[xxxi]. Increased milk production also contributes to regional and national food security efforts by ensuring a stable and sufficient supply of nutritious dairy products.

In other words, a focus on farm profitability offers benefits that go beyond farm profitability itself. The development of a more robust dairy sector offers a number of important ripple effects in the broader economy, fostering economic growth and improving quality of life for individual farmers and people throughout rural communities, as well as on a national scale. When done purposefully and properly, these efforts can therefore be a powerful tool for poverty reduction[xxxii].

Empowering women

As we have seen, the transition to a formalised dairy sector offers broad-based advantages to local and national communities. Women in particular often stand to benefit the most when dairy farming can become a more reliably profitable profession. In this way, the development of an organised dairy sector can also contribute to UN Sustainable Development Goal 5: the achievement of gender equality and the empowerment of women and girls.

Around the world, women play a major role in dairy production systems.

They are often responsible for care of the animals, milking, and transporting and selling the milk at market. In fact, according to the FAO, women directly own around a quarter of the dairy cows in cattle-keeping households, which means that upwards of 37 million dairy farms are run by women[xxxiii].

By creating the opportunity for a stable income source, a formal dairy market creates benefits for both the women running these family farms and their daughters who they can afford to send to local schools. Add to this the nutritional value that high-quality dairy products can bring to women and girls at different stages of their lives, and you start to see the immense potential that a vibrant dairy sector can offer to the cause of gender equality.

Organising the dairy sector

On a national strategic level, a comprehensive approach is required to organise dairy sectors to support economic development and the building of sustainable food systems.
Key elements to consider include:

Infrastructure development

A robust dairy infrastructure includes transportation and reliable roads, as well as efficient cooling, storage and distribution networks. Reliable infrastructure at every step of the value chain ensures milk is readily available to all regions of a country: from farmer to processor to retailer to consumer.

Regulatory measures

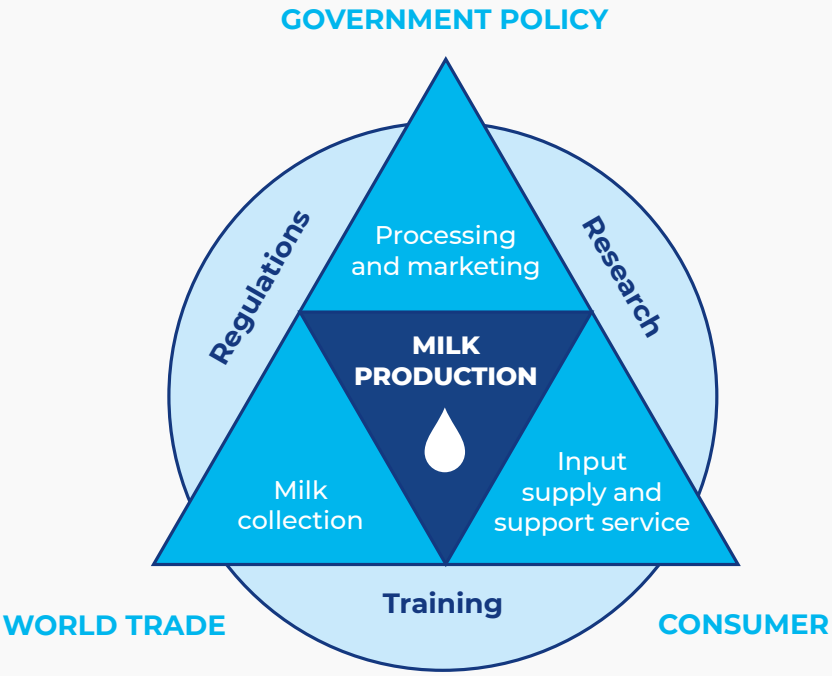
Regulations must ensure quality and safety standards for animal health and welfare, milk production on the farm, and the processing of dairy products. At the same time, they should also promote fair competition within the dairy industry.

Monitoring and evaluation

Mechanisms must be in place to monitor the effectiveness of implemented strategies, with evaluation allowing for adjustments based on feedback and data. Many emerging countries have the right policies in place, but these are not enforced, which reduces trust in the sector and enables the continued existence of informal markets.

How an organised dairy sector is structured

Dairy is an important lever for governments to understand, both economically and socially. With the right structures in place, a country can create an environment that promotes increased milk consumption as part of a broader effort to enhance public health and nutrition, while also laying the groundwork for a sustainable dairy industry. The chart here illustrates the necessary features of an organised dairy sector, as described by the FAO[xxxiv].



Key points to consider

As the information in this chapter illustrates, support to smallholder farmers can have wide-reaching socio-economic effects. But what is the best way to go about it? While technology no doubt plays a role, improved knowledge and practical skills must first be in place to address the previously discussed challenges and make inroads in economic development. There are thus a number of points to consider:

- Incentives, such as quality-based payments, are required to drive changes in milk quality. Training alone is not enough. Implementation of strategic initiatives should therefore consider ways to, for example, incentivise lower bacterial counts, lower somatic cell counts, etc.
- To carry out effective interventions at farm-level, there must be collaboration with both local and national governments to ensure a strong disease management strategy for the entire country. Without such a strategy, all improvements could be wiped out were an infection such as foot-and-mouth disease to become endemic in a community.
- Extension services are insufficient in many countries or don't exist at all, creating a need for farm advisory and training to small holder farmers.
- Dairy farmers must receive education on the priorities of milk production. This includes technical training on dairy production, animal nutrition, health and welfare, calf rearing and young stock management, disease prevention and breeding practices, as well as necessities for healthy soil and planning, growing and harvesting forage. Understanding of the right priorities can significantly enhance farm productivity and profitability.
- The most important factor in creating behavioural change is to change the way people think, which requires understanding people's goals and the reasons they do or do not want to change, aligned with science-based technical information.
- Proper diet is vital for dairy animals to increase their milk production. This includes access to enough quality feed, enough clean water (up to 150 litres per cow per day) and balanced nutrition (energy, protein, fibre, minerals, etc.).
- Building or improving infrastructure such as roads, cold storage facilities, and transportation networks can reduce waste and improve efficiency in the supply chain.
- Facilitating connections between local producers and dairy processors provides the necessary access to broader, formal markets. This includes urban areas and potential export markets, with a focus on supporting income opportunities and incentivising increased productivity.
- Farmers need access to affordable lines of credit and reliable financial services in order to invest in better feed, better farm inputs, modern technologies and improved animal health and welfare.
- Environmentally friendly practices like efficient water use and manure management can improve both the sustainability of the dairy value chain as well as long-term productivity.
- Collaborations between government bodies, private enterprises, NGOs, and research institutions offer farmers access to diverse expertise and resources for improving the efficiency of both the farms and, in the long-term, the dairy value chain.

CASE STORY

Kenya

KEMDAP

Between 2017 and 2021, Tetra Pak Food for Development collaborated with SIDA (donor) and Heifer International (implementer) to link 30,000 smallholder farmers to the dairy processor New Kenya Cooperative Creameries (NKCC). In addition to ensuring stable market access for the farmers, this enabled safe distribution of ultra-high temperature (UHT) milk throughout Kenya. The increased shelf life of UHT milk means it can reach remote areas without a cold chain and thereby improve food security and safety.

Outcome (KEMDAP):

65% increase in overall milk production, from a baseline of 5.4 to 8.9 litres per cow per day (total farms)

- Upper Eastern region: **85%** increase, from 5.9 to 10.9 litres per cow per day
- Northern Rift region: **61%** increase, from 4.5 to 7.2 litres per cow per day

36% increase in participation of women as dairy producers and active milk suppliers (total farms)

70% increase in women and youth employed by or establishing businesses along the dairy value chain (total farms)

109% increase in the proportion of women in Dairy Hub leadership positions (total farms)

Githunguri

Tetra Pak Food for Development collaborated with the dairy processor Githunguri Dairy Farmers Co-operative Society (GDFCS) to focus on increasing their total milk collection and to increase both milk production and farm profitability at farm level. The project started in 2022, including 17 farm advisors, 27 reference farms, and 11,600 total suppliers. Below data reflects results from 2022-2024.

Outcome (Githunguri GDFCS):

17% increase in milk production per cow per day (reference farms)

92% increase in total milk sold at farm level (reference farms)

26% increase in farm profitability (reference farms)

71% decrease in milk rejections from farmers at milk collection centres (total farms)

8% increase in total milk collection for the processor (total farms)

A practical solution: the Tetra Pak Dairy Hub model

As we have seen, the transformation of an informal dairy sector requires partner-based solutions and strong collaboration across the value chain. This is an idea at the core of the Tetra Pak Dairy Hub model, which is designed to foster exactly this type of collaboration.

The model serves three main purposes. It centres around support to a dedicated dairy processor with the aim of developing a stable supply of locally produced, quality milk. It facilitates the formalisation of the sector by providing smallholder farmers access to market structures. And it aids improved productivity and profitability of farms through competence development.

To realise these purposes, every Dairy Hub project starts by assessing and prioritising local needs, which can include:

- Setting up milk collection infrastructure and quality testing services.
- Ensuring regular milk collection.
- Encouraging a trustworthy formal supply agreement system to ensure fair and reliable milk payments from processor to farmer.
- Providing practical, science-based advisory services.
- Encouraging and making global best practices available and understood at farm level and during milk collection.

In short, the Dairy Hub model offers a practical solution to the complex, overlapping challenges so far discussed in this handbook, with benefits for stakeholders across the value chain.

A holistic approach to dairy development

The most important factor for a Dairy Hub's success is trust. Trust between the dairy processor and the farmer is essential, as is trust in the farm advisors. To empower farmers and motivate successful change, you must first

understand farm and family goals as well as what drives them to want to change or not. You must then prove through science and success cases that your recommendations will work.

When a person sees that a change – even a small change – has positive impact, they are more inclined to accept the proposed change. Over time, the changes become established practices, paving the way for the development of a vibrant and robust dairy sector. This is the objective behind our systems-level approach.

Taking a systems-level approach

The Tetra Pak Dairy Hub model has been designed with a holistic approach that considers all the different elements of the dairy value chain and how they interact with one another. Rather than focusing exclusively on farmer yield, the aim of this approach is to identify and prioritise what is needed to make the farmers' more profitable and, in doing so, build the trust necessary for long-term success.

The "value chain" metaphor suggests a linear order of operations, with separate and distinct "links" on the chain that lead to the next: farm, processor, packager, store, consumer, etc. But the reality of the dairy sector is far more complex. It is a tangled web of interconnected and overlapping systems. Each of the systems are dependent on and influence the others.

Some of these systems are local and hyper-specific while others are national or even international in scope. There are far too many to list here, but even a brief overview offers an understanding of the complexities at play:

- **The farm** – an entire ecosystem unto itself, but also made up of and reliant on a vast array of smaller systems: crop management systems, animal health and welfare systems, water and irrigation systems, record keeping systems, budget and economic systems, and many more.

The most important factor for a Dairy Hub's success is trust.

- **The rural community** – Smallholder farmers are often part of local communities consisting of other farmers and the people who purchase their produce. Farmers learn from and influence one another, and actions taken on one farm can impact an entire region.
- **The collection and processing networks** – There are several steps between farmer and processor, and these are reliant on a range of smaller systems: transportation systems, cooling systems, processing and packaging systems, distribution systems, and more.
- **The consumer marketplace** – Consumers create demand, but they are strongly influenced by external forces: advertising and marketing systems, grocery and retail systems, etc. In the age of social media, even communication and internet systems play an important role.
- **The policymakers** – Government policy is critical to agricultural development efforts: from animal disease prevention and infrastructural planning to public health information campaigns and nutrition initiatives that distribute milk in schools. Success of these programmes requires government commitment and the involvement of various public agencies.

Given this complexity, it's easy to see why limiting actions to the farm-level will not lead to meaningful, long-term change in the overall market. That's why the aim of the Dairy Hub model is to foster collaboration, allowing these various systems to better connect with and support one another. It is only by first stepping back and helping different stakeholders to better understand the others' needs that you can build the foundations for a formal dairy sector.

Profit over yield

The Dairy Hub model is rooted in a focus on farm profitability.

On one hand, this is a question of cost optimisation: improving farm efficiencies by, for example, working with farmers to grow their own feed rather than having to purchase it. On the other hand, it's about making sure the farmers can always sell their milk at a fair market price. The lynchpin of the model is the relationship that is built between the farmers and the processor, based on a guarantee that the dairy processor will purchase all milk that is produced.

By linking up the different systems in the value chain and focusing on profitability, you can build the trust necessary to ensure success. This is how the Dairy Hub model differs from traditional programmes, and why it has been able to produce the results it has over the course of more than a decade (see the accompanying country examples to explore these outcomes).

The one herd concept

In the Dairy Hub model, dairy processors adopt an integrated management approach, in which all cows across its network of dairy farmers are treated as a single, collective herd. This allows for coordinated efforts like joint vaccination programmes, bulk purchasing of feed, fodder preservation and prioritising shared farmer training on best practices. It also encourages farm record-keeping and data analysis to make data-driven decisions and predict milk supply volumes for processing. By managing all the suppliers as one herd, the processor enhances consistency, efficiency and sustainability while optimising resource management and providing better support to smallholder farmers.

This concept strategically defines the milking herds supplying the processor as "one herd." In doing so, it encourages and facilitates specifically defined work that will enable farms to progress according to identified priorities.

CASE STORY

Sri Lanka

Between 2013 and 2016, a Dairy Hub was set up in a collaboration between Tetra Pak Food for Development and the dairy processor Cargills Quality Dairies. The project reached 400 farms. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) served as the project's funding partner.

Outcome:

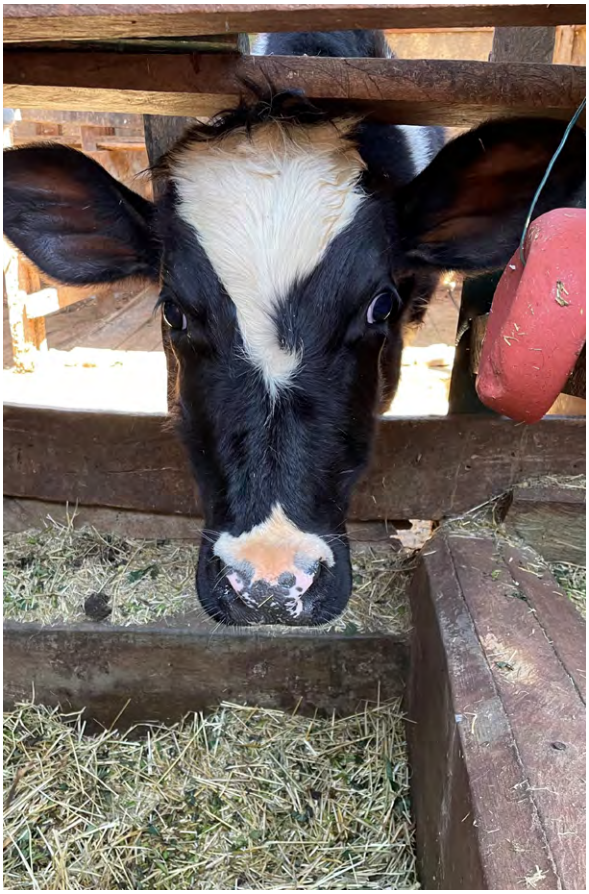
42% increase in average milk yield, from 3.1 to 4.4 litres per cow per day (total farms)

57% increase in gross income for participating smallholder farmers (total farms)

Tetra Pak's Dairy Hub model: the basics

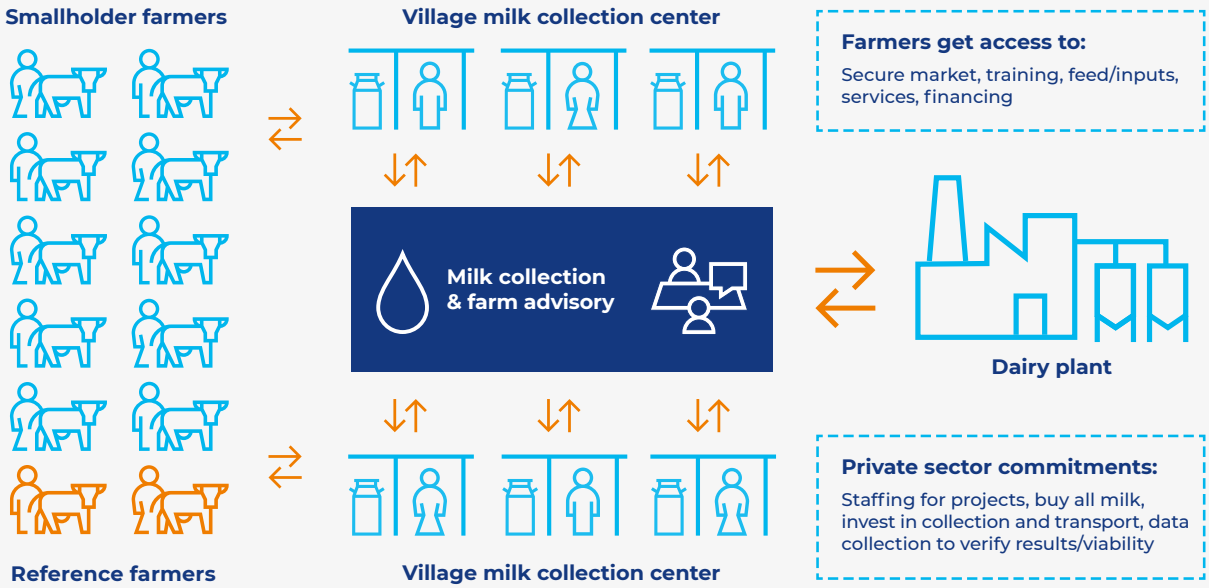
Each Dairy Hub project is unique, but the starting point is always to secure a long-term supply of locally produced, quality milk without an increased collection cost. Based on years of experience and results, our model builds on the knowledge that, through upskilling and education, it's possible to transform subsistence dairy farming into a profitable business, improving the livelihood of thousands of smallholder farmers in the process. There are four main objectives:

1. **Increasing farm profitability**
2. **Improving milk production at every level:** cow, farm, region, total supply
3. **Ensuring robust milk collection:** the supply of milk from smallholder farmers to dairy processors
4. **Improving milk quality**



Structure of the Dairy Hub model

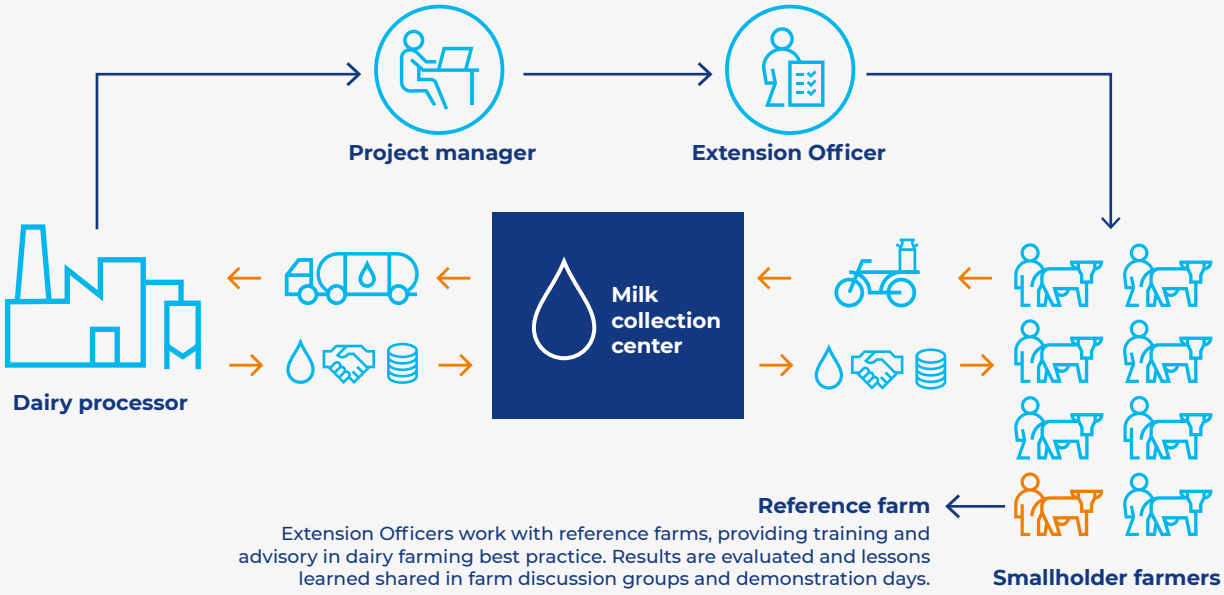
This chart shows possible flows of milk supply and payments within our Dairy Hub model.



A Dairy Hub project can encompass multiple hubs within a radius of 20-25 kilometres from the collection and cooling centres. Each hub can include between 400 and 2000 smallholder farmers, depending on the farming systems in that area. To strengthen connections between smallholder farmers and a dedicated dairy processor, an "extension team" of farm advisors provide practical technical knowledge to the farmers. These farm advisors are usually employed by the dairy processor.

Farmers deliver milk in milk cans or containers, either via a milk collection point or directly to village milk collection centres. This is typically done twice per day, in the morning and evening. Delivery can involve several modes of transportation: bicycles, motorcycles, wheelbarrows, ox or donkey carts, and much more. At the village milk collection centre, milk is tested for basic quality control, then poured or pumped into cooling tanks before transport to a central collection centre or to the dairy processor (see the accompanying figure, *Structure of the Dairy Hub model*).

Increasing access to safe food through the Dairy Hub model



Extension Officers work with reference farms, providing training and advisory in dairy farming best practice. Results are evaluated and lessons learned shared in farm discussion groups and demonstration days.

Roles and responsibilities

Understanding and elevating farmers

Throughout the world, agriculture is often considered a low-status profession performed by uneducated people. Many see farming as a simple job and a simple lifestyle. The reality is that productive, efficient farming is incredibly complex, and farm advisors in a Dairy Hub have an equally complex role. To be of true value to the farmers they are supporting, the farm advisors must first be sufficiently upskilled, with required competencies and knowledge in a vast range of fields. Focus areas include, but are not limited to:

- **Animal health and welfare**
- **Physiology**
- **Feeding and nutrition**
- **Biology**
- **Soil science**
- **Botany**
- **Crop planning**
- **Weather**
- **Machinery and machine maintenance**
- **Record keeping, data management and analysis**
- **Economics and trade**
- **Accounting and business management**
- **Food production, safety and quality**
- **People management and production systems**
- **Leadership**

Through a thorough understanding of these topics, the farm advisors' focus is on supporting farm production and profitability by providing enough water and feed, improving cow comfort and animal health, securing better record keeping, and reducing costs per litre of milk produced. Additionally, the farm advisors must understand people: what motivates them to make changes or what prevents them from doing so. They should also be able to communicate their knowledge effectively, technically, and in a manner that drives action. The Dairy Hub model is structured in a way to ensure that farm advisors have the resources, training and support to do exactly this.

Critical success factors for profitability

Access to markets for farmers

including a processor that buys all milk and pays in a timely manner.

Animal health and welfare

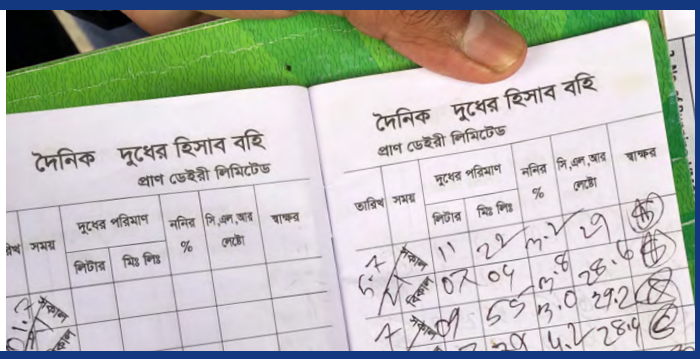
which ensures that mortality rates are lowered throughout the farm and that productive cow longevity is improved.

Quality, home-grown feed

instead of purchased feed that would otherwise increase costs and result in farmers losing control of forage quality.

Record keeping

to support data-driven decisions that support farm management and thereby long-term profitability.



How a Tetra Pak Dairy Hub project works

Stakeholders in a Dairy Hub

To understand how a Dairy Hub project works, it's first key to familiarise yourself with the different parties that are involved. As noted, the Dairy Hub model is rooted in a collaborative approach, requiring a range of diverse stakeholders. Each of these stakeholders plays a key role, contributing to the success of the project in different ways.

The dairy processor

The dairy processor's core business is collecting, processing, packaging and distributing quality milk and other dairy products to the market and consumers. Part of their work is to ensure milk and other nutritious dairy products are available and accessible, to educate consumers, and to increase awareness of milk.

The dairy processor is in effect the owner and manager of the Dairy Hub project – committed to investing in solutions and the teams required to secure a long-term supply of locally produced, quality milk. They are responsible for conducting appropriate assessments, project planning, employing the farm advisors, investing in infrastructure and running the overall Dairy Hub project. This is a long-term investment that will ideally continue long after the initial project is over.

Milk quality improvements are driven by the processor. Experience has shown that milk quality improvements only happen when the processor structures incentives or penalties for milk-quality standards.

With these responsibilities in mind, the processor commits to collecting and, on fair terms, buying all milk that meets the quality requirements from the participating farmers, twice per day, all year. As the previous chapter explained, this is critical for building trust between the farmers and the processors that is necessary for the success of the project. It is a win-win

situation, with the processor securing a stable supply of quality milk, and the farmers enjoying the benefits of the formal market, instead of reverting to selling milk through intermediaries.

The dairy farmer

In the Dairy Hub model, we ensure the dairy farmers are committed and understand the expectations and benefits of joining the project. Farmers that join are trained by the extension team of farm advisors and provided with a formal channel in which they can sell and deliver their milk.

As the previous chapters illustrated, taking part in a Dairy Hub project can offer a number of key benefits for the participating farmers. These include learning a more business-focused approach to dairy farming with a foundation of science-based knowledge. Farmers gain practical, experiential-based skills, healthier animals and a stable, increased income. In other words, participation helps create a more sustainable, profitable and viable dairy farm.

The extension team

An extension team of farm advisors are employed by the dairy processor. They receive training from the Tetra Pak Food for Development team, which they use to train the participating farmers (see Training the trainers, below). They are also responsible for supporting, monitoring and assessing the participating reference farms to ensure they are on track with project targets.

CASE STORY

Dominican Republic

Between 2021 and 2022, Tetra Pak Food for Development supported dairy processors Coopesur and Agampta, starting two separate Dairy Hub projects in the Dominican Republic.

Coopesur outcome:

13% increase in average milk production, from 176 to 198 litres per farm per day (reference farms)

23% increase in average milk yield, from 6.5 to 8 litres per cow per day (reference farms)

13% increase in average farmer income (reference farms)

37% increase in raw milk collection, from 11,740 to 16,100 litres per day (total farms)

Agampta outcome:

21% increase in average milk production, from 177 to 215 litres per farm per day (reference farms)

14% increase in average daily milk yield, from 7 to 8 litres per cow per day (reference farms)

26% increase in gross farmer income (reference farms)

Tetra Pak

Tetra Pak has vast knowledge to help local food processors and entrepreneurs develop their businesses. In the context of a Dairy Hub, a local Tetra Pak Market Company will initiate and coordinate dialogue with the dairy processing customer. Tetra Pak also maintains contact with central resources and supports the processor with dairy processing and packaging expertise.

The Tetra Pak Food for Development team consists of world-class dairy experts with extensive experience of the global dairy industry. This team works as a catalyst, knowledge source, initiator, and project management implementor of a Dairy Hub project, providing technical information and practical training expertise. With experience from previous successful development projects, the Food for Development team provides ongoing support for the project from initiation until handover.

DeLaval

DeLaval is a full-service supplier to dairy farmers around the world and has vast knowledge of milk production and animal husbandry. With their expertise and farm solution equipment and products, DeLaval helps dairy farmers improve milk production and quality.

In the context of a Dairy Hub project, DeLaval may support in a variety of ways, including contributing expertise for developing and improving milk production and milk quality at industry level and at farm level. They also guide processors and farmers in choosing the right equipment for mechanising smallholder milk production.

Donors and implementing agencies

In order to scale a project, Tetra Pak Food for Development sometimes partners with donors and implementing agencies, building strong collaborative relationships with these organisations. These partnerships are officially known as Public Private Development Partnerships (PPDPs).

Implementing a Dairy Hub project

Every Dairy Hub is set up and structured according to the specific demands of the country and region in which it is operating. In broad terms there are two main ways of implementing a Dairy Hub project:

1. **Direct implementation:** Tetra Pak Food for Development and the local Tetra Pak team work directly with a dairy processor (who is

Tetra Pak's customer) and the dairy processor's farm advisors to support smallholder farmers. Food for Development dairy experts are responsible for all training, and they manage the Dairy Hub project in collaboration with the dairy processor.

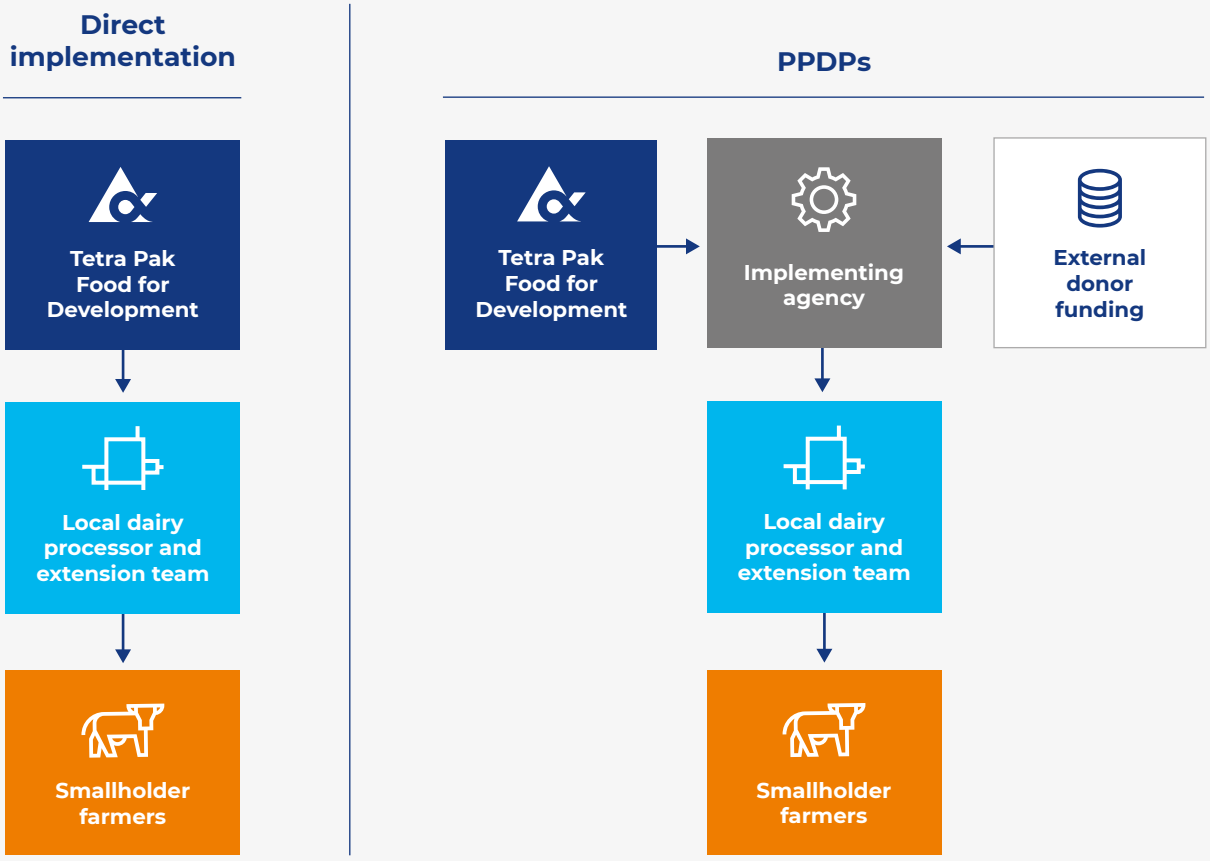
2. **Public Private Development Partnership (PPDP):** Tetra Pak works in collaboration with a donor and an implementation agency. The implementation agency runs training programmes together with the extension team under the guidance of the Food for Development dairy experts, using the Dairy Hub model and Tetra Pak's established methodology. In this model, the donor funds the implementation agency. Such collaboration must also be in alignment with national governments.

Getting started

Several initial measures are necessary for setting up a local Dairy Hub, regardless of if it is implemented directly or through a PPDP. It starts with an analysis of the current local dairy sector, including an initial online survey, discussions, and a visit from the Tetra Pak project team to assess needs, goals, challenges and opportunities.

The organisation of Dairy Hub stakeholders

An illustration of Dairy Hub project stakeholders, based on method of implementation. When donor funds are involved, an implementing agency is in charge of allocated aid funds. Donor-funded projects require government buy-in. The purpose of working in PPDPs is to enable scaling.



Next, a project plan is built according to the processor's goals. An analysis of current milk collection infrastructure and processes is crucial. If the conclusion is that infrastructure and processes are insufficient, the processor will need to invest in the required cooling and collection solutions, employees and systems needed to achieve the goals.

The processor needs to plan for building, managing and developing an extension team of farm advisors.

A long-term strategy is needed for the recruitment, onboarding and overall development of the farm advisors, which requires both investment and good leadership.

The Food for Development dairy experts provide practical and theoretical training for the farm advisors and redefine their purpose (see "Training the trainers" later in this chapter for more information).

The dairy processor's responsibilities

A dairy processor has several key responsibilities to ensure the Dairy Hub works according to the model. These include:

- **Investing** in milk collection and cooling infrastructure, trucks, data-recording systems, and milk testing equipment and processes.
- **Setting up** a system for monitoring the raw milk supply.
- **Appointing** a dedicated project manager and an extension team of farm advisors.
- **Supplying** the farm advisors with vehicles to visit the participating farms.
- **Printing** training material in collaboration with Tetra Pak.
- **Providing** access to the digital Dairy Hub training tool.
- **Ensuring** the farm advisors visit, assess, train, support, monitor and evaluate the participating farmers and reference farmers on a regular schedule.
- **Committing** to collect all milk that meets quality standards at the collection centres and to pay the farmers in a regular and timely process. The way this is done, over time, will either build or destroy the trust that is key to ensuring long-term success for the project and, as a result, for the dairy processor themselves.

How Public Private Development Partnerships work

Public Private Development Partnerships (PPDPs) bring together governments, private enterprise, and international organisations to tackle development challenges. With the Dairy Hub model, a PPDP could involve funding from a donor agency, like the Swedish International Development Cooperation Agency (SIDA) or the International Finance Corporation (IFC). The government may play a role in contributing essential infrastructure like roads. National, regional or local dairy boards may participate in making strategic decisions.

The private enterprise actors include the dairy processors who provide the milk collection and dairy processing infrastructure and systems. They also include Tetra Pak Food for Development, who provides guidance and training in milk production and dairy development, as well as expertise in sustainable dairy practices and market linkages for small-scale producers.

UN organisations and other agencies may act as implementers, ensuring the project runs smoothly and efficiently, using the Dairy Hub methodology. This type of PPDP aligns with Sustainable Development Goal 17 (revitalised global partnerships for sustainable development), strengthening the dairy sector by leveraging the resources and expertise of all actors involved and ultimately improving lives and livelihoods.

Training the trainers

Training and technical assistance is the heart of the Dairy Hub model. The goal is to equip farm advisors with technical, change management and communication skills, so that they, in turn, can properly support the smallholder farmers.

A hands-on training process

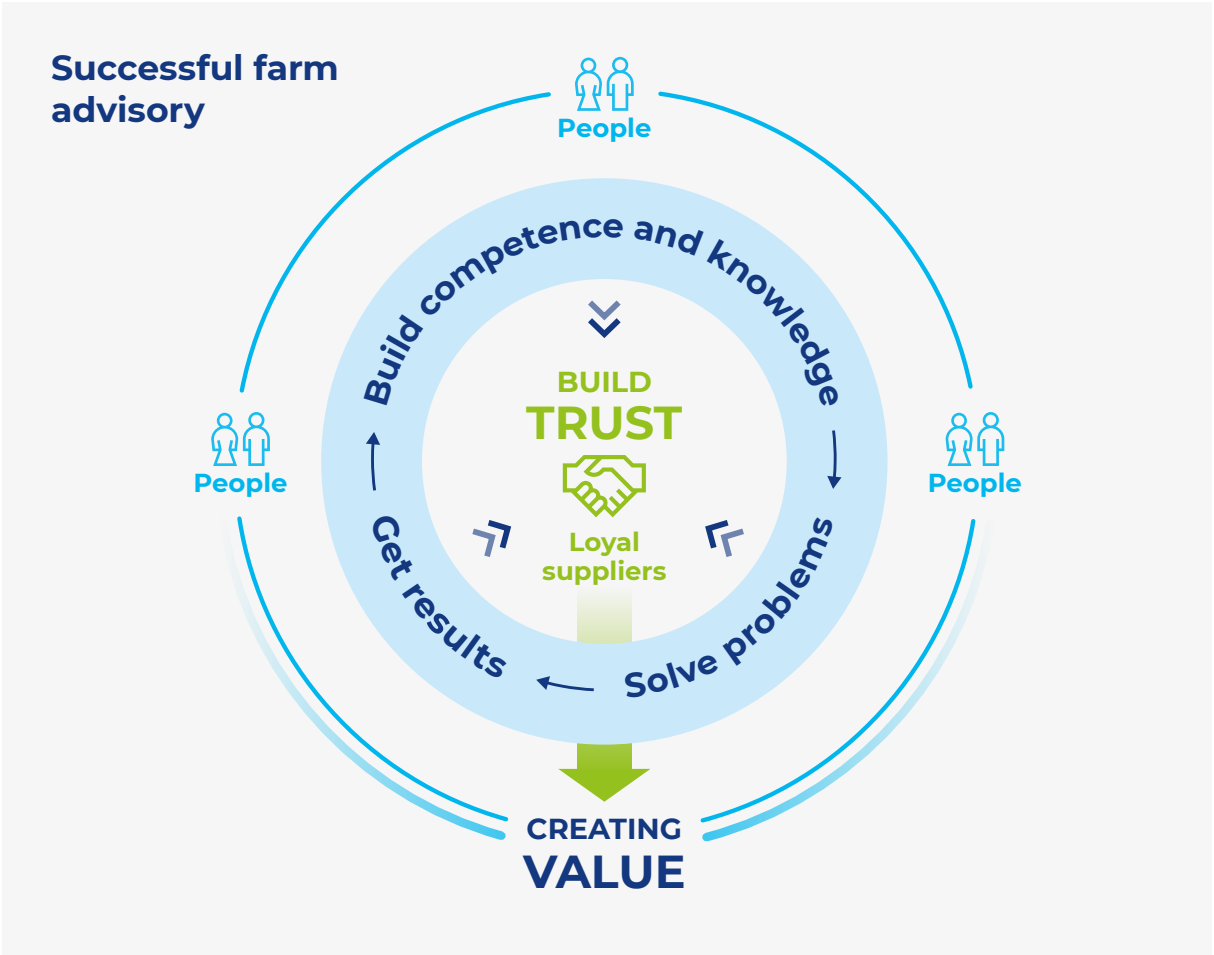
The Dairy Hub training process is characterised by a practical approach in which the farm advisors and farmers learn by doing:

1. Recording of baseline data and identification of farm and family goals, with work to achieve them through improved farm management, increased income and increased profitability.
2. Step-by-step changes in behaviour. By assessing and prioritising, change can be methodically implemented one step at a time, so farmers are not overwhelmed.
3. Recording of all activities and farm evaluation KPIs in the smallholder farmers' operations.
4. The extension team of farm advisors assists farmers to understand, prioritise, and implement changes.

Knowledge sharing is carried out using our "train the trainer" model. Tetra Pak Food for Development Dairy Experts guide the projects, providing the farm advisors with practical, foundational and science-based education. This is done in a variety of settings: in the field, in villages, on farms, in classrooms and online. The farm advisors take what they learn in this training and use it to train and implement change with the smallholder farmers. In this way, we ensure that best-practice knowledge and experience is embedded into the local organisations, contributing to long-term sustainable development.

Practical training from farm advisors starts at farm level, discussing farm and family goals with the farmers, identifying and assessing needs, and then providing the farmers with guidance and support to prioritise and solve their challenges. Here, an understanding of change management is crucial. The farmer must believe that the change is worthwhile and possible, which takes a practical understanding of ***what*** to do, ***why*** it is important (in terms of farm profitability) and ***how*** to do it. The farm advisor and the farmer must walk together in this journey, prioritising the challenges. This involves a step-by-step approach, based on the farmers' unique challenges and a farm evaluation tool (see chapter 5).

This what-why-how structure is an essential part of the train the trainer model. We know from experience that focusing on technical knowledge alone is not sufficient, and this way of teaching allows us to better convey the important reasoning behind best practices, both from an animal health and farm profitability perspective. Through this way of working, the farm advisor can demonstrate clear value to the farmers and thereby build the foundational trust discussed in the previous chapter.



Training and technical assistance is the heart of the Dairy Hub model.

In person and online

We offer an online learning tool, designed to allow learners to progress at their own pace and on the topics of their interest. The programme consists of interactive modules held via webinars and workshops, as well as follow-up video meetings, farm visits via video call and online chat groups.

The online learning tool has been developed and rolled out for various farm management topics across all modules. These include biosecurity, milk production, farm records and profitability, feeding and nutrient fundamentals, calf rearing and young stock, fertility and breeding, animal health and welfare, milk quality, and communication. Participants in interactive groups have access to follow-up materials and answers to training questions.

Food for Development Dairy Experts are also available remotely to identify and address any issues. They can support processors by:

- Answering technical questions
- Sharing articles and reports
- Communicating results
- Mentoring the farm advisor extension teams
- Posting visuals of on-farm activities.

Training modules

A selection of various online modules for Dairy Hub training. A wide variety of topics are covered, all connected to the central themes of best practice farm management and farm profitability.

Farm Records & Profitability

Nutrition & Feeding

Calf Rearing & Young Stock Managment

Fertility & Breeding

Online modules

Milk Production, Milking & Milk Quality

Animal Health & Welfare

Monitoring & Evaluation Tools

Biosecurity

The reference farm methodology

A core element of the Dairy Hub methodology is that farmers learn from farmers. That is to say, the training programme is built around sharing the successful experiences from one farm with other farms. This method has been extensively researched by industry and academics throughout food production systems and successfully implemented and optimised through experience in the Food for Development team. It has shown to be the most effective way of creating meaningful, long-term change[xxxv].

Projects are structured into three distinct phases:

1. Learn by doing
Alongside their own training, farm advisors begin working with and training "reference farms." Here, they identify and prioritise the farm's challenges, share best practice knowledge and competences, and support the farmer to implement change, leading to improved milk production and farm profitability. The farm advisors support, understand, mentor, monitor and evaluate these reference farms weekly. In turn, the reference farms provide the farm advisors with exceptional possibilities to learn how to successfully create change in a real-life situation.

2. Learn by experience
By consistently training and evaluating reference farms, we create "lead" farmers that act as an inspiration for the broader community. When the reference farms have been evaluated as being "good enough", they then share their results through farm discussion groups with surrounding neighbours and farms. By leveraging reference farmers' success stories, which inspire wider change and create a ripple effect in the local community, we harness the proven concept that farmers learn best from each other to drive meaningful transformation.

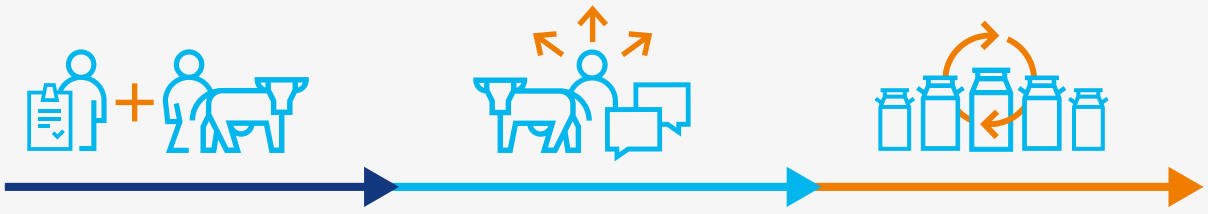
This builds trust and offers living proof that the Dairy Hub model works. The reference farm model shares the same overall objectives as the Dairy Hub model as a whole:

1. **Increasing farm profitability**
2. **Improving milk production at every level:** cow, farm, region, total supply
3. **Ensuring robust milk collection:** the supply of milk from smallholder farmers to dairy processors
4. **Improving milk quality**

3. Expansion
Led by the processor, the programme expands, and they confidently continue to share knowledge and competence throughout the industry.

Three phases of the reference farm model

The aim of the reference farm model is to reach these objectives by doing things better and more efficiently utilising the resources we have available.



1. Learn by doing

Farm advisors work closely with reference farms to implement best practices. Both farmers and the farm advisors learn by doing.

2. Learn by experience

When the farms are "good enough" they share their experience with the wider community.

3. Expansion

Food for Development hands over the continuation of the project to be led by the processor.

Project planning and tools

To support the various needs and phases of a Dairy Hub project, the Food for Development team has developed a range of project tools, based on extensive experience from previous Dairy Hub projects. These tools support the farm advisors and help in the monitoring and evaluation of the local dairy sector – both at the level of individual farms and the total milk suppliers. The tools are designed to offer flexibility, and they can be modified to accommodate specific needs in differing locations.

To meet evolving requirements, the Dairy Hub toolbox is under continuous development. Current tools include:

- The Dairy Hub Handbook
- The initial assessment survey
- The initial assessment visit and report on the local and national dairy sector
- The overview of the plan, structure and purpose of the project
- The baseline data collection form
- Commitment forms for participating farmers and extension officers
- The competence survey to understand base knowledge of farm advisors
- The farm evaluation tool
- The milking performance and milk quality evaluation tool
- The farm record keeping book
- The farm profitability recording tool
- The farm discussion group planning tool, including:
  - A change-focused question list for the discussion group
  - A farm discussion group report
- Invitation letters to kick-off events
- Training and development records for extension teams
- Technical training modules
- The online learning tool
- Analysis tables for reference farms
- Mid-point extension team interview processes and questions

All tools can be printed locally in the relevant language(s).

CASE STORY

Albania

Between 2019 and 2022, Tetra Pak Food for Development worked with dairy processors Lufra Sh.p.k. (Lufra) and Agroal & Global Services Sh.p.k. (AGS) in two separate projects to establish the first Dairy Hubs in Albania. One of the main outcomes of these projects was connecting farmers to the formal market by establishing milk collection centres in remote areas.

Outcome Lufra (2019-2020):

636 farms were involved in the initiative, including **25** reference farms

3 new milk collection centres were established

42% increase in total milk collection, from 60,000 litres per day in November 2019 to 80,000 litres per day in July 2020 (total farms)

24% increase in milk production per farm per day (reference farms)

24% increase in gross income per month (reference farms)

Outcome AGS (2019-2022):

55 farms were involved in the initiative

1 new milk collection centre was established

119% increase in milk production per farm per day, from an average of 24.9 to 54.5 litres (total farms)

27% increase in gross income per month (total farms)

Investing in a Tetra Pak Dairy Hub

Before investing in a Dairy Hub, a dairy processor should analyse what a project will mean for their business in terms of both potential expenses and benefits. Cost factors in a Dairy Hub economic calculation can involve people, infrastructure and systems, including:

- A project manager
- The extension team of farm advisors
- Cooling tanks
- Lab equipment
- Milk testing systems
- Milk tankers and milk transport
- Infrastructure installations, e.g., electricity, water and IT systems
- Monthly operating costs

The investments required will vary from case to case, depending on local market conditions and current levels of dairy industry development. We can assist with these types of assessments as needed.

Terms of reference

Each Dairy Hub project involves a Terms of Reference (ToR) agreement between the contributing stakeholders, which outlines:

- Who is involved
- The objectives and the targets of the project
- The prioritised project activities
- Who is responsible for each activity
- How the project will work
- The duration of the project

These agreements help define the project's overall scope, objectives, roles and responsibilities, and KPIs between the dairy processor and Tetra Pak.

Is a Dairy Hub right for you?

If you are a dairy processor, the first step in investigating the possibility of a Dairy Hub project is to contact the customer management team at your local Tetra Pak office. They can help you understand if a Dairy Hub could be a good fit for your business.

A long-term commitment to developing your local dairy value chain is vital to the project, along with necessary resource allocation and investments. Important factors to consider include, but are not limited to:

- Functional milk collection infrastructure
- Farm advisors to support the dairy farmers with training services
- Resources and technology
- People and systems to collect and test the milk
- Supplier management and payment systems

A Dairy Hub is a long-term strategic initiative.

The project requires ongoing, active engagement from all stakeholders. It is not a quick fix that you can start, stop, and start back up again.

CASE STORY

Panama

Between 2022 and 2024, dairy processor Industrias Lácteas, S.A. and Tetra Pak Food for Development initiated Panama's first Dairy Hub project. The project reached 300 farmers in total, through 43 reference farms.

Outcome:

10% increase in total milk collection, from 106,000 to 117,000 litres per day (total farms)

9% increase in average milk yield, from 8.8 to 9.6 litres per cow per day (reference farms)

36% increase in milk production, from 350 to 478 litres per farm per day (reference farms)

61% increase in gross income (reference farms)

Notes

i A dairy value chain involves the production of milk at farms, collection and transport of the milk to dairy processors for transformation into various products, and distribution of these products to consumers. Quality and safety are to be ensured at every step throughout the value chain.

ii Rust, Niki A., et al. Environmental Management (2021). *Have farmers had enough of experts?* https://link.springer.com/article/10.1007/s00267-021-01546-y and Enshayan, Kamyar, Deb Stinner and Ben Stinner. Journal of Soil and Water Conservation (1992). *Farmer to Farmer.* https://www.tandfonline.com/doi/pdf/10.1080/00224561.1992.12456688

iii A sustainable food value chain is a food value chain that: is profitable throughout all of its stages (economic sustainability); has broad-based benefits for society (social sustainability); and has a positive or neutral impact on the natural environment (environmental sustainability). See: Food and Agriculture Organization of the United Nations (FAO) (2016). *Sustainable Food Value Chains Knowledge Platform: What is it?*. https://www.fao.org/sustainable-food-value-chains/what-is-it/en/

iv This figure is a daily average based on currently available data from dairy processors.

v Stock, Jay T. and Jonathan C.K. Wells. Animal Frontiers (2023). *Dairying and the evolution and consequences of lactase persistence in humans.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10266752/pdf/vfad022.pdf

vi FAO (2016). *The Global Dairy Sector: Facts.* https://openknowledge.fao.org/server/api/core/bitstreams/beee9189-d92d-4a0d-86af-a1e3328c33d1/content

vii United States Department of Agriculture (USDA) (2019). *FoodData Central: Milk, whole, 3.25% milkfat, with added vitamin D.* https://fdc.nal.usda.gov/fdc-app.html#/food-details/746782/nutrients

viii International Dairy Federation (IDF) (2018). *Milk and dairy products are a sustainable food source for the next generation: Ban Ki Moon.* https://fil-idf.org/news_insights/milk-and-dairy-products-are-a-sustainable-food-source-for-the-next-generation-ban-ki-moon/

ix See: Global Dairy Platform (2023). *Simple facts about the dairy sector.* https://globaldairyplatform.com/

x Global dairy Platform (2017). *2017 Annual Review: Dairy. Everyday. Around the world.* https://www.globaldairyplatform.com/wp-content/uploads/2018/04/gdp-annual-report-online.pdf

xi Crippa, M., et al. Nature (2021). *Food systems are responsible for a third of global anthropogenic GHG emissions.* https://www.nature.com/articles/s43016-021-00225-9

xii United Nations (2023). *Goal 2: Zero Hunger.* https://www.un.org/sustainabledevelopment/hunger/

xiii World Wide Fund for Nature (WWF) (2022). *Save 1/3.* https://www.saveonethird.org/

xiv Learn more at https://www.tetrapak.com/sustainability/acting-for-sustainability/moving-food-forward

xv FAO (2022). *The future of food and agriculture: Drivers and triggers for transformation – Summary version.* https://doi.org/10.4060/cc1024en

xvi FAO (2018). *Sustainable food systems: Concept and framework.* https://www.fao.org/3/ca2079en/CA2079EN.pdf

xvii FAO (2019). *Climate change and the global dairy cattle sector.* https://www.fao.org/3/ca2929en/ca2929en.pdf

xviii IFCN Dairy Research Network (2021). *Dairy share on global GHG emissions.* https://ifcndairy.org/dairy-share-on-global-ghg-emissions/

xix While diseases in livestock do not directly contribute to methane emissions, illnesses cause animals to become less productive. This leads to a decrease in farm efficiency, contributing indirectly to an increase in emissions. See: Rinkus, Alex and Simon Coote. HealthforAnimals & Oxford Analytica (2023). *Animal health and Sustainability: A global Data Analysis*.

xx See: Ritchie, Hannah. Our World in Data (2021). *Smallholders produce one-third of the world's food, less than half of what many headlines claim*. https://ourworldindata.org/smallholder-food-production

xxi Borda, Áron József, Balázs Sárvár and Jeremiás Máté Balogh. Economies (2023). *Generation Change in Agriculture: A Systematic Review of the Literature*. https://www.mdpi.com/2227-7099/11/5/129#B55-economies-11-00129

xxii FAO (2021). *UN calls for urgent action to feed the world's growing population healthily, equitably and sustainably.* https://www.un.org/sustainabledevelopment/blog/2021/04/un-calls-for-urgent-action-to-feed-the-worlds-growing-population-healthily-equitably-and-sustainably/

xxiii HLPE (2021). *Promoting youth engagement and employment in agriculture and food systems: A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.* https://openknowledge.fao.org/server/api/core/bitstreams/034c-7cf9-9215-4304-a264-ecb0215a50d2/content

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xxv FAO (2013). *Family Farming Knowledge Platform*. https://www.fao.org/family-farming/detail/en/c/273864/

xxvi Ritchie, Hannah. Our World in Data (2021). *Smallholders produce one-third of the world's food, less than half of what many headlines claim*.

xxvii IFCN (2024). *Dairy Report 2024: Helping people in the dairy world to make better decisions. Extract:* https://ifcndairy.org/wp-content/uploads/2024/10/DR-2024-extract.pdf

xxviii See, e.g.: United States Food and Drug Administration (FDA) (2024). *The Dangers of Raw Milk: Unpasteurized Milk Can Pose a Serious Health Risk.* https://www.fda.gov/food/buy-store-serve-safe-food/dangers-raw-milk-unpasteurized-milk-can-pose-serious-health-risk and N. de Klerk, Joanna and Philip A. Robinson. PeerJ (2022). *Drivers and hazards of consumption of unpasteurised bovine milk and milk products in high-income countries.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9135038/

xxix Dattani, Saloni, Fiona Spooner, Hanna Ritchie and Max Roser. Our World In Data (2020). *Causes of Death*. https://ourworldindata.org/causes-of-death

xxx Raw milk should be cooled to 4°C as soon as possible after milking and ideally within three hours at most.

xxxi FAO (2018). *Dairy Development's Impact on Poverty Reduction.* https://openknowledge.fao.org/server/api/core/bitstreams/d6ccc94e-54de-4ba9-9573-1e2d1b948cb9/content

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xxxiv Dugdill, Brian, et al. *Dairy-industry development programmes: Their role in food and nutrition security and poverty reduction*. In Muehlhoff, Ellen, Anthony Bennett and Deirdre McMahon (eds). FAO (2013). *Milk and dairy products in human nutrition*. https://www.fao.org/4/i3396e/i3396e.pdf

xxxv For more on the way farmers learn through first-hand experiences and peer teaching, with an emphasis on the role of agricultural educators in facilitating the process, see: Franz, Nancy, et al. (2010). Journal of Rural Social Sciences. *How Farmers Learn: Implications for Agricultural Educators.* https://egrove.olemiss.edu/cgi/viewcontent.cgi?article=1375&context=jrss

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