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Final report

Small research and development activity

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2 Abbreviations

AANR	Agriculture, Aquatic, and Natural Resources
AANZFTA	ASEAN-Australia-New Zealand Free Trade Area
ACEF	Agricultural Competitiveness Enhancement Fund
ACIAR	Australian Centre of Agricultural Research
ACPC	Agricultural Credit Policy Council
AHKFTA	Australia-Hong Kong Free Trade Agreement
AI	Artificial insemination
AIFTA	ASEAN-India Free Trade Area
ANYO	Agri-Negosyo Loan Program
APCP	Agrarian Production Credit Program
ASEAN	Association of Southeast Asian Nations
ASF	African Swine Flu
BAC	Batangas Agri-Business Center
BADACO	Batangas Dairy and Multi-Purpose Cooperative
BAI	Bureau of Animal Industry, Department of Agriculture
CAFS	College of Agriculture and Food Science
CAR	Cordillera Administrative Region
CARP	Comprehensive Agrarian Reform Program
CC	Communal/Commercial
CDA	Cooperative Development Authority
cfu	Colony forming units
CIF	Cost, insurance and freight
CO_2e	Carbon dioxide equivalents
COC	Certificate of compliance
CP	Crude protein
DA	Department of Agriculture, the Republic of the Philippines
DairyCon	Dairy Confederation of the Philippines
DepEd	Department of Education
DIM	Days in Milk
DM	Dry matter
DMF	Dairy multiplier farms
DOH	Department of Health
DOST-PCAARRD	Department of Science and Technology - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
DRM	Dairy Road Map
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry, the Republic of the Philippines
DTRI	Dairy Training and Research Institute

DVF	Danillo V. Fausto
EBIT	Earnings before interest and taxation
ELISA	Enzyme-linked immunosorbent assay
ESL	Extended shelf life
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration, Department of Health
FOB	Freight on board
FPCM	Fat and Protein Corrected Milk
FSRA	Food Safety Regulatory Agency
GDP	Gross Domestic Product
GFAR	Centre for Global Food and Resources
GHG	Greenhouse Gas
GoP	Government of the Philippines
HBP	Herd Build-Up program
HMI	Hacienda Macalauan Inc.
IAS	Institute of Animal Science
KKMI	Katipunan ng Mga Kooperatibang Maggagatas Inc
LGU	Local Government Unit
LIFE	Livelihood Improvement through Facilitated Extension
LME	Litres milk equivalent
LTO	License to operate
MCC	Milk Collection Centre
MC:NC	Milking cows: non-milking females
MRL	Maximum residual limits
MT	Metric Tonne
NIA	National Irrigation Authority
NCR	National Capital Region
NDA	National Dairy Authority
NGO	Non-Government Organisation
NQS	National quality standards
OAD	Once a day
PAMAKA	Pangantucan Maramag Kalilangan Farmers Dairy Cooperative
PBMP	Plant-based milk products
PCC	Philippine Carabao Centre
PHP	Philippine Pesos
PMM	Portable milking machines
PRDP	Philippine Rural Development Project
PSA	Philippine Statistics Authority
QUEDAFCO	Quezon Dairy Farmers Cooperative

R&D	Research and Development
RD&E	Research, Development and Extension
RENI	Recommended Energy and Nutrient Intake
RM2017	Dairy R&D Roadmap 2017-2021
RTD	Ready to drink
SAMABACO	Samahang Maggagatas ng Batangas Cooperative
SBFP	School Based Feeding Program
SHD	Smallholder dairy
SIDC	Soro-Soro Ibaba Development Cooperative
SRA	Small Research Activity
SSL	Short shelf life
STH	Save the Herd
TMR	Total mix ration
TPC	Total plate counts
TS	Total solids
UEWMPC	Unified Engineering Workers Multi-Purpose Cooperative
UHT	Ultra-high temperature
USD	United States dollar
VAT	Value Added Tax
VCs	Value chains
WHO	World Health Organization
WTO	World Trade Organisation

3 Executive summary

Developing the domestic dairy industry is seen as a priority for the Philippine Government. A request to ACIAR by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) initiated the development of this Small Research Activity (SRA) to undertake a scoping exercise and landscape analysis of the dairy industry. Specific project objectives were to:

- Analyse the markets, value chains and key features of the Philippines dairy sector, including the contribution of smallholder dairy (SHD) farmers;
- Describe and analyse dairy farming systems in the Philippines, including current attributes, opportunities and barriers for SHDs;
- Identify and formulate key research priorities and potential partnerships for a longer-term dairy development project in the Philippines with an emphasis on the commercial sector.

Despite Covid-19 travel restrictions preventing an Australian mission to the Philippines, the team worked closely through online engagement with local consultants to collaborate with the Philippine government, industry stakeholders, supply chain participants, the farming community and their service providers to understand and document interventions to grow SHD inclusive value chains. Our approach involved an overview of the policy and operational landscape of the Philippine dairy industry (both historic and current) and whole-of-chain analysis to collect information on productivity and financial parameters of key segments and actors.

The Philippines is not self-sufficient in dairy. Its annual domestic milk supply is 24 million litres. The drinking milk market (chilled and ambient) is 125 million litres, while the overall dairy marketplace equates to three billion litres. Domestic demand for dairy-based products is growing at 17% per year. This is primarily driven by the country's economic growth and emerging middle classes, mostly located in urban centres. Post Covid-19, the Philippines is expected to resume its trajectory of strong economic growth and is expected to be ranked in the top 20 global economies by 2050. The fundamentals for growth of the Philippine SHD sector are strong. Farm gate milk price is high compared to other countries, as is retail price for fresh milk and specialty cheeses.

This research identifies some key factors and interventions that could lead to the development of the Philippines smallholder dairy sector and their value chains:

1. Sustainable farming systems

By global standards, Philippine SHDs receive a high farm gate price for their milk. This contributes to high profitability per cow compared to neighbouring industries and sets a good platform for an expansion in farm supply. Growing the typical SHD herd size from an average of three milking cows to seven or more would see SHDs move from subsistence farms in poverty to full time resilient dairy businesses providing good financial rewards. Many SHDs surveyed shared this vision. Currently several factors on farm are constraining growth, including milk bacterial contamination, low production and seasonal supply. Farmers are aware of the problems that exist, but until they have market signals and a milk pricing system that will stimulate practice change, provide confidence to improve their infrastructure (such as having hot water), learn new skills, and have better knowledge of their milk quality, they will lack the motivation to change. Many will remain as mixed enterprise smallholders.

There are a multitude of ways to improve milk production per cow and improve farm productivity. Herd genetics, reproduction management, herd nutrition, forage production and quality, and improving how replacements are reared, are all opportunities. Many of these resources such as better forage varieties, grains, commodities, leasing cropping land and

replacing *Bos indicus* with *Bos taurus* genetics are readily accessible to SHDs. Focussing on the nutrition of individual cows to maximise their profitability is also an immediate opportunity. Improvements to these factors gives scope to increase from eight litres per cow per day from the SHD farms surveyed compared to 22 litres per cow per day achieved from neighbouring commercial farms.

There is an emerging global need to reduce green-house gas (GHG) emissions with many multinational processors setting a zero-emission target by 2050. Dairy systems in subtropical and tropical countries produce a third of the world's milk supply but emit over half of the global dairy GHG emissions. We have identified that focusing on improved herd nutritional practices and addressing poor reproductive performance are options to reduce the GHG footprint of SHD farms. Focussing on these strategies will not only reduce carbon footprints but also have the potential to increase milk supply and farm profitability. The emergence of methane reducing rumen additives used globally also warrant investigation under SHD operating conditions.

Priorities:
- Moving from a subsistence small holder to a full-time resilient dairy business;
- The seasonality of milk supply from SHD farms limits access to some markets;
- Improve milk quality and herd productivity as well as market access;
- Lowering the GHG footprint of SHD farms.

2. Processing to retail

The School Based Feeding Programme (SBFP) underwrites many SHD inclusive value chains, especially those incorporating co-operatives. It's structure essentially places a floor in the retail price of fresh and flavoured milk. It does however come with limitations for SHD value chains such as not being an all-year round market and quality issues at the point of consumption by school children. Regardless the SBFP provides a good foundation for local processors to capitalise on market opportunities for fresh short shelf-life (SSL) products. This includes finished dairy consumables, such as chilled fresh milk and soft cheeses, which are not easily traded globally. Consumer confidence in local brands and the bargaining power of large retailers are challenges, however these are not insurmountable. Short e-Commerce retail transactions and home delivery are two potential options to be explored. For some SHD farms, logistical challenges will mean local value chains will be their primary focus.

There needs to be improved signals from processors and co-operatives to SHDs regarding the quality and quantity of milk they need to service markets. These signals require payment systems and supply agreements that are well designed and will stimulate practice change by SHDs. This needs to be supported by improved milk quality testing and reporting. In time, farm to factory milk logistics will also need to improve as the current delivery systems are placing a cap on farm growth. Similarly, there needs to be rationalization of processing entities nationally, with the current large number (e.g. 66 co-operatives) servicing a low volume of milk by global standards (five million litres) resulting in unsustainable overhead costs.

Priorities:
- Partnering processors with co-operatives and/or SHDs to realise SSL market opportunities;
- Improved milk supply payment and quality testing systems to stimulate changes in farming practices and infrastructure;
- Overcoming high transportation costs to urban centres by capitalising on local shorter supply chains;
- Servicing the speciality coffee market with high froth, low taint milk.

3. Enabling policy environment

The Philippine's government provides a vast array of services and finances to support its nation's dairy industry. However, an area of future focus would be to address the business practice of marketing ambient ultra-high treatment (UHT) milk or reconstituted milk as "fresh" milk. This current practice competes directly with local processors of pasteurised milk and needs government intervention. In addition, further tactical information regarding customer needs and developing marketing opportunities would be beneficial in growing fresh milk supply chains.

Contemporary development and extension methodologies would support to improve return on investment for government and to support farming systems, terms of trade and farmer demographics and future capacity building.

Priorities:
- Improve information about consumer's attitudes towards SSL dairy;
- Advising government regarding branding legislation;
- Introducing and imbedding contemporary approaches to Development and Extension.

4. Partnerships

There are companies today who would like to work with SHD farmers to improve both of their businesses. Some of these provide inputs such as seed and concentrates, while others operate post-farm gate and see opportunities with consumers. There is a role for government and not-for-profit organisations to grow these collaborations.

Generally, the opportunities and interventions we have identified in this SRA are not unique to the Philippines as similar impediments have been observed in other developing dairy industries in Asia. The information sourced and discussions held during this research have helped to identify approaches to overcome these barriers and realise the potential to grow the Philippine smallholder dairy sector, with the greatest challenge of how to implement this change.

4 Background Rationale for project

4.1 Overview

Today, the domestic supply of milk in the Philippines equates to approximately 0.8% of the nation's consumption of dairy products, with the balance met by imported ingredients, such as powdered milk, or finished products. In 2019, national milk production was approximately 24 million litres milk equivalent (LME), with demand approaching 3 billion LME. Looking forward, SHDs have a role in addressing this low national self-sufficiency but only in value chains which allow for their sustainable sector growth and profitability. Identifying these value chains and overcoming barriers to participation by SHDs are key challenges. However, for the SHD sector to grow its footprint in domestic short shelf life (SSL) supply chains, it needs to address some opportunities and challenges:

- While urbanization and an increase in per capita income has driven demand, we are also seeing emerging consumers value product safety, quality, consistency and choice. There is also greater consumer scrutiny on the environmental and animal welfare credentials of brands and supply chain members. Zero carbon footprints, ensuring off-farm nutrients and pathogens do not contaminant waterways, calf welfare and greater levels of animal comfort, such as housing design and environmental control, are emerging internationally as fundamentals for sustainable dairy value chains;

- In the Philippines, urban dairy markets are generally serviced by formal supply chains underpinned by high quality standards, advanced distribution infrastructure, ambient product lines and multinational processors with access to internationally traded commodities under more liberal trade agreements;

- We are seeing growth in private companies servicing emerging markets, with some of their value chains inclusive of SHDs. These chains are based on chilled SSL dairy products whose value proposition cannot be easily replicated by ambient supply chains based on imports. Fresh milk, cheeses, and high frothing milk for coffee baristas are all examples sold through a variety of interfaces such as online, co-operative outlets and wholesaling to retailers or the hospitality sector. If SHDs are to increase their milk supply within these SSL value chains, they will only achieve this by being competitive in terms of scale, quality, consistency and efficiency.

4.2 Market opportunities in the Philippines

4.2.1 Social and economic status

The Philippines has a population of 108 million people dispersed across more than 7,600 islands. Hunger and poverty are significant issues facing many in the Philippines, with the Food and Agriculture Organization (FAO) estimating 53% of the population (or 55 million people) to be moderately to severely food insecure (FAO et al., 2019). Additionally, 16% of the population is living below the poverty line (Asia Development Bank, 2018). However, there have been recent improvements to the socio-economic landscape in the Philippines.

4.2.2 Forecast economic growth and consumption of dairy

In many developing Asian countries, high economic growth is driving an emerging middle class. Between 2010 and 2019, the Philippines annual growth in gross domestic product (GDP) was 6.4% (World Bank, 2021a). Higher household incomes lead to increased protein intake per capita. Based on yearly dairy product consumption data provided by the

Philippines National Dairy Authority (NDA) and World Bank population data, we have estimated that annual dairy consumption per capita in the Philippines has increased from 16 kg in 2015 to 27 kg in 2019. Estimates based on NDA forecasts show this annual consumption increasing to 32 kg in 2020.

4.3 The smallholder dairy sector

Various authors and reports have suggested reasons for the lack of growth of the Philippines SHD sector. At a farm level, these constraints include enterprise scale and lack of business profitability. Contributing factors are land tenure policy and low productivity within farm practices such as agronomy, herd nutrition, animal husbandry, reproductive performance and milk harvesting. The dairy farm sector is also dispersed across 16 islands in the archipelago offering logistical challenges. Our initial review of the literature shows milk production per cow is very low compared to neighbouring SHD systems in Indonesia (AGB/2012/099: *'Improving milk supply, competitiveness and livelihoods of smallholder dairy chains in Indonesia'*) and Thailand (BC Granzin pers. comm. 2016). Post farm gate, the lack of cold chain infrastructure, milk quality and safety, and access to competitively priced imported dairy ingredients and finished products have all been impediments to industry development (USDA, 2018). A significant amount of Philippine milk supply is actually UHT milk reconstituted from imported milk powder because of the country's cold chain challenges and limited production (USDA, 2018). This situation is exacerbated by the lack of government policy distinguishing between the branding of fresh milk and re-constituted products.

A critical issue to overcome initially is the outdated or lack of information of the dairy value chain and contribution of SHDs to local production; dairy production systems in the Philippines, including attributes, opportunities and barriers for SHDs; and the key strategic priorities that will lead to greatest impacts for SHD farmers based on evidence in-country and experiences from similar production systems in the region. For example, there is a strong desire by many governments, particularly in Southeast Asia, to develop capacity in advanced technologies such as embryo transfer. However, underlying persistent herd nutritional gaps will mask any gains made by these advanced technologies, meaning this investment is less effective. Therefore, it is imperative to undertake a prioritisation process with local stakeholders regarding what are high impact interventions and understand their intent to co-deliver these interventions in the future.

4.4 Alignment with Philippines Research and Development and ACIAR Priorities

The Philippine Development Plan 2017-2022 provides an overall framework for national development outcomes. These are:

- By 2022:
    - The Philippines will be an upper middle-income country;
    - Growth will be more inclusive as manifested by a lower poverty incidence in rural areas – reducing from 30 percent in 2015 to 20 percent;
    - The Philippines will have a high level of human development;
    - The unemployment rate will decline from 5.5 percent to 3.5 percent;
- There will be greater trust in government and in society;
- Individuals and communities will be more resilient;
- Filipinos will have greater drive for innovation.

While this research activity will not be able to directly contribute to these development outcomes, it will set the foundations to contribute to these through supporting the

development of rural economies and livelihoods through innovation and value adding in smallholder agriculture.

The NDA is mandated to ensure the accelerated development of the Philippine dairy industry through policy direction and program implementation. It was established in 1995 (GoP, 1995). The NDA operates through 29 zones across Luzon, Visayas and Mindanao. The NDA has led the development of two industry strategic plans that have relevance to this project. The first was the Dairy Roadmap 2010-2016 - A Medium Term Dairy Development Plan (RM 2010). The second is the Dairy R&D Roadmap 2017-2021 (RM2017).

Key objectives from the RM2017 are:

- Increase average daily milk production per cow from 5 to 7 litres/day;
- Increase lactation period from 270 to 285 days;
- Decrease breeding period from 6-7 to 2 months; calving intervals from 17 to 14 months;
- Reduce milk wastage and/or spoilage from 30-10%;
- Increase milk sales by 20%.

This SRA strongly aligns with the NDA's objectives for the Philippine's dairy industry, with a similar vision of '*A profitable, competitive and sustainable growing dairy industry built on financially viable business performance throughout the value chain, providing a good quality of life for farmers and ensuring consumers safe and quality milk and milk products.* Additionally, the timing of the SRA will align well with re-establishing priorities for the Philippines dairy industry, with the RM2017 set to conclude in 2021.

4.4.1 ACIAR Strategic Goals and Country Priorities

The ACIAR 10-Year Strategy 2018–2027[1] is underpinned by six high-level development objectives which sets out how to work with partners across the Indo-Pacific region. This project closely aligns and directly contributes to the following ACIAR Strategic Objectives**:**

- ***ACIAR Objective 1: Improving food security and reducing poverty among smallholder farmers and rural communities***
  Developing smallholder dairy chains will have direct impacts on the profitability and livelihoods of SHD households, as well as spill-over impacts to their local rural communities. This is achieved through increased incomes in farming households, and new opportunities for employment and innovative businesses along the value chain.

- ***ACIAR Objective 2: Managing natural resources and producing food more sustainably, adapting to climate variability and mitigating climate change***
  Since 2018, we have seen multinational dairy processors operating in the Philippines (Nestle and Fonterra) communicate their strategic intent regarding reducing their carbon footprints. These strategies are aggressive with Nestle targeting zero net emissions by 2050. Similarly, Fonterra in alignment with New Zealand government policy is targeting a 47% reduction by the same time. Ultimately these strategies will affect the value proposition offered by these companies to consumers and potentially be a strong marketing approach for their brands, both in the retail sector and dairy commodity marketplace. This scenario is problematic for SHDs in tropical and subtropical countries who have almost double the carbon footprint per litre of milk than large scale dairy industries in temperate countries. Estimating the carbon footprint of Philippines SHDs and identifying strategies to reduce their footprint will be important if the sector is going to compete with multinational processors in the future.

[1] ACIAR 10-Year Strategy 2018-2027: https://aciar.gov.au/publication/Ten-Year-Strategy

- ***ACIAR Objective 3: Enhancing human nutrition and reducing risks to human health***
  Consumption of dairy products has multiple potential effects on human health and nutrition, some positive and negative. Consumption of milk, especially by children and breastfeeding women, has been shown many times to improve physical and cognitive development due to bioavailability of essential nutrients. However, the development of highly processed products, many dairy-based (e.g., sweet-condensed milk) are contributing to obesity levels globally. Furthermore, foodborne diseases are a significant issue in dairy value chains in developing countries, due to the highly perishable nature of milk. However, despite the potential negative outcomes, these can be managed through effective policies and assurance systems in place to test and monitor milk quality. Additionally, policymakers need to be engaged in order to ensure the right regulations and policy mechanisms are in place to prevent an increase in obesity levels.

- ***ACIAR Objective 5: Fostering more inclusive agrifood and forestry value chains, engaging the private sector where possible***
  As part of this objective the project has ensured its research outcomes are equitable, inclusive and empowering while engaging with the private sector. The methodology has engaged with producers and the private sector, including farm input providers, traders, processors and food retailers to understand the structure of the dairy industry in the Philippines and barriers preventing an increase in value, yields and returns for the SHD sector.

- ***ACIAR Objective 6: Building scientific and policy capability within our partner countries***
  Developing the capacity and skills of farmers, milk processors and extension staff, researchers and policy makers will be a central feature of any future research projects. This project will identify key interventions within disciplines that could be addressed in the future through capacity development.

5 Objectives

Objective 1: Analyse the markets, value chains and key features of the Philippines dairy sector, including the contribution of smallholder farmers.

Activity 1.1 Analyse key domestic and export markets as well as importation of dairy commodities regarding consumption, volume, value, products and barriers to entry and regulation.

Activity 1.2 Conduct a value chain analysis and describe key dairy value chains and identify successful SHD inclusive value-chain models.

Activity 1.3 Assess and identify opportunities post-farm gate focusing on milk collection, processing and value-adding, as well as the role of input suppliers for SHDs.

Objective 2: Describe and analyse dairy farming systems in the Philippines, including current attributes, opportunities and barriers for SHDs.

Activity 2.1 Analyse the current and historic characteristics of dairy farming regions in the Philippines.

Activity 2.2 Survey at least 15 SHD analysing biophysical, financial and sustainability measures, availability of inputs, and farmer access to knowledge and practices.

Objective 3: Identify and formulate key research priorities and potential partnerships for a longer-term dairy development project in the Philippines.

Activity 3.1 Identify and describe key research and industry stakeholders in the Philippines dairy industry.

Activity 3.2 Identify key gaps in SHD information in the Philippines and formulate priority strategies in key result areas.

Activity 3.3 Develop a detailed plan of activities for a large, multi-year ACIAR dairy project.

6 Methodology

6.1 Overview and project team

The methodology of this research activity involved a detailed, whole-of-chain analysis to collect information on productivity and financial parameters of key segments and actors in Philippine dairy value chains based on the three project objectives. After analysis, this led to the identification of interventions delivering productive and financial benefits to SHDs, which will contribute to key research hypotheses for a larger dual country project (Indonesia and the Philippines) currently under development. A key outcome was the identification of potential project collaborators (public and private) who could potentially co-invest in interventions, resulting in improved inclusive, sustainable value chains for SHDs.

The project team comprised of researchers from the Centre for Global Food and Resources (GFAR) University of Adelaide, FoodLink (a cooperative of leading Philippine agribusinesses located in Mandaluyong City in the National Capital Region (NCR)) and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCAARRD). The Australian research team has extensive experience in international dairy value chain analysis and tropical and subtropical dairy science in Australasia. GFAR has been the lead agency since 2014 for a project based in Indonesia (AGB/2012/099: *Improving milk supply, competitiveness and livelihoods in smallholder dairy chains in Indonesia – IndoDairy*). Apart from their international experience in SHD systems, members of the Australian team also service the Australian dairy industry, with access to contemporary dairy science RD&E. The Philippine team brought extensive experience in Philippine focused livestock R&D and strong links to government and industry. Foodlink played a critical role in accessing the Government of Philippines (GoP) and commercial information and data, facilitating interviews, and project managing on-farm data and image collection.

In the original methodology, the Australian team was scheduled to undertake an extended mission to the Philippines to carry-out field research involving semi-structured interviews and meetings with relevant dairy stakeholders such as processors and farmers. Given the restriction on international travel due to the Covid-19 pandemic, the Australian team was unable to complete this mission. Consequently, the project methodology relied on online collaborative platforms and engaging in-country consultants to complete this research.

6.2 Key methodologies

6.2.1 Desktop landscape review

During the initial stage of the project, there was a focus on desktop research and literature reviews, analysis of key national data sources and designing surveys for interviews and farm benchmarking. Foodlink were instrumental in accessing GoP resources that were not readily available on the internet.

6.2.2 Online interviews

Twenty-seven semi-structured interviews were conducted online (Zoom) with various stakeholders and value chain actors. These are listed in Section A6.1 (p146) and included dairy cooperatives, government agencies, industry bodies, agribusiness service providers, milk processors and research organisations. Discussions focused on organisational purpose and structures, technical, socio-economic, capacity, policy and institutional constraints and opportunities that affect the supply, quality and value of milk and milk products, and that limit SHD participation, efficiency and profitability. These organisations were later characterised based on their strategies, investment and impact in relation to the SHD sector. Their specific

areas of expertise, potential collaborative and co-investment opportunities and areas of relative comparative advantage were reviewed.

Interviews were also completed with collaborators of a previous dairy development project and a non-dairy specific extension project in Mindanao. Key learnings and advice from these projects were captured.

6.2.3 Reviewing SHD and commercial farming systems

A series of on-farm surveys were undertaken with 15 SHD and three communal or commercial (CC) farms. Historic data (2019) was also provided from four SHDs. The SHD survey was adapted from baseline research used in IndoDairy AGB/2012/099. It was designed to provide simple cross site descriptors and indicators which are typical of SHD farming systems internationally, as well as provide baseline financial and biophysical data that could be used to calculate performance indicators of profitability, productivity and sustainability. We included CC farms in our research to understand if their scale provided any particular benefit in terms of productivity, profitability and market access.

Information captured during SHD farm visits related to: input providers; services and markets; farm assets and infrastructure such as land, housing and sheds; farm equipment and transportation; herd inventory; financial such as revenue, expenses and access to credit; labour inputs; marketing of dairy products; milk production including quality; farm practices such as herd nutrition, calf management, herd health, and hygiene; access to extension resources such as information and service providers; adoption of technology and management practices; membership to industry organisations such as co-operatives; attitudes to risk; and perceptions of external operating environment. The impact of Covid-19 on their operations was also noted.

The farm survey for the CC farms was based on the SHD farm survey, however had commercially sensitive financial data removed, as well as some other indicators related to co-operatives.

6.2.4 SHD farm reviews

After a selection process, Foodlink engaged three university-based consultants to undertake farm surveys (as noted in Acknowledgements).

Smallholder farms. The survey (as well as other aspects of the project) focused on several provinces located in the northern region of Luzon (Batangas, Laguna, Cayagan, Isabela and Quezon) and the southern region of Mindanao (Bukidnon). These provinces were chosen based on their higher numbers of SHDs, the implementation of provincial dairy development plans, and their proximity to large urban markets such as Manila and Davao City.

There were several challenges that arose during the SHD survey, primarily related to Covid-19:

- There was the risk of our consultants contracting Covid-19 and causing health issues, not only for themselves but also their families;
- Farmers were reluctant to have visitors, given public concern regarding potential infection from Covid-19;
- Government Covid-19 travel regulations meant that inter-province travel was not always possible, or in some cases, overnight stays were not permitted;
- Covid-19 saw some SHDs (particularly in Isabela) dry off their herds as Covid-19 reduced milk sales. This also coincided with the development of a communal farm in Isabela facilitated by the NDA, which added further impetus for SHD farm closure. Regardless of these challenges, we were however able to get historic data from 2019 for four SHD farms in Isabela.

Analysis of survey data

For the SHD dataset, analysis was limited to the generation of arthrometric means, maximum and minimum values. Due to the inherent challenges of measuring pasture intake in grazing herds, estimations of intake were made on an energetic basis. It was also noted that some estimations of cow liveweight were statistically outliers and were adjusted accordingly. Some biophysical parameters e.g., nutrient intake and financial e.g., gross margin, were also calculated. Greenhouse gas emissions were also calculated on a per cow basis using the Australian Dairy Carbon Calculator developed by Dairy Australia. Biophysical and finance performance measures from the SHD survey were also benchmarked with values from Queensland, Australia (2019/20) and Indonesia (2017, IndoDairy AGB/2012/099).

For the three CC farms, no analysis of data was completed.

6.2.5 Developing a detailed plan of activities for a large, multi-year ACIAR dairy project.

During May 2021, high ranking opportunities and associated activities were integrated into a multiyear project Concept Note for delivery in the Philippines and Indonesia. Relevant Philippine interventions are described in Section 16.

The Concept Note proposal outlined a strategy to co-implement interventions with a focus on improving farm productivity, product quality and availability, supply chain efficiencies and creating a more conducive enabling environment for smallholder dairy farmers in both countries. This proposal was accepted by ACIAR and at the time of writing this report, preparations are underway for developing a Phase 1 proposal.

7 Dairying in the Philippines – a landscape analysis

7.1 Introduction

This section provides an overview of the dairy industry in the Philippines, from the perspectives of farm supply, post farm gate value chains, associated organisations, business and government. It provides some statistics, observations and analysis of strengths and weaknesses. It also describes government laws, regulations, policy and services along the supply chain and the role government has today in growing the SHD sector.

7.2 The contribution of dairying to the Philippine economy

During 2019, the Philippine dairy farm sector contributed ₱966 million (0.0045%) to national GDP. It represents 0.05% of agricultural GDP and 0.3% of the livestock sector (PSA).

Agriculture was estimated to contribute 8.8% to Philippine GDP in 2019 (₱1.74 million). This proportion has consistently fallen over the last sixty years. Crops (such as palay (unhusked rice), bananas, corn and coconuts) comprise the majority of agriculture commodities by value (53%) and by volume (93%). The remaining agricultural sectors are the livestock sector (17%), fisheries (16%) and poultry (14%). The livestock sector is dominated by the pig and beef industries (82% and 10%, respectively).

Overall, the dairy industry plays a very minor role in the Philippine economy.

7.3 National milk supply

In 2020, the Philippine Statistics Authority (PSA) estimated total national milk production from all species to be approximately 26 million litres (ML). Dairy cows account for around 63 percent (16.4 ML) of the country's total milk production. Carabao milk production accounts for about 35 percent while the remaining 2 percent is goat's milk. This project focusses on value chains based on supply from dairy cows as opposed to other species. Over the last decade, milk production increased by an average six percent per annum. Figure 7.1 shows an example of this growth from 2010 to 2015.

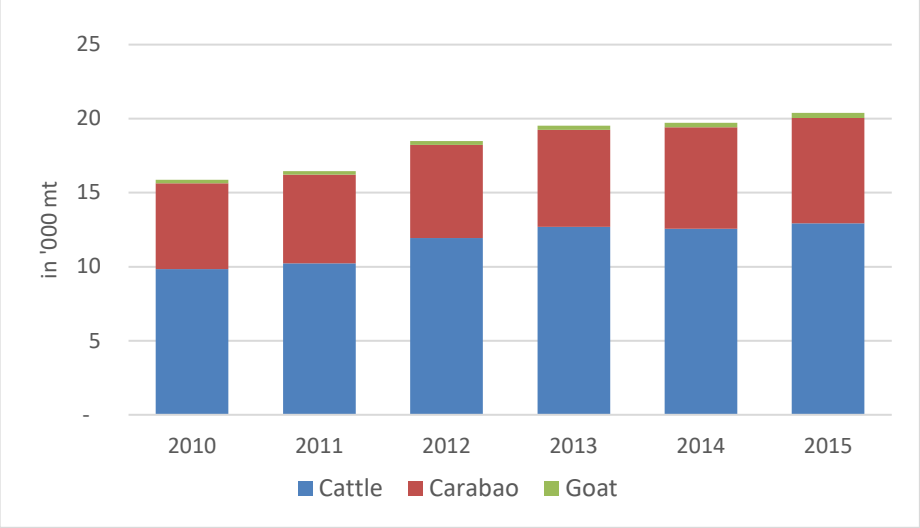


Figure 7.1. Total milk production by species 2010-2015.

Source: Philippine Statistics Authority

7.4 Milk supply sources

Milk production derived from dairy cattle is sourced from four different supply models: individual farms, commercial/private farms, government-owned or institutional, and cooperatives. Given the limited involvement of SHDs in government owned or institutional farms, our research focussed on co-operatives and commercial/private farms sourcing milk from SHDs. In 2020, the NDA reported there were 589 milk supply entities in the Philippines.

7.4.1 Co-operatives and farmer associations

There are 66 co-operatives selling SSL dairy products, such as fresh and/or flavoured milk, through various supply chains (NDA, 2019b). There are at least 25 dairy cooperatives and farmer associations in the three regions considered in the study; Isabela/Cagayan with 12 (Region 2), Calabarzon/Batangas with six (Region 4A) and Northern Mindanao with seven (Region 10). These are shown in Table A7.1 (p156). Cooperative memberships range between tens and tens-of-thousands of farmers, with many cooperatives involved in multiple industries. For instance, Soro-Soro Ibaba Development Cooperative (SIDC) has 43,000 members across the Philippines. However, dairy is only a small proportion of their business, with pork, poultry and corn production making up the majority of their operations.

Of the SHD inclusive co-operatives we analysed, they had been in operation from 6 to 30 years. The damage however Covid-19 was having on their retail operations had created significant risk regarding their long-term viability with only a limited number of members (estimated at 20%) currently supplying milk. Generally, SHD co-operative members were separate entities that supplied milk directly to the factory, or in some instances an intermediate milk collection centre. A unique co-operative model we identified was where shareholders (27) co-owned a larger farm, processing facilities and distribution. This joint ownership model was present in a number of regions.

Federation cooperatives

In some regions there are secondary (federation) cooperatives, with smaller cooperatives being members of the larger entity. In these supply chains, the smaller cooperatives sell their milk to the secondary cooperative, where milk is further consolidated, processed and marketed. For instance, *Katipunan ng mga Kooperatibang Maggagatas, Incorporated* (KKMI) is a secondary cooperative in Region 4A (adjacent to the National Capital Region) which has seven primary cooperatives in its membership. It was established in 1994 (Department of Agriculture, 2014). Figure 7.2 illustrates KKMI's supplying co-operatives.

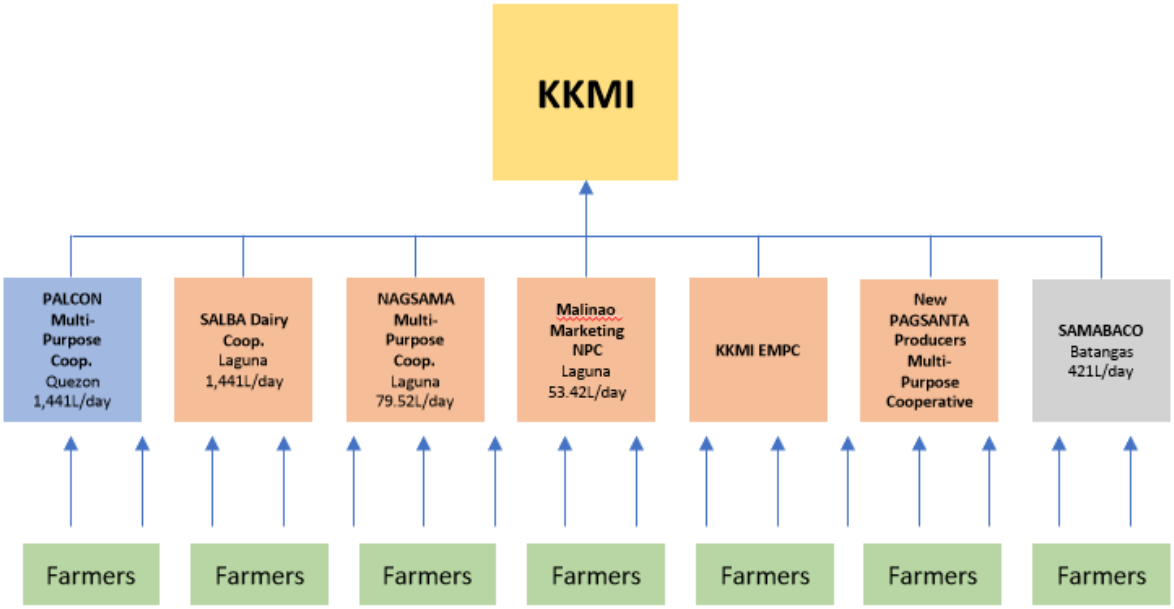


Figure 7.2. Supply map of KKMI, a secondary/federation cooperative in Calabarzon.

The Cooperative Development Authority (CDA)

The CDA is the regulatory body of cooperatives in the Philippines. The CDA is responsible for managing cooperative registrations and technical advisory services. There is a central CDA office and 16 extension offices.

7.4.2 Milk contribution from different supply models

In 2015, individual farms (including NDA supported breeder farms) contributed around 38% of national milk supply, with the balance being co-operatives (37%), commercial/private (23%) and government (2%) (Figure 7.3) (PSA). As far as we could ascertain, the difference between individual farms and commercial farms is their business structure (i.e., an individual trader versus a company).

There has been considerable change in the contribution from different supply models over the preceding 11 years from 2004 (Figures 7.3 and 7.4). Milk supply from individual and private farms has grown substantially, with supply from co-operatives declining slightly.

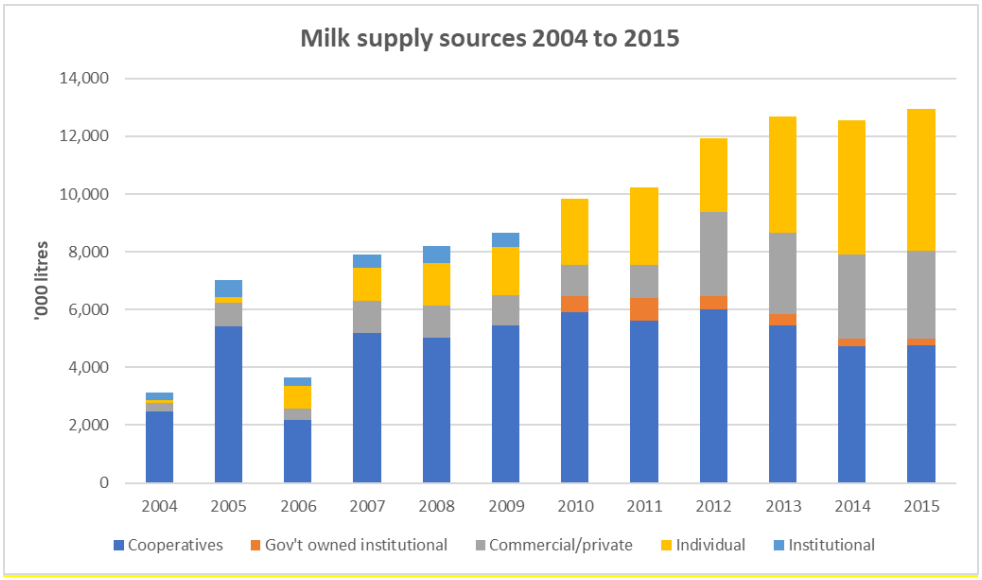


Figure 7.3 Growth in national milk supply in the Philippines from various milk supply pools (2004 to 2015).

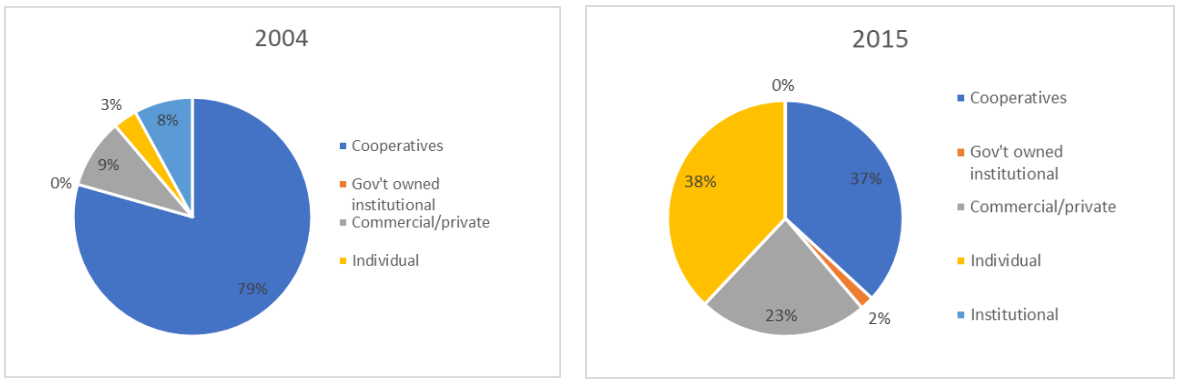


Figure 7.4. A comparison of the contribution of various milk supply pools in 2004 versus 2015.

7.5 Dairy producing regions in the Philippines

Figure A7.1 (p142) provides an overview of Philippine provinces. Figures A7.2 (p143) to A7.4 (p145) provides an overview of dairy producing regions, dairy area farmed and dairy farm intensity. Table 7.1 shows national milk production, coop and farm numbers, cows in production (NDA, 2018a) and estimated milk production per lactation based on the data provided. Provinces are ranked within regions based on total milk production. Only 30 out of the 81 Philippine provinces have dairy farms (NDA, 2018a). On a regional basis, this equates to 8.7 (55%), 2.3 (15%) and 4.9 (31%) ML of dairy cow milk supply for Luzon, Visayas and Mindanao, respectively.

7.5.1 Farm numbers, size and production

NDA 2018a data estimates there are 8,691 dairy farms in the Philippines. Data for Cebu and Antique in the Visayas however is very high relative to the herd sizes in these provinces. Making corrections to this data would indicate approximately 4,600 Philippine dairy farms. Farm numbers in the four provinces studied in further detail totalled 532 or approximately 12% of the national farm population. As noted, Covid-19 has had a significant impact on farm numbers in some provinces such as Isabela.

We estimate based on NDA (2018b) that on average, each SHD farm produces approximately 3,500 L milk per year or 10 L per day. The annual milk production from the SHD farms we surveyed was greater (an average of approximately 8,000 L per year). In terms of international SHD sector performance, farm production is low. Our past work in Indonesia has recorded average SHD milk production of 30 L per milk per day or around 13,000 L per annum.

Based on NDA (2018b), the national dairy cow herd was approximately 9,300 cows in production with an additional 38,000 non milking stock such as dry cows, replacements and bulls. For the 4,600 herds, this averages two milking cows per herd and eight dry stock. This compares to the results from our SHD farm survey of an average milking herd of 2.7 cows and 6.0 dry stock.

Table 7.1. Milk supply and characteristics from Philippine's provinces.

Regional	Dairy Zone Name	Total Production ('000 L)	No. of Coops/ Entities	No. of Farmers	Total Herd Inventory	Milking cows in production	Average production per lactating cow (L)
South Luzon	Batangas	3,485	23	147	5,762	1,338	2605
North Luzon	Bulacan	1,506	19	131	2,471	144	NA
South Luzon	Laguna	1,451	17	73	2,227	481	3017
South Luzon	Quezon	749	6	111	1,680	336	2228
North Luzon	Nueva Ecija	376	9	9	1,289	224	1679
South Luzon	Rizal	301	8	113	735	205	1469
North Luzon	Pangasinan	233	5	7	380	143	1627
North Luzon	Cagayan	181	4	8	2,274	115	1577
South Luzon	Cavite	118	21	21	319	104	1136
South Luzon	Camarines Sur	105	13	603	673	96	1094
North Luzon	Isabela	98	23	180	414	82	1192
North Luzon	Tarlac	93	13	104	1,719	229	406
South Luzon	Palawan	19	3	3	392	15	1267
Central Visayas	Cebu	687	45	1,033	2,627	572	1201
Western Visayas	Negros Occidental	439	32	302	1,529	314	1399
Western Visayas	Iloilo	409	32	625	2,110	349	1171
Central Visayas	Negros Oriental	244	23	224	1,175	224	1090
Western Visayas	Antique	225	5	3,377	306	80	2818
Eastern Visayas	Leyte	188	24	691	4,366	521	361
Central Visayas	Bohol	159	17	393	872	183	870
Northern Mindanao	Bukidnon	2,698	29	94	4,840	1,346	2005
Southern Mindanao	Davao City	940	17	171	1,094	357	2633
Northern Mindanao	Misamis Oriental	452	31	50	1,303	359	1259
Southern Mindanao	Davao del Sur	317	21	23	2,497	701	452
Southern Mindanao	South Cotabato	159	17	65	1,089	226	705
Southern Mindanao	North Cotabato	146	21	46	1,168	259	564
Southern Mindanao	Davao del Norte	122	17	44	762	122	998
Southern Mindanao	Sultan Kudarat	53	2	2	713	135	396
Southern Mindanao	Davao Oriental	19	8	8	353	62	307
Northern Mindanao	Agusan del Sur	10	5	33	302	52	195

Changes in farm numbers and the national herd

Table 7.2 provides a comparison across a range of NDA dairy zones of changes in various industry statistics from 2006 to 2018. Milk production, dairy cattle numbers and average dairy cattle per farm have all increased during this period, with the number of dairy farms declining substantially. The change in milk production per cow should be treated with caution. The cause of this discrepancy would appear to be an over estimation of herd growth in 2018. Regardless, the reduction in farm numbers and increase in average herd size is typical of trends seen internationally due to declining farm terms of trade.

Table 7.2. Change in milk production, herd size, farm numbers, cattle per farm and average milk production per lactation across a range of dairy zones[1] from 2006 to 2018.

Parameter	2006	2018	% Change
Milk production ('000 L)	7,208	9,975	38%
Dairy cattle (no.)	12,253	29,008	137%
Dairy farms (no.)	9,757	8,691	-11%
Cattle per farm (no.)	1.3	9.4	623%
Milk production per cow (L per yr)	588	344	-41%

[1] *Batangas, Bulacan, Camarines Sur, Cebu, Davao de Sur, Laguna-Quezon combined, Misamis Oriental, Negros Occidental and Nueva Ecija. Source NDA.*

Farm size

A breakdown of Philippine dairy farm size is shown in Table 7.3 (NDA, 2018b). There are some regional differences in average farm size with Mindanao, Luzon and Visayas with averages of 6.8, 2.7 and 0.9 milking cows, respectively. Overall, there are approximately 8,548 (98.3%) farms which would be typically classed as a SHD (less than 10 cows).

Table 7.3. Size of Philippine dairy farms.

Size of dairy farms (cows in production)	Farm numbers	%
Small holders		
1 or less	7,559	87.0
1 to 5	641	7.3
5 to 10	348	4.0
Total	***8,548***	***98.3***
Semi commercial and commercial		
10 to 20	109	1.3
25 to 50	32	0.4
More than 50 cows	2	0.02
Total	***143***	***1.7***
Total	**8691**	**100**

Source: NDA 2018b

7.6 Climate, topography and soils in Philippine dairy regions

Modern-day dairying in the tropics is challenging. Highly productive cows, typically of *Bos taurus* genetics, such as Holsteins, are susceptible to heat stress, disease and pests. Tropical forages have inherent characteristics that make them less productive than temperate species. Rainfall patterns can also be more extreme. While all of these challenges can be addressed, they come with cost and risk. As noted later, the Philippine SHD industry has chosen to utilise crossbred herds with substantial Zebu (*Bos indicus*)

genetics, as opposed to modifying the biophysical environment and herd nutrition. As we note later, this has had consequences on productivity and hasn't delivered improvements in herd reproduction and cow longevity that would be expected with Zebu cross herds.

Climate

The Philippines has a tropical climate, strongly influenced by four maritime weather patterns (PAGASA, 2021):

- Type I. Pronounced dry season from November to April, with rainfall during the remainder of the year. Main falls occur from June to September;
- Type II. No dry season with rain occurring every month. Highest falls occur from December to February;
- Type III. No pronounced wet season with a dry season lasting one to three months. This can occur from December to February or from March to May;
- Type IV. Rainfall is evenly distributed throughout the year.

Temperature and humidity

Table A7.2 (p158) provides average temperature and rainfall data across the major Philippine dairy provinces including those in Luzon and Mindanao where we focussed our research. All have average ambient temperatures in excess of 25^{o}C with maximum temperatures in excess of 30^{o}C while their average relative humidity (RH) was above 80%. These ambient temperatures in conjunction with high relative humidity would lead to temperature humidity indexes causing mild to severe heat stress in *Bos taurus* (European e.g., Holstein, Jersey) dairy herds. Our research has shown that this issue has been addressed in the Philippines by maintaining a significant proportion of *Bos indicus* (Zebu) genetics within herds, as opposed to using environmental control measures such as shade, sprinklers and air flow. Of note however is the significant variation in the ratio of *Bos taurus*: *Bos indicus* genetics within SHD herds. Our observations indicate that within a three cow SHD herd, there may be one cow of 90% *Bos indicus* genetics, one of local native Philippine breed, and one cow of 80% *Bos taurus* genetics. All of these cows would require different management approaches to maximise their profitability.

Rainfall and soil water balances

For the Philippine SHD sector to successfully service and grow fresh SSL dairy value chains, rainfed farming systems must be able to manage variable forage production throughout the year. This issue is compounded further by variable inter-year rainfall patterns due to *El Nino* and *La Nina* Southern Oscillation Index events in the Pacific.

Table 7.4 shows monthly rainfall and estimated soils water balances across dairy provinces. Annual rainfall is generally high, however this is heavily biased from June to November. An analysis of monthly rainfall versus predicted tropical pasture evapotranspiration rate shows that no province has adequate soil moisture to sustain pasture growth all year round, with the range in deficiencies between two to six months of the year. From a feed budgeting perspective, this analysis shows that either conserved forages, such as silage, or irrigation would be required to sustain all year-round milk production in many provinces. Some with minimal deficiencies may be able to dry cows off during the low rainfall months or utilise stand-over pasture. Feedback from our SHD survey however indicates these systems have adapted to seasonal rainfall patterns. Of the 14 SHD respondents, 64% noted a difference in herd milk production between the wet and dry season. 43% noted lower milk production (20% decrease) during the dry season, with the remaining 21% noting lower milk production (39% decrease) during the wet season. Despite this seasonal variation in milk production, the feeding of conserved forages was limited to 33% of SHD farms.

Table 7.4. Average monthly and annual total rainfall across the major dairy and project research provinces. Green cells highlight months were the rainfall is in excess of tropical pasture evapotranspiration rates (estimated at 4 mm per day) while red cells depict negative values.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall
Batangas	25	15	20	31	135	230	315	313	273	220	149	111	1837
Bukidnon	159	112	102	111	240	315	332	311	300	301	183	141	2606
Bulacan	20	11	14	34	172	338	498	518	382	198	146	71	2402
Laguna	104	46	47	57	145	238	276	276	292	311	344	248	2384
Davao del Sur	135	107	96	134	189	192	169	171	176	182	140	119	1810
Quezon	244	159	124	81	113	188	227	168	268	500	539	633	3244
Cebu	123	78	56	49	88	180	201	149	187	189	145	151	1596
Misamis Oriental	99	73	58	43	127	223	233	232	262	224	158	127	1859
Negros Occidental	39	17	27	56	136	269	415	405	381	369	196	98	2408
Iloilo	54	25	36	53	151	286	350	351	293	271	193	93	2156
Isabela	61	47	54	71	139	150	187	223	223	296	320	188	1959

Inter-year variation in rainfall

Inter-year rainfall patterns show significant variation in the Philippines with correlations with *El Nino* and *La Nina* events in the Pacific. Table 7.5 from Cruz et al., 2013 displays the standard deviation of mean rainfall across a range of weather stations in Luzon and Visayas. Figure 7.5 also shows similar annual variability in the monsoon season.

Estimating the 10% decile rainfall shows that for most regions at least 1000 mm annual rainfall is still recorded (Table 7.5). This is supported by the lowest values reported in Figure 7.5. Our observations would suggest that agronomic and forage harvesting practices are likely limiting farm productivity as opposed to regular severe long-term negative soil water balances.

Table 7.5. Mean and standard deviation of rainfall over 50 years from Philippine weather stations (from Cruz et al., 2013).

Station name	Province	Region	Mean (mm)	Std dev (mm)	10% decile	90% decile
Ambulong	Batangas	Luzon	1141	269	797	1485
Baguio	Benguet	Luzon	2821	915	1650	3992
Coron	Palawan	Visayas	1811	469	1211	2411
Dagupan	Pangasinan	Luzon	1827	560	1110	2544
Iba	Zambales	Luzon	2910	738	1965	3855
Iloilo	Iloilo	Visayas	1275	276	922	1628
Laoag	Ilocos Norte	Luzon	1762	514	1104	2420
Science Garden	Metro Manila	Luzon	1748	422	1208	2288
Vigan	Metro Manila	Luzon	1992	581	1248	2736

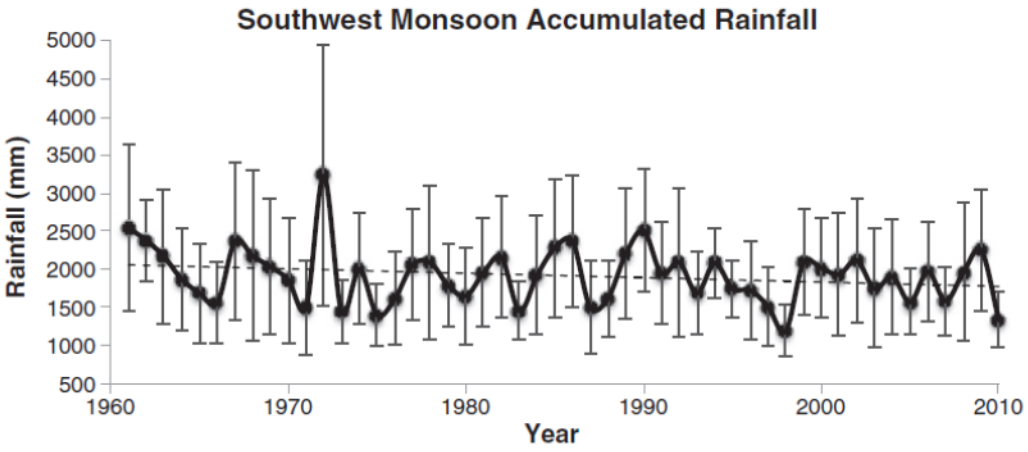


Figure 7.5. Time-series of the annual Southwest Monsoon accumulated rainfall, taken as an average across all stations. Error bars indicate the standard deviation of station values. Dashed line indicates the linear trend (reprinted from Cruz et al., 2013).

Irrigation

The Philippines has 10.3 million ha of arable land, with 3.1 million ha considered by the National Irrigation Authority (NIA) as irrigable, with a slope of less than 3%. The NIA also cited a report carried out by the World Bank (1982) which highlighted a further 3 million has of slope between 3 and 8% gradient. As of 31 December 2019, the NIA reported that 2.0 million ha had been developed for irrigation. Of this area developed, approximately 0.9 million ha (46%) was serviced by the National Irrigation System, 0.7 million ha (36%) was serviced by communal systems, 177,733 ha (9%) was privately owned, with 170,610 (9%) supported by other government programs. Based on data from 2007, surface water is the major source of irrigation in the Philippines (86%) with the balance from groundwater (14%) (FAO, 2021). According to the NIA, the majority of irrigation is limited to rice and corn production. There are limited reports in the literature (Moog, 2006) of some ruminant farms irrigating pastures.

Table A7.3 (p159) displays the progress of irrigation development for major dairy provinces. With the exception of Isabela, the potential for the dairy industry to access new areas for irrigation in Luzon appear limited. There is greater scope for potential access to irrigation for the dairy industry in southern provinces.

Despite limited irrigation being used for dairying to date, the location of irrigated cropping land adjacent to SHD regions offers scope for co-operatives to secure contract grown forages propagated under irrigation during the dry season. Options could include maize silage crops in more secure irrigation schemes or sorghum-based forages in regions with less water security.

Topography and altitude

Figure 7.6 shows the topography and elevation of the Philippines. With the exception of Bukidnon in Mindanao, the Philippine dairy sector is located at altitudes below 200 metres above sea level.

The Philippines has seven significant mountain ranges comprising of peaks in excess of 1500 metres in altitude. There are also significant regions in excess of 1000 metres above sea level. Assuming a reduction in ambient temperatures of 6.5^{o}C for every 1000 metres in altitude, these elevated regions would offer average temperatures of less than 20^{o}C (range of 17^{o}C to 26^{o}C) providing a much more suitable climate for farming dairy cattle in the tropics.

Both Luzon and Mindanao have elevated regions e.g., Tagaytay (in Region 4A) and Sagada (in CAR). These would require further investigation regarding their feasibility for dairy production.

Figure 7.6. Elevation of the Philippines (from Menard and Siler 2018).

Soils

Utilsols, Inceptisols and Alfisols are the most common soil orders found in the Philippines. More details regarding the common soils found across dairy provinces can be found in Table A7.4 (p160).

Ultisols are undefined mountain soils comprising about 70% of the soils in the Philippines (Evangelista, 1993 cited in Asio et al., 2009) and are present in the major dairy provinces. They are strongly leached, acid forest soils with relatively low native fertility and are noted for low contents of essential plant nutrients particularly nitrogen and phosphorus (Asio et al., 2009). They require ongoing maintenance with fertilisers and lime to avoid degradation.

The next major category are Inceptisols which are often found on fairly steep slopes, young geomorphic surfaces and on resistant parent materials. A sizable percentage of Inceptisols are found in mountainous areas and are used for forestry, recreation and watershed.

The last major group are Alfisols. These are moderately leached soils that have relatively high native fertility. Alfisols can be very productive soils for agriculture.

Our survey showed that SHD farms are located on a range of soil types from productive soils, such as kraznozems, through to lighter loamy soils often in undulating topography. We did not see SHD farms located on more productive heavier cropping soils, although these were often adjacent, with corn, sugar cane and rice being grown.

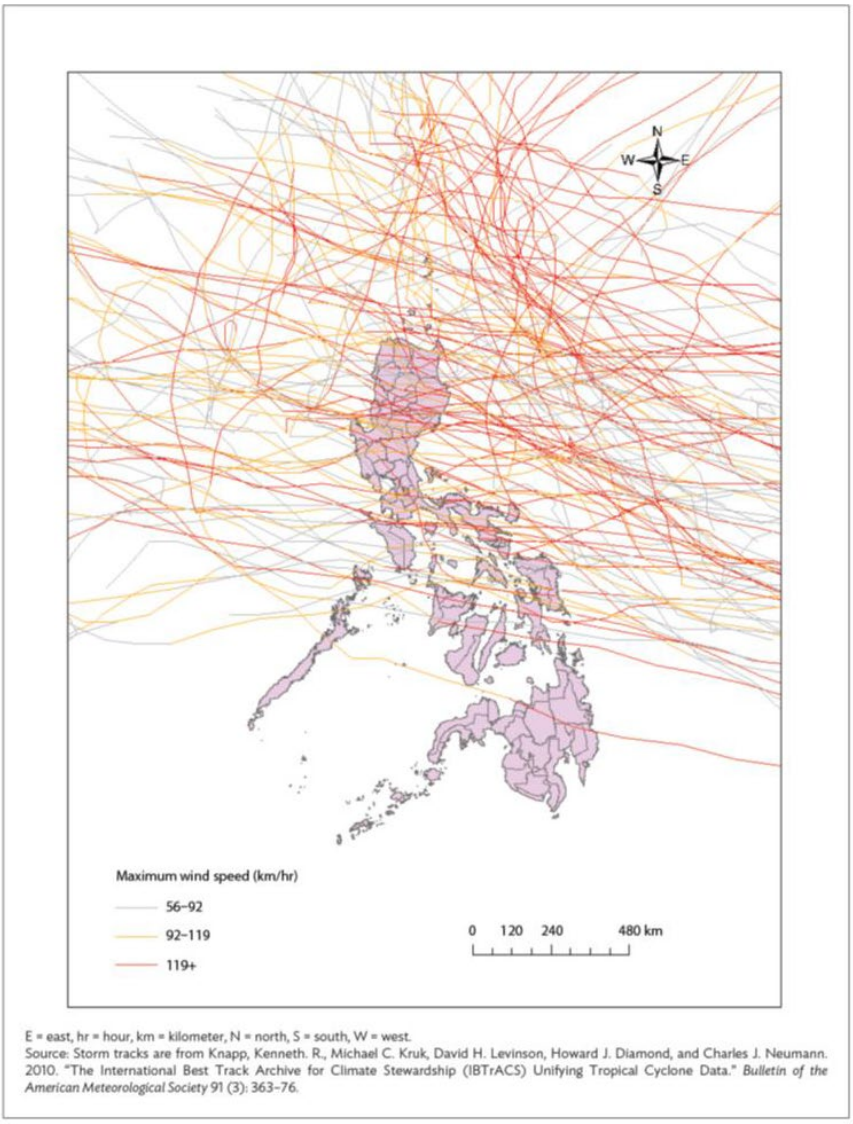
Asio et al. (2009) noted that soil degradation in the Philippines, such as erosion, leaching and nutrient extraction, is a major problem due to frequent heavy rainfall events and flooding, and also the farming practices of smallholder farms in upland areas. Our observations concur with this conclusion with poor pasture growth, weed infestation and poor soil structure noted on approximately two thirds of the SHD farms we reviewed. Fertilising with manure was practiced on some farms, but only in small, concentrated areas dedicated to growing grasses such as Napier grass for cut and carry. Overgrazing was common, leading to some visual degradation of soil structure.

Incidence of natural disasters

The Philippines is one of the most typhoon prone countries in the world and has experienced between 6 to 9 typhoons per year since the 1970 (Blanc and Strobl, 2016). Figure 7.7 from Strobl (2019) shows the path of these storms from 1987 to 2013. A preliminary analysis of these tracks indicates that Luzon is much more prone to experience typhoons (39 noted), in comparison to Visayas (11) or Mindanao (1).

Strong winds and flooding from typhoons can cause crop destruction, power loss, disrupted market access and farm infrastructure damage. Mitigating these risks need to be considered in the infrastructure and resilience of farm systems. Our research team (BC Granzin pers comm) has seen instances in other SHD industries (e.g., Thailand) where European manufacturers have sold herd barns not rated for strong winds, resulting in their total destruction.

Other natural disasters in the Philippines include volcanic eruptions with 22 active volcanos, with five rated as highly active (Taal, Mayon and Bulusan in Luzon, Kanlaon in Visayas, and Hibok – Hibok in Mindanao) (CEDMHA, 2018). The last significant eruption was Mt Taal in January 2020. Seismic activity is also common in the Philippines with 12 major earthquakes recorded between 1968 and 2017 (CEDMHA, 2018).



E = east, hr = hour, km = kilometer, N = north, S = south, W = west.
Source: Storm tracks are from Knapp, Kenneth. R., Michael C. Kruk, David H. Levinson, Howard J. Diamond, and Charles J. Neumann. 2010. "The International Best Track Archive for Climate Stewardship (IBTrACS) Unifying Tropical Cyclone Data." *Bulletin of the American Meteorological Society* 91 (3): 363–76.

Figure 7.7. Tracks of typhoons in the Philippines 1987 to 2013 (reprinted from Strobl, 2019).

Climate change

There are various accounts in the literature regarding the effects of climate change in the Philippines and forecast impacts for the remainder of the century. Retrospectively, mean temperature has increased at 0.1–0.3°C per decade between 1951 and 2000 (Weiss, 2009). Rainfall (mean annual) has increased since the 1960s with more rainy days. This has also been accompanied by greater rainfall variability. However, as shown in Figure 7.5 (p29), the contribution of the monsoon to annual rainfall is gradually decreasing. Heat waves, droughts, floods, and typhoons have increased in severity and intensity. The incidence of recorded floods and storms has increased from under 20 during 1960–1969 to nearly 120 during 2000–2008 (Weiss, 2009).

Looking forward, annual mean temperature is projected to rise 4.8°C by 2100 (relative to 1990 levels) (Weiss, 2009) with more substantive increases in the latter half of the 21st century (Thomas et al., 2015). The Philippines is also expected to receive more rainfall (relative to 1950 to 2000 data) with models predicting between 102 mm (10%) to 176 mm (18%) more rain during the wettest three months, and between 17 (7%) to 36 mm (14%) over the three driest months.

With respect to the Philippine dairy industry, these changes in temperature and rainfall, in combination with more atmospheric CO_2 will mean a change in feedbase production and

animal performance. Subject to water availability, higher temperatures may increase the growth of perennial tropical grasses. However, a negative of this will be a reduction in the digestibility (productive capacity) of these forages. A 4°C increase in ambient temperatures would see the milk producing capacity of perennial tropical forages reduce by approximately 15% (BC Granzin pers comm).

In addition to perennial tropical forages, modelling (International Model for Policy Analysis of Agricultural Commodities and Trade) predicts an average 6.5% decline in the productivity of corn yield in the Philippines by 2050, unless forage development can mitigate climate change effects. This will place upward pricing pressure on both corn grain and corn silage used in dairy systems.

Herd performance is also expected to be impacted by more warmer, humid conditions. Milking cow productivity will decline with more high heat load events, and parasites (e.g ticks) and disease will prolifierate further. Unless there are specific breeding strategies to select for traits resilient to heat and parasites, or there is significant investment in on-farm mitigation such as infrastructure, this will result in reduced milk production and poorer reproductive performance.

7.7 The processing sector

The following sections 7.7 to 7.10 provides an overview of the scale and key aspects of the Philippine processing sector. Section 8 looks in more detail at their market share, pricing and value propositions.

7.7.1 Philippine-owned

Excluding co-operatives, our research identified 12 Philippine owned milk processors predominantly servicing Luzon and the NCR. These processors source milk from third parties or their own farm. The main products are pasteurised milk, cheeses including white, ricotta, cottage and feta, and yogurts, both live culture and Greek (Figure 7.8).

In 2019, an American-based dairy company supplying fresh milk, Darigold, exited the Philippine market. This provided the opportunity for locally produced brands to fill this gap e.g., Pinkie's Farm (sold online and through specialist retailers), Holly's Fresh Milk (Real Fresh Dairy Farms Inc) and Pure & Best (Hacienda Macalauan Inc) (Euromonitor International, 2021a). Further information regarding Philippine processors can be found in Table A7.5 (p161).

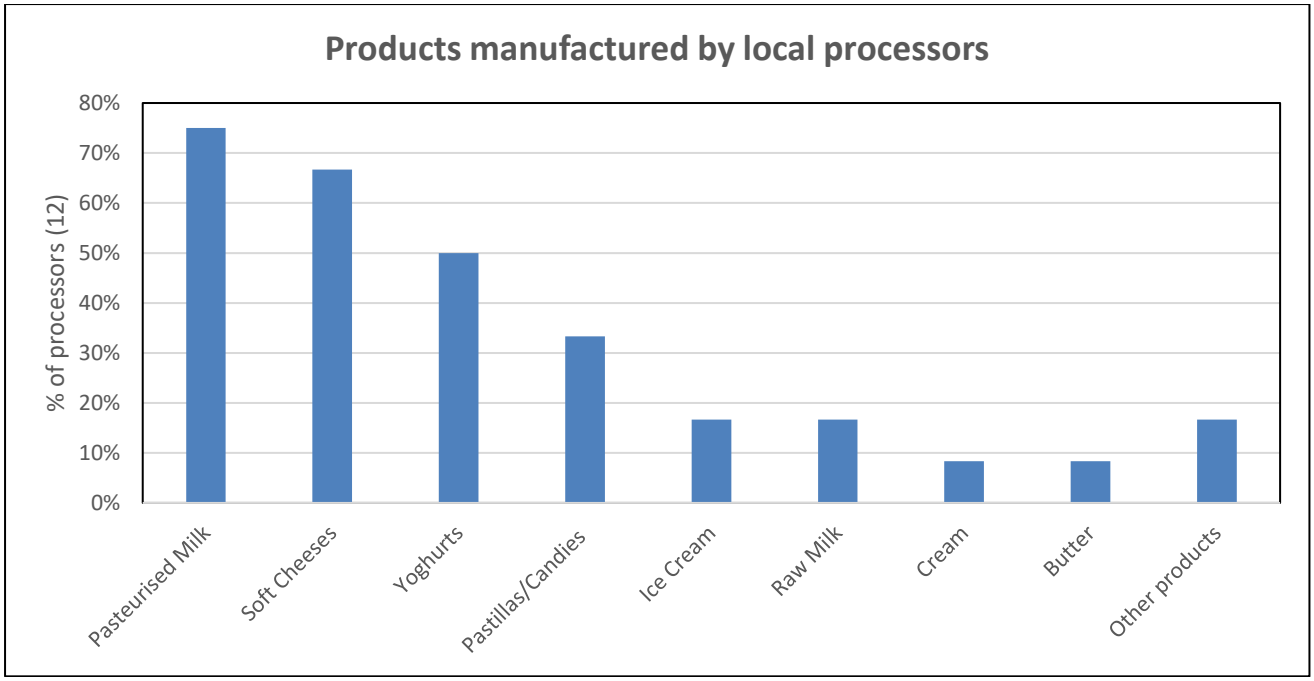


Figure 7.8. Products manufactured by Philippine owned processors.

Philippine processors interviewed

During this project, three Philippine owned processors were interviewed: Batangas Agri-Business Center, Inc., DVF Dairy Farm Inc and Hacienda Macalauan, Inc. (HMI). All three businesses are within three hours' drive of Manila. Summaries of these interviews can be found in Section A7.1 (p148). These processors have some common attributes:

- They are very entrepreneurial, with owners/managers having a strong commercial acumen;
- They all have their own brands and value proposition within SSL value chains;
- They focus on formal urban value chains, but avoid large retailers;
- Online trading is a key part of their business;
- They deal with hospitality and restaurant sectors who value add to their products e.g., high end coffee shops;
- The bacterial quality of their milk is very important, given their markets. For those that trade with SHDs or co-operatives, they have differential milk payment schemes based on quality;
- They each have their own dairy farm, providing security in both milk supply and quality.

Multinational processors

Nestle. Neste Philippines Inc. is the major multinational processor in the Philippines. They have five factories in the Philippines; powdered and liquid beverages; milk products and ice cream; nutrition and health science; prepared dishes and cooking aids (Nestle, 2019).

At this time, Nestle were not sourcing milk from local dairy farms. This was due to inconsistency of supply, primarily caused by seasonal variations. While milk quality (including microbial contamination) was an issue, this could be addressed through their processing techniques and was not considered a major obstacle.

Nestle employs extension officers to assist their Philippine coffee growers. Looking forward, it would be of value to a future project if this extension support was replicated to SHDs in the event Nestle commenced sourcing their milk.

Alaska Milk Corporation. Alaska Milk Corporation is the second largest processor in the Philippines and is a subsidiary of the Dutch-based multinational Friesland Campina (Euromonitor International, 2021a).

Fonterra Brands. Fonterra is the third largest processor in the Philippines. (Euromonitor International, 2021a). Their parent entity Fonterra Co-operative is a publicly traded New Zealand based multinational business owned by New Zealand dairy farmers.

Other multinational processors. The remaining market share is comprised of a multitude of processors including AB Nutribec Inc, Mead Johnson Philippines Inc, RFM Corp, Snow Mountain Inc. and Vitasoy URC Inc (Euromonitor International, 2021a).

Current investment by multinational processors

According to Euromonitor International (2021a), major milk processors have been investing significantly in infrastructure since 2019 to support the expansion of local production and manufacturing. These include:

- Nestlé: ₱2.8 billion ($56 million USD) investment into a dairy manufacturing plant located in Batangas, Luzon which has an annual capacity of 80,000 tonnes;
- Vitasoy URC: ₱1 billion ($20 million USD) investment for the construction of a local production facility for Vitasoy in Pampanga, Luzon;
- RFM Corp (selling 'Selecta' brand ice cream): ₱320 million ($6.4 million USD) to increase its capacity of its Cabuyao (Luzon) factory by 30 percent, with an additional ₱220 million ($4.4 million USD) further investment under consideration.

It is highly unlikely these factories have the capacity to receive fresh milk.

7.8 Exporters

Table 7.6 lists businesses currently exporting dairy products from the Philippines (NDA, 2021a). Based on our research, DVF Dairy Farm Inc. was the only exporter that accessed milk supply directly from SHDs. The majority of exporters were based in Luzon. Further detail regarding exports can be found in Section 8.2.

Table 7.6. Milk and dairy product exporters as of July 2020.

Company	Location
Century Pacific Food Inc.	Manila Luzon
DVF Dairy Farm Inc.	Quezon City Luzon
Interfood Export-Import Corporation	Manila Luzon
LTH Food Industries Inc.	Mandaue City, Visayas
Magnolia Inc.	Manila Luzon
MFP Home of Quality Food Corporation	Manila Luzon
San Miguel Pure Foods Inc.	Manila Luzon
Sucere Foods Corp./Twin Oaks Foods Corp.	Malolos City, Luzon
Century Pacific Food Inc.	Manila Luzon

7.9 Wholesalers

Table 7.7 summarises dairy product wholesalers in the Philippines. It was challenging to find extensive details regarding these businesses. All of these wholesalers were based in Luzon.

Table 7.7. Dairy product wholesalers in the Philippines.

Name	Products traded
Ferna Corporation	Cream powder, yogurt, ice cream.
Mondelez Phils., Inc.	Processed cheese, powdered beverages and chocolates
Juno Foods (LICA/Pinkie's Dairy Products)	Fresh milk, yogurt, frozen yoghurt, white cheese, chocolate, cultured buttermilk, butter, smoked scamorza
Hacienda Macalauan, Inc.	Fresh milk, yogurt, cheese and cream
DVF Dairy Farm Inc.	Fresh milk, yogurt, cheese, candies
Rizal Dairy Farms	Kesong puti, ricotta, Greek yogurt
Malagos Farmhouse	Cheeses

Source: Foodlink database of key informants.

7.10 Retailers

Supermarkets

According to Euromonitor International data (2021a), the majority (55 percent) of drinking milk products are sold through traditional grocery retailers in the Philippines, including family-owned convenience stores known as 'sari-sari' stores. This is followed by modern supermarkets channels (37 percent). In contrast, the majority of yoghurt and sour milk products (55 percent), and ice cream and frozen desserts (60 percent) are sold through modern supermarkets.

There have been some trends evolve over the last five years regarding the retailing of dairy lines:

- *Drinking milks:*
  - There has been growth in online sales (1.8%) at the expense of store-based trading;
  - Modern larger retailers are growing in market share (increase of 43%, particularly hypermarkets) at the expense of traditional smaller grocery stores (down 55%).
- *Ice cream and frozen desserts (Euromonitor International, 2021b):*
  - There has been no growth in online sales;
  - Modern larger retailer chains are growing in sales (increase of 37%), with convenience stores also growing in market share;
  - There has been a decline in smaller grocery store sales (down 23%).
- *Yogurts and sour milk (Euromonitor International, 2021c):*
  - Store based trading has increased (86%) with negative growth in non-store sales (14%) and direct trading (14%);
  - Supermarkets (up 55%) and hypermarkets (up 12%) have continued to grow their sales, with sales in traditional grocery stores contracting (down 17%).

In developing SHD inclusive value chains, these trends in consumer purchasing need to be recognised. Partnering with large retailers, given their marketing power and food safety customer proposition is a positive, however low margins and the proliferation of ambient ready to drink (RTD) dairy lines in their marketing strategies are challenges. The growth in e-Commerce in drinking milks (presumably driven by regular customers making frequent

purchases) is an opportunity for short, higher margin SHD inclusive value chains to sell more trusted, safe and available brands with local provenance.

Cafes and restaurants
Starbucks (licensed under Rustan Coffee Corp) is the major coffee retail chain in the Philippines with 53 percent of the market and almost 400 outlets. Other branded chains are Dunkin' Donuts (9.5%), The Coffee Bean & Tea Leaf (5.5%) and McCafé (4.8%). Further details regarding café chains can be found in Table A7.6 (p163, Euromonitor International, 2021d).

Prior to Covid-19, independent specialist coffee and tea shops were benefitting from increasing demand especially from middle- and high-income urban consumers. However, this demand has slowed due to Covid-19. Cafes and bars saw transactions decline by 54 percent in 2020 and outlet numbers fall by 12 percent. Despite this slowdown, Starbucks has been able to increase its share value in 2020. This was in part due to its partnership with the GrabFood delivery service and its drive through/contactless options (Euromonitor International, 2021d). Delivery services in conjunction with strong online branding would be an avenue for SHD inclusive value chains to review, especially in conjunction with chilled coffee beverages.

7.11 Government programs and policy in relation to the dairy farming and processing sectors

7.11.1 An overview of government departments servicing the dairy industry

Figure 7.9 from Gera (2018) shows the different levels of government in the Philippines. During this project, the government departments we interviewed were linked to the Central Government or Provinces. We did not have the opportunity to meet with Barangays, who would be important stakeholders in a future project. The following section gives an overview of where these departments are located within tiers of government, laws, regulations, strategies and services.

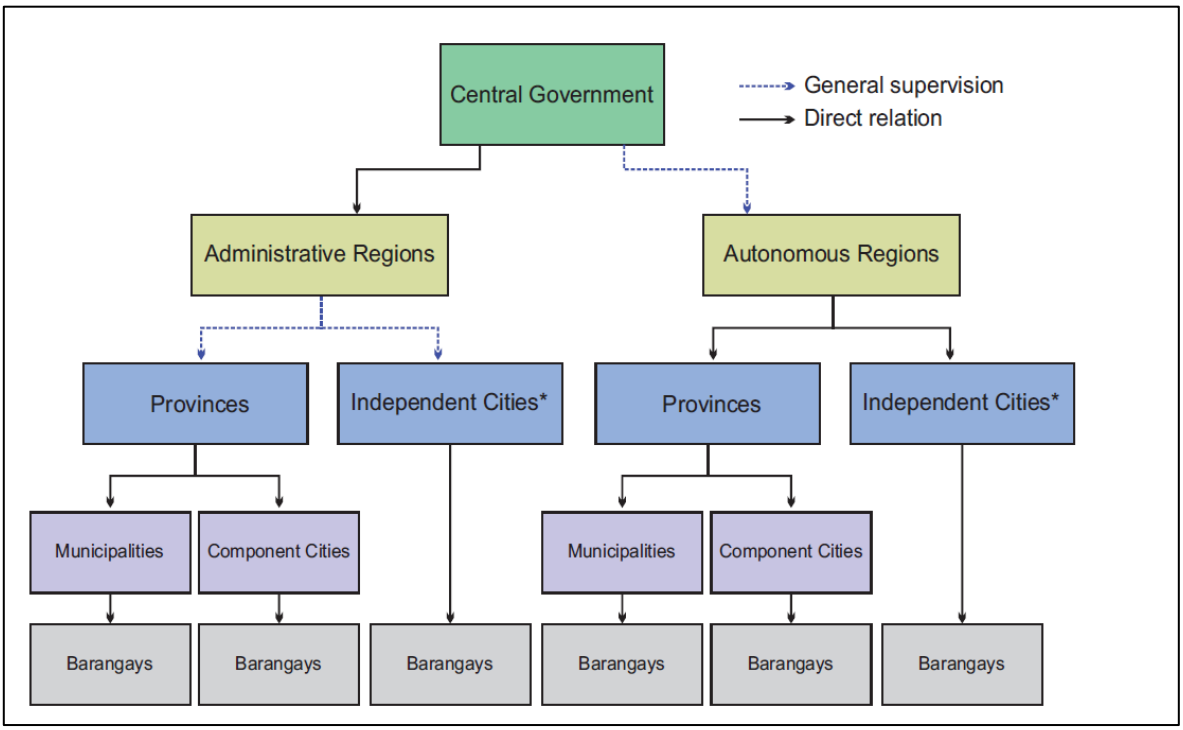


Figure 7.9. The structure of government in the Philippines.

1. **Central Government**
   a. **Department of Agrarian Reform**: Leads the implementation of the Comprehensive Agrarian Reform Program (CARP) through Land Tenure Improvement (LTI), Agrarian Justice and coordinated delivery of essential support services to client beneficiaries.

   b. **Department of Agriculture:**
      i. *Bureau of Animal Industry (BAI)*: Vision is to make the animal industry productive and profitable under sustainable environment through sound policies, programs, research and services on animal production, post-harvest, health and welfare.
      ii. *National Dairy Authority (NDA)*: To provide leadership to the Philippine dairy industry in partnership with the private sector through the provision of well-crafted policy, science-based technical expertise, sound business support and effective management of dairy programs.
      iii. National Artificial Breeding Centre.

   c. **Department of Environment and Natural Resources:**
      i. *Environmental Management Bureau (EMB)*: Protect, restore and enhance environmental quality towards good public health, environmental integrity and economic viability. Ensures a nation is empowered to protect our finite natural resources, attuned to the pursuit of sustainable development, for a clean and healthy environment that enhances the Filipino Quality of life for present and future generations.

   d. **Department of Health:**
      i. *Food and Drug Administration (FDA)*: FDA is mandated to ensure the safety, efficacy or quality of health products which include food, drugs, cosmetics, devices, biologicals, vaccines, in-vitro diagnostic reagents, radiation-emitting devices or equipment, and household/urban hazardous substances, including pesticides and toys, or consumer products that may have an effect on health which require regulations.

   e. **Department of Science and Technology (DOST):**
      i. *Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)*: Provide strategic leadership in promoting science and technology (S&T) as a platform for Agriculture, Aquatic, and Natural Resources (AANR) products innovation and environment resiliency.

   f. **Department of Trade and Industry (DTI):** Deliver business and consumer services directly to stakeholders and the general public; provision of support to increase competitiveness, innovation, and ease of doing business, protect consumers, consumer education, and formation of consumer groups, trade and industry policy formulation and implementation of the Manufacturing Resurgence Program; ensure operational efficiency within the Department by providing support services to all units to properly equip them in the performance of their respective functions; responsible for export and investment development program.

   g. **State Universities and Colleges.**
      i. Institute of Animal Science (IAS), *College of Agriculture and Food Science (CAFS), University of the Philippines Los Banos (UPLB)* The college's objectives are to produce highly competent graduates with deep sense of nationalism; advance knowledge and effective technology adoption among end-users; and advocate policies that will promote animal food security and safety based on sound social and ecological principles.
      ii. *Dairy Training and Research Institute* (DTRI*), CAFS, UPLB*: The DTRI has the following goals and objectives: 1) To train competent manpower required

by the local and international dairy industry, 2) To conduct research relevant to the needs of the dairy industry, which includes genetics evaluation, reproductive biotechnology, forage evaluation, and milk products development, and 3) To assist farmers in improving their activities in coordination with government and private agencies concerned with the local dairy industry and develop and disseminate dairy technologies and information responsive to the needs of all sectors at all levels of the dairy industry and related industries.

2. **Provincial Governments.** *Provincial veterinary offices*. These offices play a role in controlling and preventing the outbreak of economically significant animal diseases, promoting food safety through regulation of farms and slaughterhouses, increasing the income of livestock farmers and upgrading livestock genotypes.

In addition to government departments, the Dairy Confederation of the Philippines (DairyCon) also provides a range of services. DairyCon was founded in 1993 and serves as the apex advocacy organization of all dairy cooperatives, associations and processors.

7.11.2 Government strategies for the dairy industry

Sections 7.11.2 and 7.11.3 provide an overview of government policy, laws and regulations. 7.11.4 describes government initiatives and projects in more detail. Government services are covered in Section 7.12.

Gearing Up For Dairy 2030, The National Dairy Development Plan 2008-2030 (National Dairy Authority (NDA 2018c))

This plan published in 2008 outlines the longer-term objectives for dairy development in the Philippines. The plan describes components for longer-term expansion of the dairy industry with broader outcomes of:

- Enhanced food security;
- Improved poverty alleviation and social equity;
- Enhanced income and profitability;
- Enhanced sustainability.

Dairy industry objectives to achieve these goals include increasing herd size, improving milk handling and equipment, facilitating the establishment of a Dairy Credit Opportunity Window to support investment initiatives, cost-shared milk feeding activities and increase family income through dairy farming.

Four main programs are outlined in this plan to achieve the objectives and broader goals:

- Milk and Herd Build-up;
- Dairy enterprise development;
- National milk feeding;
- Industry support.

National Dairy Authority R&D Roadmap (NDA 2018c)

At least three Philippine Dairy Road Maps (DRM) have been developed including 2007-2010, 2010-2016 and 2017-2022. They are medium term roadmaps that serve as blueprints for achieving development of the local dairy industry while contributing to agribusiness expansion and job creation in agriculture. The current DRM 2017-2021 is a strategic plan developed by the NDA in consultation with stakeholders with a target to increase by 2022 the national dairy herd to 485,378 head and increase milk self-sufficiency from one to ten percent, which is equivalent to 184 million litres. Strategies outlined in the plan include:

- Implementation of a national milk feeding program;

- Providing a special credit window for dairy;
- Building capacity of implementing agencies and partners;
- Herd infusion including importation of dairy stock, diversification of sources and local procurement of dairy animals.

The diagram below (Figure 7.10) contains an overview of the current plan. Key objectives of the DRM 2017-2021 include:

- Increase average dairy milk production per cow from 5 to 7 litres/day;
- Increase lactation length from 270 to 285 days;
- Reduce the mating period post calving from 6-7 months to 2 months, and reduce calving intervals from 17 to 14 months;
- Reduce milk wastage and/or spoilage from 30% to 10%;
- Increase milk sales by 20%.

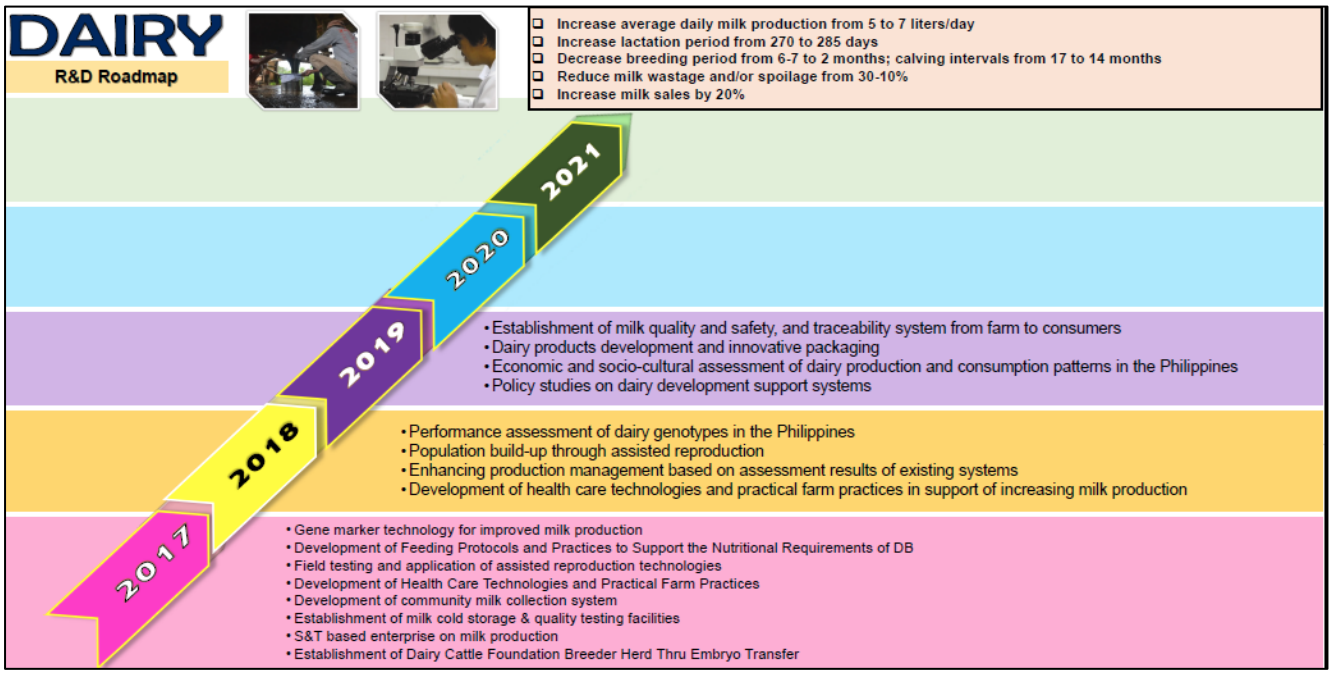


Figure 7.10. National Dairy Authority Roadmap 2017-2021.

Key challenges identified restricting the implementation of the DRM 2017-2021 include: a limited supply of dairy cattle; funding for infrastructure and logistics support; limited capacity of service providers servicing supply chains; inefficient productivity and ineffective marketing (Dept Ag, Quezon).

The DRM 2017-2021 introduces a program focussed on development of dairy business enterprises owned and managed by dairy cooperatives or federations in respective dairy zones. A subset of this broader program is the Herd Build-Up (HBP) and Carabao Development Program. According to the NDA, HBP is the base component of dairy development and aims to accelerate local dairy stocks and local milk production through importation of genetic material and artificial insemination programs.

The recent Commission on Audit report (2020) stated that despite these targets in the DRM 2017-2021, local dairy market share remained at only at 1.2 percent for 2013-16 and 1.3 percent in 2017-18. The main factors limiting the attainment of increased milk self-sufficiency includes: i) issues with policy coherence; ii) unclear roles and responsibilities of key stakeholders in the DRM 2017-2021; and iii) insufficient funding for importation of dairy animals.

Government policy and regulations relating to dairy farm, processing and retail sectors

Policy

Trade Policies

Food security and poverty alleviation have been the Philippine's main agricultural policy objectives for many decades now. The country has mainly used price support and input subsidies to achieve these objectives (OECD, 2017). In the 1980s, efforts towards liberalisation were undertaken, but it was only in the 1990s when major developments took place through the country's accession to the World Trade Organisation (WTO) and the initiation of the Association of Southeast Asian Nations (ASEAN) Free Trade Area.

The Philippines uses tariffs as its main trade policy instrument (OECD, 2017). As a member of the WTO, the Philippines committed to replace all quantitative restrictions with tariffs, impose a ceiling on tariff rates, and reduce tariff protection over time (David et al., 2007). However, the country's efforts towards trade liberalisation have been mostly through regional trade agreements (OECD, 2017). There are a number of trade agreements in place with the Philippines. These are:

- Most favoured nation (MFN)
- ASEAN-Australia-New Zealand Free Trade Area (AANZFTA)
- ASEAN–China Free Trade Area (ACFTA)
- ASEAN-India Free Trade Area (AIFTA)
- ASEAN-Japan Comprehensive Economic Partnership (AJCEPA)
- ASEAN Trade in Goods Agreement (ATIGA)
- Philippines-Japan Economic Partnership Agreement (PJEPA)
- Philippines-European Free Trade Association Free Trade Agreement Norway (PH-EFTA FTA (NOR)
- Philippines-European Free Trade Association Free Trade Agreement Switzerland/ Liechtenstein (PH-EFTA FTA (CHE/LIE)
- Australia-Hong Kong Free Trade Agreement (AHKFTA)
- Philippines-European Free Trade Association Free Trade Agreement Iceland (PH-EFTA FTA (ISL)

Tables A7.7 (p164) show Philippine import tariffs for fresh milk, milk powders, yogurt and ice cream since 2012 and predicted tariffs in 2024. Average tariffs in 2012 on fresh milk, milk powders, yogurt and ice cream were 1.8%, 0.7%, 4% and 4%, respectively. There has been an easing of tariffs across these commodities over the last eight years, with zero tariffs predicted under many trade agreements in 2024. Exceptions to these are yogurt importation under AANZFTA (3%) and AIFTA (5%), and ice cream under AHKFTA (4%).

The easing of tariffs under more a liberal global trade environment will mean more competition from imports for local SHD inclusive value chains. Given that SSL dairy products such as fresh milk and yogurts had historically low tariffs, their easing will not likely have a significant effect.

Dairy ingredients (with minimal processing) whether imported or produced domestically are exempt from a 12% value added tax (VAT) (PWC, 2019). Finished processed dairy products such as UHT tetra Pak products (whether domestic or imported) attract a VAT tax of 12%. Certain transactions are exempt from VAT. This means there will be no VAT on costs related to the making of these exempt goods. Some examples of dairy-relevant exempt transactions are:
a. Sale or importation of agriculture food products in their original state;

- Livestock generally used as, or yielding or producing foods for human consumption;
- Breeding stock and genetic materials.

b. Sale or importation of fertilizers; seeds, and livestock feeds.

The VAT exemptions on these imported farm inputs are advantageous for the SHD sector.

Comprehensive Agrarian Reform Program (CARP)

The 1988 land reform in the Philippines known as the Comprehensive Agrarian Reform Program (CARP) has had substantial effects on the scale and productivity of Philippine's agriculture. This reform followed a series of redistribution programs extending back to the 1930s. CARP imposed a restrictive ownership ceiling on existing land holdings with above-ceiling land primarily provided to landless and small landholders through a government redistribution process. It also allowed for the disposal of under-utilised and new public lands. This reform has been implemented across approximately 70% of agricultural land in the Philippines (Ballesteros et al., 2018).

A key aspect of the policy is an ownership limit of five hectares for any landowner. Additional holdings can be awarded to dependants (three ha), provided that a child was 15 years of age at the time the law was enacted and was actually working the land.

There are provisions in the policy regarding collective management of land tenures by co-operatives and private corporations with over 60% Filipino stakeholders. There are also options for corporations to lease larger parcels of land under longer terms. Additional provisions are included regarding historical land ownership from communities that can provide evidence of historical cultural links to holdings.

The CARP has had profound effects on the number of farm enterprises and farm size. The 2012 Census of Agriculture showed that from 1980 to 2012, the number of farms/holdings increased by 62.6 percent to 5.56 million farms, while the average farm area decreased from 2.84 hectares to 1.29 hectares (PSA, 2012). This has had significant ramifications on agricultural productivity with a decline of 17% post CARP implementation (Adamopoulos and Restuccia, 2020).

The CARP has also had implications for the dairy industry. While it has improved the sustainability of SHDs from a tenure perspective, it provides real limitations in terms of enterprise growth. Assuming 4.5 ha of a rainfed 5 ha SHD farm could be used for forage production, best practice would result in harvestable yields of 15 tonnes dry matter per hectare per year, allowing for a stocking rate (including dry stock) of three cows per ha or 14 cows per enterprise. Additional enterprise growth would require the outside sourcing of forages.

Sagip Saka Act

The Sagip Saka Act (Republic Act (R.A.) 11321, An Act Instituting the Farmers and Fisherfolk Enterprise Development Program of the Department of Agriculture) was signed into law on April 17, 2019.

This policy aims to achieve sustainable modern agriculture and food security by helping the agricultural and fishing communities to reach their full potential, increasing farmers' and fisherfolk's incomes, and bridging gaps through public-private partnerships, thereby improving their quality of life. Its desired outcomes are:

1. Improved productivity through enhanced business management;
2. Increased enterprise income through expanded access to markets and product development/improvement;
3. Improved maturity level/category of enterprises by upgrading its business processes; and

4. An efficient, effective, timely, and properly documented program implementation.

To implement the Program, there is a National Sagip Saka Program Steering Committee.

Emerging policy

In 2020, a bill was filed in the lower house of the Philippine Congress regarding a comprehensive development plan for dairy (Republic of the Philippines House of Representatives, 2020). The bill introduced five measures:

1. Monitoring the implementation of dairy-related Public Investment Programs under the National Economic Development Agency programs;
2. Prioritising projects that improve animal health, welfare and nutrition;
3. Identification of model farms, to support mentoring and training for dairy farmers and industry;
4. Form institutional linkages between dairy farms and local government units to support marketing of dairy products and school milk programs;
5. Revitalising and streamlining financial aid programs for dairy farmers.

For the bill to be enacted into law, it needs approval from the upper house or the Senate. At the time of writing of this report, it was still being discussed in parliament.

Regulations

Food Safety Act and Dairy Food Regulations

National quality standards (NQS) relating to milk production ex-farm and processing

Republic Act No. 10611, known as the Food Safety Act of 2013, aims to protect consumer health, enhance industry and consumer confidence in the food regulatory system, and promote fair trade practices and sound regulatory foundation for domestic and international trade.

Under the Food Safety Act, the National Dairy Authority (NDA) was designated as the Food Safety Regulatory Agency (FSRA) for pasteurized liquid milk products (Lomuntad, 2020). As such, NDA developed the Dairy Food Regulations, which specify the standards and requirements for raw milk collection and milk pasteurization. Table A7.8 (p165) shows the standards set for raw milk and dairy animals, while Table A7.9 (p166) shows the standards for pasteurized milk. The NDA outlines that raw milk collected that does not pass the minimum standard will be rejected, and standards are in place to encourage milk processors to adopt premium pricing schemes for raw milk.

Also included in the Dairy Food Regulations are the fees and charges for the issuance of Certificate of Compliance (COC) and License to Operate (LTO) (Table A7.10 (p167)).

The Philippine NQS are generally comparable to global standards e.g., Australia and New Zealand Food Authority (ANZFA). A couple of points of difference are as follows:

- The upper limit for Standard Plate Count (Total Plate Count) for farm milk supply in the NQS is 150,000 colony forming units (cfu)/mL. This compares to 50,000 cfu/mL in ANZFA;
- Freezing point (0.517^{o}C) as an indicator of adulteration with water does not appear in the Philippine NQS. Specific gravity is measured as an indicator in the NQS, but this can be affected by milk components such as fat, protein and minerals. Freezing point is determined by lactose and salt concentrations in milk which has little variation unless water addition dilutes their concentrations.

Recommendations from this review would be to evaluate the feasibility of lowering the upper limit for total plate count (TPC) and introducing freezing point into the Philippines NQS.

7.11.3 Regulations regarding labelling at the point of retail sale

Packaging and labelling regulation

The Food Safety Act of 2013 (Republic Act No. 10611) mandates the Department of Health (DOH) to oversee the safety of all food processing and product packaging activities. The DOH, through the FDA, is responsible for the overall regulation of all activities pertaining to processed food (pre-packaged or not pre-packaged).

As mandated by Administrative Order 2014-0030 (Rules and Regulations Governing the Labelling of Pre-packaged Food Products Distributed in the Philippines), labels of pre-packaged food must contain the following information:

- Product name or name of food;
- Brand name and/or Trademark;
- Complete lists of ingredients;
- Net contents and drained weight;
- Name and address of manufacturer, re-packer, packer, importer, trader, and distributor;
- Lot identification;
- Storage conditions/instructions;
- Expiry date/use by date/best before date;
- Food allergen information;
- Direction/instruction(s) for use;
- Nutrition facts/nutrition information/nutritive value.

Laws and codes of practice relating to nutritional information, food safety, IP protection

The Dairy Food Regulations specifies the safety and quality standards for pasteurized milk and the kind/quality of packaging materials for pasteurized liquid milk products. The Philippine National Standard for fresh milk (DTI-BPS, 2008) specifies that the concentrations of milk fat and milk protein should be included in labelling of fresh milk. It specifies that the following information should also be included in the label:

- Name of the food (e.g., fresh cow's milk, fresh carabao's milk);
- Heat treatment process (e.g., whole milk pasteurized/UHT);
- Labelling of non-retail container (e.g., storage instructions).

Nutritional content

Nutritional content on food items is listed using a format (tabulated form) as prescribed in the Rules and Regulations Governing the Labelling of Pre-packaged Food Products (Administrative Order No. 2014-0030). Nutrients can be declared or expressed either in unit per serving or percent Recommended Energy and Nutrient Intake (RENI) or both. The computation of the nutrient expressed in percent RENI is based on the Philippine RENI for male adults ages 19 to 29. These nutrients are expressed as follows:

- Carbohydrates, protein, fats (cholesterol expressed in mg), sugar, and dietary fibre – in nearest gram (g). Energy values in Calories (*kcal*) and sodium in *mg*.
- Vitamins and minerals – in milligram (*mg*) or microgram (*mcg* or ≤*µg*). International units (I.U.) for Vitamins A, D and E.
- Locally manufactured food products for local consumption should also include the RENI values in actual percentage expressed in whole numbers.

The regulations covering the nutritional content and labelling of processed dairy products is comparable to global standards.

Regulations regarding the use of fresh milk in labelling

In Australia, state government laws stipulate the definition of fresh milk. Generally, this is described as containing not less than 90% unaltered mammary secretion which has been pasteurised. We were unable to find reciprocal laws in the Philippines.

7.11.4 Government agriculture and dairy development programs

Department of Agriculture (DA) - Philippine Rural Development Project (PRDP)

The Philippine Rural Development Project (PRDP) is a six-year project designed to establish a government policy and funding platform for a modern, climate-smart and market-oriented agri-fishery sector (Department of Agriculture, 2021). It commenced in 2014 and has the key objective of increasing rural incomes by supporting smallholders to improve their access to markets. Embedded within its broader agricultural development programs, the DA has a key strategy to make the development of the Philippine dairy industry a priority with a special emphasis on improving local supply of fresh milk and increasing farmers' income. The strategies for achieving this are through: (a) supporting changes in agricultural planning, resource programming and implementation practices; and (b) financing priority local investments in rural infrastructure and enterprise development. Its key outcomes are to deliver:

- At least a five percent increase in annual real farm incomes of household beneficiaries;
- 30 percent increase in income for targeted beneficiaries of enterprise development;
- Seven percent increase in value of annual marketed output;
- Twenty percent increase in number of farmers and fishers with improved access to DA services.

The DA program has the following components (direct project budget (million PHP)):

- Investments in Agriculture and Fisheries Modernization Program Planning at the Local and National Levels (790);
- Intensified Building up of Infrastructure and Logistics for Development (I-BUILD; 18,537);
- Investments in Rural Enterprises and Agriculture and Fisheries Productivity (I-REAP; 6,927);
- And Implementation Support to PRDP (I-SUPPORT; 230).

The PRDP is funded by the World Bank (75%), the Philippine National Government (13%) and Local Government Units (11%) (World Bank, 2021b).

Implementation

There are a number of provinces which specifically have strategies aligned to the PRDP to grow their dairy industries (excluding carabao). These are shown in Table 7.8. The project team took this into account when selecting provinces to undertake SHD benchmarking. A similar review would be recommended during the deployment of a larger project.

Table 7.8. Provinces with specific reference to dairy development in their Rural Development Project prospectuses.

Region	Province
North Luzon	Cagayan
North Luzon	Isabela
South Luzon	Batangas
South Luzon	Laguna
South Luzon	Quezon
Central Visayas	Bohol
Western Mindanao	Zamboanga del Norte
Northern Mindanao	Misamis Oriental
Southern Mindanao	Compostela Valley
Southern Mindanao	Davao del Sur
Southern Mindanao	South Cotabato

The following are two examples where co-operatives have benefited from PRDP funding:

- The Nabunturan Farmers Multipurpose Cooperative in Davao de Oro has participated under the I-REAP component to implement the “Cow’s Milk Processing and Marketing Enterprise” and have secured 50 head of dairy cows imported from Australia (Department of Agriculture, 2020). They have developed small scale processing to supply milk under the School Based Feeding Program (SBFP);
- The Unified Engineering Workers Multi-Purpose Cooperative (UEWMPC) of Polomolok in South Cotabato, Mindanao have also secured funding under PRDP for infrastructure development and securing 120 head of dairy cattle (Mindanews, 2020). These were distributed to four partner dairy cooperatives of UEWMPC. The provincial government of South Cotabato is also pushing for expansion of dairy production and processing in the region to meet local demand.

7.11.5 School Based Feeding Program (SBFP)

The GoP SBFP first commenced in 1997. This is enforced by Section 16 of the National Dairy Development Act of 1995 (GoP, 1995). This section requires that government nutrition programs use milk supplied by local milk producers which is co-ordinated by NDA (NDA website). The Department of Social Welfare and Development (DSWD) and Department of Education (DepEd) have been mandated to implement the Supplementary Feeding Program including the SBFP to address undernutrition among Filipino children. In coordination with the DA, the NDA and the Philippine Carabao Centre (PCC) are the lead agencies mandated to conserve, propagate and promote the source of milk and assume lead roles for the nationwide coordination and implementation of the SBFP (Department of Education, 2019; DSWD, 2020).

The SBFP has the primary goals of providing milk to undernourished children from kindergarten to Year 6 for at least 20 days per year. Daily servings are 180 to 200 mL. It is noted however in the regulations that products can be stored at room temperature until consumption, highlighting that many schools do not have refrigeration capacity to store pasteurised milk post-delivery. The NDA also provides regulations regarding minimum nutritional content (1.5% fat; 4% protein) and monitor these regulations. Given that typical cow’s milk contains 3.2% protein, supplying this protein level would be challenging and would indicate that some modification is occurring during manufacturing. Milk protein concentrations are also not part of the NQS.

It has been reported that half of the fresh milk produced predominantly by SHDs is used in the SBFP with the remainder being UHT and reconstituted milks. Exact amounts are difficult

to ascertain as some reconstituted dairy milk products manufactured from commodities are supplied through co-operatives. NDA Annual Reports list the following:

- From 1995 to 2012, there was 23.4 million litres of milk supplied paid at ₱22 per litre. This represents approximately 20% of national dairy cattle farm supply;
- Between 2012 and 2014, the SBFP program received ₱230 million. 2.04 million litres were supplied in 180-200 mL packs;
- In 2019, there was ₱991 million allocated through the Department of Education for the SBFP. Based on a co-operative purchase price by NDA of ₱18 for 200 mL, this represents a program milk supply of 11 million litres (NDA, 2019a);
- The 2019 SBFP was resourced to service 223 divisions with 1.84 million beneficiaries. Assuming an intake per beneficiary of four litres p.a., this equates to 7.36 million litres p.a. or around 31% of national milk supply (NDA, 2019a).

Our conclusions are that the SBFP uses 20 to 30% of national milk supply, with the majority of milk sourced from co-operatives. Therefore this is an important value chain for SHDs. With school attendance restrictions imposed due to Covid-19, there have been flow-on impacts to co-operatives, with many having to either find new markets, decrease milk intake or both.

The SBFP has, and will be an important government program to provide a market entry point for new co-operatives and provide a reliable ongoing market for established co-operatives.

From a milk supply perspective, the SBFP does pose some challenges. A question raised during our interviews related to how co-operatives manage their milk supply and processing during school holidays, especially with small scale processing facilities being unable to implement UHT technology due to its high capital cost. Two common responses were that co-operatives manufactured frozen flavoured milk products (that were retailed directly or wholesaled through schools), or they manufactured milk-based candies. During our interviews, we heard that contract Philippine UHT processors require a minimum of 20,000 litres to undertake a manufacturing run of UHT tetra Pak products. This volume of milk supply is beyond the capacity of most of the co-operatives we researched.

7.11.6 NDA Dairy Development Programs

As noted, the NDA has a focus on four main development programs, which align with the DRM 2017-2021. In addition to the SBFP, these are the Herd Build Up Program; Dairy Business Enhancement Program and the Milk Quality Assurance Program.

Herd Build Up Program

The Herd Build-Up Program (HBP) aims to expand local dairy production through the importation of dairy animals, embryos, and equipment; upgrading of local animals to dairy breeds via breeding programs; the establishment of multiplier farms; and the preservation of existing herds (USDA, 2020a).

The HBP is broken down into a number of sub-programs which include:

1. *Save-the-Herd (STH) Scheme*: Promotes animal trading, dairy enterprise enhancement and herd conservation. Under this program, the STH partner receives a dairy animal from NDA which they are obligated to rear and impregnate according to prescribed dairy husbandry management standards;
2. *"Palit-Baka" Scheme of Dairy Animal Distribution*: is a program whereby NDA distributes a heifer to an eligible participant who, in turn, would eventually provide NDA with a heifer (or cow) as payment *in kind*;
3. *Bull Loan*: Loan program that provides purebred and crossbred dairy bulls to regional field units of the DA or to other project partners for semen production, collection, and processing purposes;

4. *Herd Infusion*: Includes importation of dairy stocks, diversification of sources, and local procurement of dairy animals;
5. *Improved Breeding Efficiency*: Breeding services to maximize the reproductive capacity of dairy animals either through artificial insemination or natural (bull) breeding;
6. *Animal Financing*: Tailoring of animal loan programs to the dairy business cycle and identifying new sources of affordable loans. An example of this is the Dairy Care Giver Scheme, mentioned in the National Plan 2008-2030 where recipients repay capital within five years with annual interest;
7. *Upgrading of Local Animals*: Artificial insemination of local cattle with 100 percent purebred Holstein-Friesian semen. Calves born from upgrading programs are distributed to new farmers interested in dairying;
8. *Breeding/Multiplier Farm Operations*: Engaging and encouraging private-public partnerships in producing local-born heifers. There are currently 61 dairy multiplier farms with more than 5,500 dairy cows.

Performance of Herd Build-Up Program

A report on the HBP published by the Commission on Audit 2020 found that the increase in the dairy herd size was not sufficient to meet the desired goals of local milk sufficiency, among other factors. According to PSA data, at the end of 2018 the national herd numbered 47,600. This was only 24 percent of the target of 198,977 head under the DRM 2017-2021.

Table 7.9 provides targets and actual performance from the NDA Herd Build Up program from 2013 to 2018. Genotype upgrading from insemination met program targets while heifer importation and farmer buy back projects were below target.

Table 7.9. Targets and actual performance from the NDA Herd Build Up program (2013-2018).

Program	Target (head)	Actual (head)	Proportion achieved (%)
Herd infusion (importation)	11,880	3,060	26%
Local herd upgrading	35,000	38,441	110%
Buy Back	7,000	0	0%

The under-delivery of the importation program was due to unfunded plans, absence of suppliers, unavailable dairy stock, and foot and mouth disease risk. Issues have also arisen with imported animals, with 25% mortality due to animal health management issues.

Other issues impeding national herd development were also discussed in the Audit:
- High mortality was raised with 10% of the national herd dying during the reporting period (It is unclear if this data included mortalities due to targeted culling);
- Regarding AI programs between 2013 to 2018, 88,617 inseminations were performed with 37,200 calves born; a pregnancy rate of 42%. A comparable pregnancy rate in Australia is 55%, which would suggest some underperformance;
- Under the NDA buy back initiative, the harvest rate was 11% versus a target of 20%;
- Under the Palit-Baka scheme, repayments were only 37% of the total due.

Dairy Multiplier Farms (DMF)

The outcome from DMF is to primarily increase the national dairy herd population through supporting farms with livestock and technical support. There are various selection criteria the farm must meet before being accepted (USDA, 2020a) (Section A7.2 (p149)).

Other herd development initiatives - Embryo importation

In May 2019, the Bureau of Animal Industries approved the importation of dairy embryos from the USA. These are being used in a project entitled “Establishment of Dairy Cattle Foundation Breeder Herd” in a partnership between NDA and PCAARD. This project will evaluate the technical and economic feasibility of embryo transfer. The genetic merit of embryos relative to Philippine operating conditions is unclear (NDA, 2019a).

Dairy Business Enhancement Program

This program fosters entrepreneurship among dairy producers by installation of business management systems, continuous education, training and infrastructure development. The program also supports local dairy enterprises establish the marketability of locally produced milk through business assistance such as provision of dairy inputs (infrastructure, dairy equipment or capital through credit or grants), market development, dairy promotion activities and product development.

The Milk Quality Assurance Program

This program focuses on the installation of quality-based milk test and payment systems, farm and plant audits, and installation of quality control systems. The program also aims to educate dairy stakeholders in the adoption of safety standard protocols of milk handling from the farm gate to post-harvest, as well as fair practices in food trade. To improve the delivery of services of laboratory analysis and testing, the NDA has started a renovation of its Milk Quality Assurance and Product Development laboratory located at its headquarters in Quezon City (NDA, 2018a).

7.12 Government services to dairy farmers, co-operatives and processors

The GoP through the DA, NDA and provincial government provides direct inputs and significant support services to SHDs and processors. These government departments and their services are shown in Table 7.10.

Table 7.10. A summary of government service provision to the Philippines dairy farm and processing sector.

Name	Services
Bureau of Animal Industry (BAI)	• Extension services for animal health; veterinary quarantine services; regulatory and research and development; • Priority Programs and Projects: Animal health protection and welfare; animal genetic resource improvement and conservation; animal trade competitiveness enhancement; research and development; stakeholder engagements; ISO quality management; facilities and laboratory equipment improvement; and fiscal management and improvement.
Department of Agriculture (DA)	• Soil testing kits; • Seeds – tropical grasses; • Semen and AI technicians; • Training on breeding and feed production and product promotion; • Laboratory analysis services. • Dairy product promotion
Department of Agrarian Reform (DAR) - Regional Offices	• Implementation of the Comprehensive Agrarian Reform Program (CARP) through Land Tenure Improvement (LTI). • Laboratory services, A.I. supplies and biologics, and development of milk collection and processing centres.
Department of Science and Technology (DOST) - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)	• Research and development in dairy science; • Assistance in the development of milk collection and processing centres, product development and laboratory analysis.
Department of Trade and Industry (DTI)	Shared service facility, Study Missions, Training, Trade Fairs, GMP and HACCP training, Investment promotion and facilitation, and Market development.
Environmental Management Bureau (EMB)	Pasture lease forage production, Forage germplasm, advocacy and training on environmental management
Food and Drug Administration (FDA)	Issuance of license to operate processing facilities and product registration
National Artificial Breeding Centre	Provision of semen
National Dairy Authority (NDA)	• Technical services, training and extension; • Evaluation of farmer skills and capability; • Technology dissemination (breeding); • Analysis services; • Business development services; • Marketing through feeding program.

Philippine Rural Development Project (PRDP)	A six-year (6) project designed to establish the government platform for a modern, climate-smart and market-oriented agri-fishery sector. PRDP partners with local government and the private sector.
Provincial veterinary offices	Animal health care services, biologics, extension services and training on forage development.
State Universities and Colleges	Extension services, research and development, and market studies

Source: Foodlink database of key informants.

7.12.1 Provision of testing services by NDA

Milk quality testing services offered by NDA (2021l) are shown below in Table 7.11. While turnaround times are typical of global standards, pricing of physio-chemical and somatic cell tests are above average. Larger contract laboratories in developed countries would undertake a combined analysis of fat, protein, lactose and somatic cells for less than $1.50 USD per sample. The cost of TPC, coliform and antibiotic testing is typical of prices paid in Australia from contract laboratories.

A challenge with the NDA testing system is the relatively large milk sample required (500 mL). Transporting these samples between 2ºC and 6ºC ex-farm to the laboratory would be a considerable cost. Typically, samples of less than 50 mL are usually required for manual testing with automated testing systems needing less than 10 mL per sample. These smaller sample sizes are however from milk collection systems that have subsampling technology i.e. drip samplers, which ensure a representative sample for analysis.

Given the relatively low milk production per farm and per cow, and also the low volumes processed through co-operative, the frequency of undertaking milk quality tests whether from the perspectives of food safety, quality or genetic improvement, would be limited by their high cost. While low cost analysers are available for milk components and somatic cells, low cost testing for TPC remains a challenge for all dairy industries globally. The development of rapid indicators e.g., Marri et al., 2020, offers scope to address this issue and should be included in future R&D strategies.

Table 7.11. Milk quality testing services offered by National Dairy Authority.

Test/parameters	Cost PHP (USD)	Turnaround time
Physio-Chemical Analyses		
Fat (as butterfat) determination	526.40 ($10.39)	7 hours & 10 minutes
Solids Non-fat determination	56 ($1.12)	
Total Solids determination	56 ($1.12)	
Protein	56 ($1.12)	
Specific gravity	56 ($1.12)	
pH	56 ($1.12)	
All tests	806.40 ($16.13)	
Microbiological Analyses		
Total Plate Count (TPC)	285.60 ($5.71)	2 days & 6 hours (Total Plate Count)
E. coli/Coliform count	1,008.00 ($20.16)	1 day & 6 hours (E. coli/ Coliform count
Direct Microscopic Somatic Cell Count (DMSCC);	128.80 ($2.58)	7 hours & 15 mins
Other		
Antibiotic Residue Test	336.00 ($6.72)	7 hours & 15 mins

Our overall conclusion is that the food safety policy and regulation along SHD supply chains is consistent with global standards. However, the implementation of these standards within supply chains is variable. As a general conclusion, adherence and enforcement of these standards is limited within SHD value chains for a number of reasons such as a lack of regular monitoring and feedback, due to limited testing laboratories and communication.

7.12.2 Additional government services provided to dairy farmers

Genetics and livestock

As noted earlier, the GoP through the DA and NDA have key mandates to grow and improve the genetic merit of the Philippine dairy herd. Farmers can access various herd development services from the NDA, both live cattle and semen/straws.

Live cattle

The NDA Central and their Regional Offices offer loan programs for farmers to access cattle (NDA, 2021i & k). The Dairy Multiplier Farm Program offers a minimum consignment of 50 head, with options for repayments through progeny or a mix of progeny and cash payments.

Breeding Services

The NDA provides breeding services, including synchronised breeding, and artificial insemination (NDA, 2021b). To access the NDA breeding services, farmers need to pay for the technician, either NDA personnel or an accredited private technician. There are 1,600 accredited private technicians across the Philippines, with 900 active. The cost of conventional semen is free with sexed-semen available for purchase at ₱3000 per straw. Farmers also have the option to 'upgrade' their non-dairy animals by insemination with Holstein-Friesian semen.

Buy-Back Services

Farmers have an option to sell dairy animals back to the NDA in order to reduce their herd size and contribute to NDA's Herd Build-up Program (NDA, 2021j). The value of their cattle is determined by the NDA's Technical Evaluation Team. One SHD surveyed sold four pregnant heifers to NDA for ₱88,000 per animal.

Veterinary services

According to the BAI and provincial veterinary offices, a number of diseases and parasites were endemic to the Philippine dairy industry, including haemorrhagic septicaemia, ephemeral fever, contagious bovine pleuropneumonia, flukes, tapeworm and ticks (NDA, 2021h). Eradication schemes are in place for tuberculous (TB) and brucellosis, with infected cattle culled. Testing for TB and brucellosis occurs during *ad hoc* farm visits. Further health issues reported by the BAI included mineral deficiencies (e.g., calcium, magnesium), mastitis, scouring and respiratory issues in calves. Dairy farmers receive veterinary services from both the NDA and provincial veterinary offices. Regular health services include vaccinations, vitamin supplementation, de-horning, de-worming, de-ticking and hoof trimming.

The NDA websites reports these services are free and that the client bares the cost of drugs and biologics. Our SHD survey indicates that NDA provides some drugs for free.

Agronomy and nutrition

The NDA provides agronomy advice on request (NDA, 2021m). The cost for this is shared between the NDA and farmer/client. For example, the venue, food, accommodation is covered by the client, while time and technical resources are covered by NDA.

As part of the Animal Loan Services, the NDA requires farmers to demonstrate the capability of producing adequate feed for the herd size they are proposing. In order to support farmers improving their feed production, farmers can request support from the NDA's Animal Nutrition Services (NDA, 2021c).

Loans

In addition to the herd expansion finance options from NDA discussed above, there are a range of loans and financial products from governments and co-operatives available for SHDs to help expand their business. These are available through these organisations directly, however there are options available for cooperatives to be a conduit for farmers to access loans. Available financial products for SHDs are shown in Table A7.11 (p168). We were unable to fully review their terms and conditions, however the interest rate of some of these loans (8 to 15% p.a.) were relatively high versus Philippine Central Bank rates of 1.5%.

7.12.3 Provincial government

The provincial government offices also support veterinary services which are free for dairy farmers. These services are similar to those provided by NDA including AI, de-worming, and vaccinations (e.g., haemorrhagic septicaemia). Multiple interviewers reported NDA would be contacted prior to the provincial office.

Additionally, the provincial government (in conjunction with DA) provides free laboratory testing services for SHDs. For instance, the Cagayan Valley Integrated Agricultural Laboratory provides, soil, animal and plant disease diagnosis, and feed testing. These analyses are shown in Sections A7.3 to A7.6 (p149). These services are comprehensive. Of note was the dated methodologies used for some feed testing.

7.13 Degree of collaboration between government sectors

According to FAO (2009), a number of trends in the Philippine dairy sector have helped to accelerate development. Collaborative efforts between governments and dairy enterprises in conjunction with development assistance, have been important growth drivers.

To achieve the targets in the DRM 2017-2021, one of the strategies identified was to unify the efforts of government and non-government agencies. The intention was that with NDA (as the leading agency), alongside other institutions including Livestock Development Council, PCC, BAI and DTRI, would join resources in developing the local dairy industry in collaboration with the Dairy Confederation. However, the only visible partnership intention, was between the NDA and PCC was through a Memorandum of Agreement in 2017 when they agreed to collaborate through their respective buy-back programs (Commission on Audit, 2020).

The 2020 Audit Report of the Herd Build up program noted that in this particular case, there was no clear protocol of data sharing between NDA and PCC, hindering the efforts and collaboration needed to achieve the objectives in the DRM 2017-2021. Gaps in program administration, including poor coordination among cooperating agencies (as well as gaps in contract provisions and monitoring) were also stated to have impacted on the poor implementation of this program. The audit report criticises the lack of clear roles and responsibilities resulting in fragmented efforts in carrying out the dairy program, impacting the attainment of the DRM 2017-21 objectives.

A key recommendation from the audit report was as the Department of Agriculture has the authority and responsibility for ensuring that government dairy programs are aligned, it is best positioned to strengthen the coordination and cooperation among key stakeholders.

8 An analysis of key domestic and export market opportunities in the Philippines

8.1 The domestic marketplace

8.1.1 Consumption of dairy products

USDA (2020a) cites that the annual per capita kg milk equivalent (LME) dairy consumption in the Philippines is estimated at 22 kg (NDA estimate 27 kg), compared with Thailand at 26 kg, Malaysia at 52 kg, and the United States at 287 kg. A Filipino family spends a little over ₱4,000 ($82 USD) per year on dairy products. Current consumption of different dairy lines and their forecast growth are shown in Figure 8.1. With the exception of skim milk powder, less than 1 kg/capita of different dairy products are consumed on average per year.

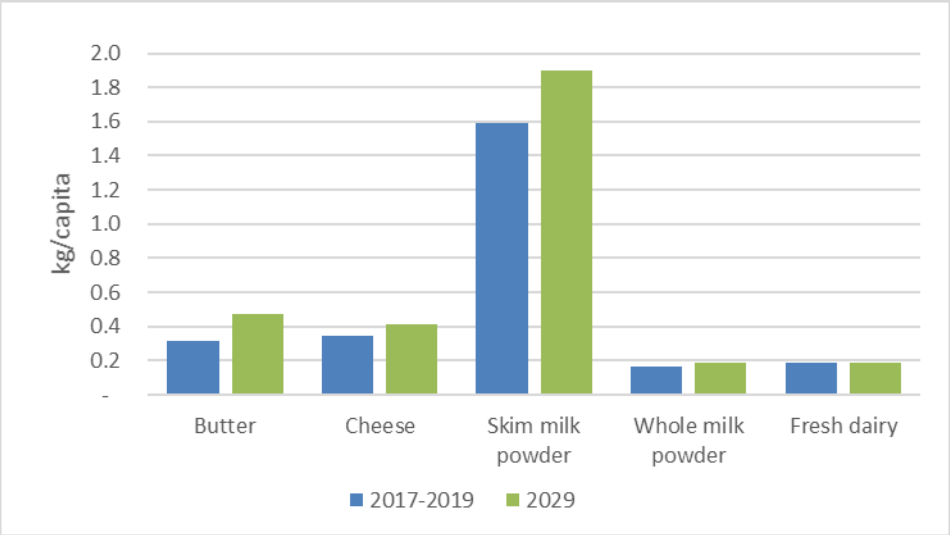


Figure 8.1. Consumption projections.

Source: OECD-FAO, 2020

The PSA estimated that annual per capita consumption of fresh/pasteurized milk in 2015-2016 was 0.26 litres. Urban consumers consume more (0.62 litres) compared to those in the rural areas (0.11 litres). Per capita consumption of fresh/pasteurized milk also differed across the regions with Western Visayas consuming the highest at 0.71 litres followed by the National Capital Region (NCR) at 0.65 litres and Central Luzon at 0.58 litres. Ilocos Region consumed the lowest at 0.02 litres per capita per year. Across the different socio-economic classes, the C or middle class had the highest per capita consumption at 0.36 litres per year followed by the AB or upper class with consumption of 0.29 litres. The D or lower class consumed 0.15 litres per capita per year while the E, or the extremely lower class, had the lowest consumption at 0.05 litres. More information of regional milk consumption can be found in Figure A8.1 (p146) and Table A8.1 (p169).

Consumption projections within dairy lines

The OECD-FAO (2020) projected that per capita consumption of fresh dairy products will increase by a modest 0.02 percent per annum over the coming decade (2020-2029) (Figure 8.1). Consumption of butter is projected to increase by 2.77 percent per annum during 2020-2029 (to 0.5 kg in 2029 from an average of 0.3 kg in 2017-2019). Cheese consumption is

forecasted to increase by 1.67 percent per annum to 0.4 kg in 2029 (from 0.3 kg in 2017-2019).

Other factors contributing to growth in dairy consumption are expanding cold chain capacity, an increasing number of formal supply chains such as supermarkets, and a developing food processing industry (USDA, 2020a).

8.1.2 Major dairy brands in formal supply chains

Drinking milk

Philippine supermarkets are dominated by RTD shelf stable (ambient) milk, with international brands being prominent (Euromonitor International, 2021a). The pasteurised (or Extended Shelf Life (ESL)) fresh milk sector is classed as niche with its growth restricted by a lack of major brands. A further challenge for fresh milk growth in the supermarket sector is the use of “fresh” in ambient products. This creates confusion for consumers.

Nestle Philippines Inc. dominate the ambient milk market with 49.3% of market value in 2020. Next was Alaska Milk Corp with 20.7% and Fonterra Brands Philippines with 11%. In combination, these three processors have 81% of market share. Regarding Philippine owned companies, RFM Corporation has 1.7% of the market while Snow Mountain Dairy Corporation shares 1.1% (Euromonitor International, 2021a). Regarding brands of ambient milk, Bear Brand (Nestle) leads with 35.3%, Alaska (Royal Friesland Campina NV) has 20.7%, Nido Nestle 7.6% and Anchor Fonterra with 6.0%.

Pasteurised fresh milk is limited to less well-known or locally produced brands such as Pinkie’s Farm (sold online and through specialist retailers), Holly’s Fresh Milk (Real Fresh Dairy Farms Inc) and Pure & Best (Hacienda Macalauan). They contribute to less than 1% of the drinking milk market. A survey we undertook of online shopping from three Philippine supermarkets (Pushkart, MetroMart and WalterMart) showed they did not offer these local brands.

Ice Cream and Frozen desserts

During 2019, Unilever RFM Ice Cream Inc. was the most dominant company in the Philippines, with 62.4% of market share. Next was Nestlé Philippines Inc (26.4%) followed by Magnolia Inc (6.0%). Major brands (and their owners) are Selecta (Unilever) 38.1%, Cornetto (Unilever) 19.9%, Nestlé 14.2%, Magnolia 5.9%, Drumstick (Froneri Nestlé Philippines) 4.0% and Magnum (Unilever) 2.5%. There were no significant domestic companies or brands in formal supply chains (Euromonitor International, 2021b).

Yogurt and Sour Milk products

Yakult Philippines Inc dominate the yogurt and sour milk product segment with 92.9% of retail value. Next is Nestlé Philippines Inc with 3.9%, Savencia Fromage & Dairy 0.8% and Dutch Mill Co Ltd 0.3%. All of these companies are internationally owned with subsidiaries in the Philippines (Euromonitor International, 2021c).

Supermarkets

Our research could not find evidence of retailers selling private label/home brands in dairy lines as seen in other countries such as England, USA and Australia. This concurs with Sebri and Zaccour (2017) who found that private label only shared 0.6% of market share of chain stores in the Philippines including supermarkets, hypermarkets and warehouse clubs.

8.1.3 Retail price of key dairy lines (fresh milk, soft cheese and yoghurt)

Milk

Noting that there are branding discrepancies regarding the use of "fresh" on UHT and reconstituted drinking milks, Filipino consumers pay a comparable price to other Australasian countries for milk (Table 8.1). Average price per litre 2% milkfat across Australasia is $1.80 USD. Philippine pricing at $1.75 USD is very comparable. This would indicate that comparable value and margins can be gained from Philippine drinking milk supply chains provided there is no distortion (e.g., abuse of market power).

Table 8.1. Comparison of Australasian milk price.

Country	USD 1 litre 2% fat
South Korea	$2.44
New Zealand	$2.05
Singapore	$1.89
Thailand	$1.83
Philippines	$1.75
Australia	$1.69
Vietnam	$1.56
Malaysia	$1.51
Indonesia	$1.50
Average	**$1.80**

Source: www.globalproductprices.com

Our team undertook a survey of online shopping for full cream and modified milk lines from three supermarkets (PushKart, MetroMart and WalterMart) located in or close to Manila. The average price for full cream milk (> 1 litre) was ₱84 per litre with a range from ₱77 for locally manufactured reconstituted full cream milk to ₱91 per litre for imported UHT milk. There was less price differential between imported UHT and local reconstituted products for low fat or zero fat variants. Further information can be found in Table A8.2 (p170).

As part of the wholesale pricing determination for the SBFP, the NDA (2020b) undertake an annual national survey of fresh milk and chocolate flavoured milk from co-operatives and private dealers. A summary of this data is shown in Table 8.2. Additional information can be found in Table A8.3 (p171). Within the NDA survey, Luzon had 22 suppliers of fresh milk and 21 for flavoured milk, Visayas had five suppliers of fresh milk and flavoured milk, and Mindanao had 14 processors of fresh milk and two for flavoured milk. Of the three regions, Luzon had the highest pricing, especially in those provinces adjacent to the NCR. Average pricing in Luzon was comparable to online supermarket pricing (as discussed above) and shows the influence supermarket value chains are having on local processors and co-operatives.

Table 8.2. Provincial fresh and flavoured milk pricing (PHP per litre) across provinces during 2020 – NDA survey (NDA, 2020b).

	Fresh Milk				Flavoured milk			
	Avg	**Max**	**Min**	**N**	**Avg**	**Max**	**Min**	**N**
Luzon	₱103	₱240	₱75	40	₱109	₱250	₱77	39
Visayas	₱82	₱90	₱75	32	₱89	₱95	₱85	32
Davao	₱76	₱105	₱67	45	₱85	₱89	₱80	2

Online pricing for smaller Philippine processors noted in 8.1.2 are shown below in Table 8.3. The data would indicate that this pricing was above average pricing from supermarkets, NDA and pricing paid in Australasia ($1.80 USD Table 8.1). Higher premiums were sought for organic products.

Table 8.3. Some online prices of fresh whole milk and modified direct to customer.

Category	**Processing**	**Pack size**	**Retail price per litre**		**Processor**
			USD	**PHP**	
Full Cream	Organic Pasteurised	200 mL	$7.73	₱375	Pinkies Farm
	Organic Pasteurised	1 litre	$4.95	₱240	Pinkies Farm
	ESL	1 litre	$2.89	₱140	Hacienda Macalauan
	Pasteurised	1 litre	$3.30	₱160	Holly's
	Pasteurised	1 litre	$1.65	₱80	QUEDAFCO
Avg Full Cream			**$4.10**	**₱199**	
Low Fat	Organic Pasteurised	200 mL	$7.73	₱375	Pinkies Farm
	Organic Pasteurised	1 litre	$4.95	₱240	Pinkies Farm
	Pasteurised	300 mL	$5.15	₱250	Holly's
Avg Low Fat			**$5.94**	**₱288**	
Flavoured milk	Pasteurised	200 mL	$6.70	₱325	Holly's
	Pasteurised	200 mL	$1.86	₱90	PAMAKA
	Pasteurised	1 litre	$1.86	₱90	QUEDAFCO
Avg Flavoured			**$3.47**	**₱168**	

QUEDAFCO – Quezon Dairy Farmers Co-operative; PAMAKA - Pangantucan Maramag Kalilangan Farmers Dairy Cooperative; Based on currency exchange of 1 USD = 48.5 PHP

White and soft cheeses

Hard cheeses such as cheddar are readily traded internationally, usually in bulk with processing such as slicing and shredding occurring in the destination country. It is a low margin, competitive environment. With the exception of some products such as cottage cheese, soft and immature cheeses are traded less internationally. They tend to have a higher moisture content and are logistically difficult to transport.

We found that there are a number of high value soft and speciality cheeses traded online in the Philippines manufactured by local processors (Table 8.4). Average price for ricotta and cottage price online was $2.18 USD per 100 g compared to an average of $1.39 USD per 100 g from a survey of online shopping across Australasia (Table A8.4 (p173)). A reason for the ability of local manufacturers to attract these premiums may be the lack of products available in supermarkets and larger retailers. We could only find one example of a soft cheese priced at $1.93 per 100 g (Table 8.5) which was also above Australasian pricing. Similarly, speciality hard cheese locally manufactured also sold at a premium online, albeit at pricing more comparable to local supermarkets.

The high retail pricing of soft cheeses in the Philippines and their lack of presence in formal value chains is a potential opportunity for SHD inclusive value chains. Its feasibility should be explored.

Table 8.4. Some online prices of cheeses manufactured by local processors.

Category	Pack size	Retail price per 100 g		Brand/Processor
		USD	PHP	
Kesong Puti (white cheese)	225 g	$4.18	₱200	DVF Farm
	200 g	$1.36	₱65	Hacienda
	200 g	$1.36	₱65	Hollys
	200 g	$1.63	₱78	Rizal Dairy Farms
	1000 g	$1.46	₱70	Rizal Dairy Farms
	200 g	$1.57	₱75	Pinkies
Average		**$1.48**	**₱71**	(excludes DVF Farm)
Soft Cheeses				
Ricotta	200 g	$1.53	₱73	Hacienda
	200 g	$2.72	₱130	Rizal Dairy Farms
	1000 g	$2.30	₱110	Rizal Dairy Farms
Cottage	200 g	$1.53	₱73	Hacienda
	200 g	$2.51	₱120	Rizal Dairy Farms
	1000 g	$2.51	₱120	Rizal Dairy Farms
Average		**$2.18**	**₱104**	
Hard Cheeses				
Gouda	100 g	$2.72	₱130	Hollys
Mozzarella	200 g	$2.72	₱130	Rizal Dairy Farms
	1000 g	$2.30	₱110	Rizal Dairy Farms
Scamorza	280 g	$2.99	₱143	Pinkies
Average		**$2.68**	**₱128**	

Table 8.5. Pricing for cheeses (per 100 g) from online supermarket survey Manila June 2021.

Category	Pack size	Retail price per 100 g		Source
		USD	PHP	
Soft Cheeses				
	300 g	**$1.93**	**₱92**	Denmark
Hard Cheeses				
Gouda	200 g	$1.53	₱73	Unknown
Mozzarella	150 g	$2.08	₱99	Denmark
	250 g	$2.52	₱120	Australia
	500 g	$2.05	₱98	United States
Average		**$2.05**	**₱98**	

Yoghurt

Table 8.6 provides a retail price comparison of drinking milk yogurts throughout Australasia, while Table 8.7 provide a similar comparison with set yogurts. A review of online pricing for Manila supermarkets (Table A8.5 (p173)) confirmed these results with the same average price being observed for both drinking and set yogurts ($0.26 USD per 100 mL and $0.62 USD per 100 g, respectively). Similar pricing was also noted for local processors (Table A8.6 (p174)) through direct online marketing ($0.63 - $0.68 USD per 100 g for set and cream yogurts, respectively).

It is unclear why the retail pricing for drinking and set yogurts is so low in the Philippines versus Australasian pricing. Regardless, the devalued market offers little scope for further development by SHD inclusive value chains. A higher average retail price ($1.00 USD per 100 g) pricing was observed for Greek yogurt from our online survey (A8.5 (p173)) and also from online sales from local processors (avg $1.11 USD per 100 g). As a guide, it typically takes four times as much milk to make Greek yogurt as final solids are typically over 20% solid not fat compared to a minimum of 8.25% in normal set yogurt.

Table 8.6. Comparison of international drinking yogurt retail price (USD) per 100 mLs.

Country	Drinking USD per 100 mLs
New Zealand	1.19
Australia	0.93
South Korea	0.71
Indonesia	0.34
Philippines	**0.26**
Vietnam	0.23
Singapore	0.22
Malaysia	0.18
Thailand	0.18
Average	**0.47**

Source: Euromonitor

Table 8.7. Comparison of international set yogurt retail price (USD) per 100 grams.

Country	Set USD per 100 g
Singapore	1.61
South Korea	1.27
Vietnam	1.25
Indonesia	0.84
Thailand	0.84
Philippines	**0.62**
Australia	0.55
New Zealand	0.47
Malaysia	0.46
Average	**0.88**

Source: Euromonitor and survey of three online Manila supermarkets

Direct sales ex farm

Of the SHD farms we surveyed, the majority (87%) either sold to a co-operative or a company. However, there were some examples of direct sales:

- Two farms sold raw milk directly to ethnic-Indian households for ₱31 to 35 per litre. Annual sales from one farm in Quezon were between 2,400 to 4,800 litres per annum. Indian households were the only main buyer in this locality;
- One farmer in Bukidnon sells 400 litres of pasteurised milk to multiple individual consumers for ₱30 per litre;
- Another farmer in Quezon was selling direct dairy-based dessert to local restaurants.

None of these direct sales attracted a price higher than we noted in our SHD farm survey.

Livestock sales from SHDs

Table 8.8 summarises the price SHD farmers received for live and slaughtered dairy cattle we noted from our survey. As a comparison, cull cows in Australia in May 2021 were valued at $1,700 AUD. These have increased by 58% over the last 12 months (Dairy Australia).

Table 8.8. Price for live and slaughtered dairy cattle.

Type	Sale price PHP (AUD) per head
Milking cows	60,000 ($1622)
Dry cows	45,000 ($1216)
Heifers	15,000 to 23,000 ($405 to $623)
Bull calves	7,000 to 50,000 ($189 to $1,351)
Culling cows	25,000 to 30,000 ($676 to $811)
Dairy bulls	25,000 to 26,000 ($676 to $703)

8.1.4 Relative affordability and convenience of dairy products versus other nutritious beverages and foods

As a source of nutrients, dairy products often compete with fruit juices and emerging plant-based milk products (PBMP) in formal supply chains such as supermarkets. Growth of the PBMP is also being driven by greater consumer focus on the carbon footprint of different products. Soyabean milk for example is promoted as having a lower carbon footprint than dairy products, however the evidence supporting these claims is variable and inconclusive.

Table 8.9 shows some average pricing per litre across fruit juice and soymilk lines from three large Manila supermarkets (PushKart, MetroMart and WalterMart) across a variety of pack sizes. Average prices (USD per litre equivalents) were $1.93, $1.63 and $1.78 for fruit juice, soymilk and soymilk flavoured, respectively. All of these products are comparatively cheaper than full cream milk ($2.22 USD per litre) and modified milk ($2.30 USD per litre) purchased from the same retailers in 8.1.3. They are however comparable to fresh milk pricing (USD per litre) noted by NDA in 2020 (see section 8.1.3) of $2.12, $1.69 and $1.56 for Luzon, Visayas and Mindanao, respectively.

Our conclusions are that milk is competitively priced versus other nutritious beverages.

Table 8.9. Supermarket pricing of fruit juice and soymilk products from three Manila supermarkets (online shopping March 2021).

Category	Pack size	Retail price per litre	
		USD	PHP
Fruit juice	<250 mL	2.33	113
	250 to 500 mL	1.67	81
	1000 mL	1.95	95
	1000 to 1892 mL	1.75	85
Avg Fruit Juice		**1.93**	**94**
Soy milk	<300 mL	1.78	86
	1000 mL	1.47	71
Avg Soy Milk		**1.63**	**79**
Soy milk - flavoured	<300 mL	2.05	99
	1000 mL	1.50	73
Avg Soy Milk - flavoured		**1.78**	**86**

8.1.5 Does the location of the Philippine dairy industry stop it from accessing domestic markets?

The population in 2021 is forecast to be 111 million (PSA). Of the three major regions, Luzon has a forecast population of 58 million (with 53 million located on Luzon island), Visayas has 21 million people and Mindanao has approximately 25 million people. These three regions represent 55, 20 and 25% of the Philippines population, respectively.

As noted earlier, annual per capita consumption of dairy products in the Philippines is 22 kg LME (USDA, 2020a). An analysis of milk demand versus supply of dairy cow milk products would indicate that none of the 30 most populated provinces in the Philippines are self-sufficient (Table A8.7 (p175)). Given that almost 13% of the Philippines population resides in the National Capital Region (NCR) of Manila, and that eight out of the ten most populated provinces are in Luzon, dairy producing provinces in this region (Batangas, Bulacan, Laguna and Quezon) have the greatest potential to service the NCR market (Figure 8.3). Sea travel and undulating winding roads provide challenges for many dairy regions to service distant markets with SSL products. Figures A7.2 to A7.4 (p143) provide an overview of spatial distribution of dairy farms across the Philippines.

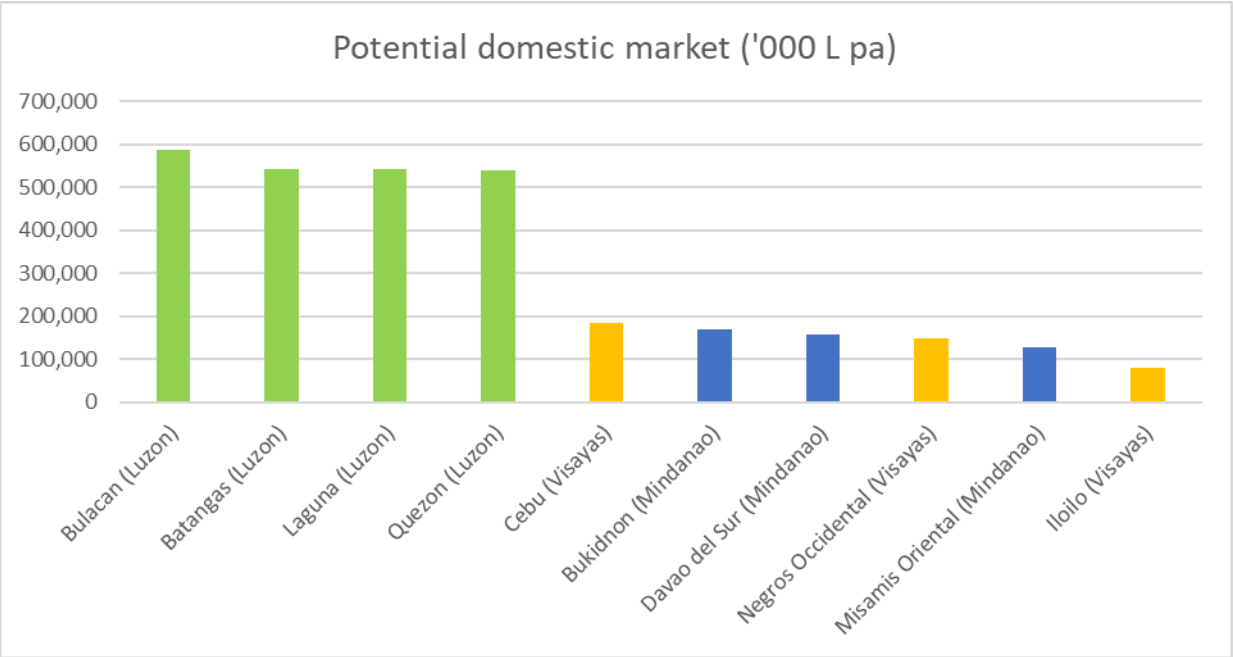


Figure 8.3. Market size and access for the top ten producing milk producing provinces (dairy cow).

Analysis completed based on provincial supply shortfall (market demand – provincial milk supply) and maximum transportation distance of 300 km one way from province to potential market.

8.1.6 Emerging retail innovations and consumer trends

Filipino consumers are becoming more aware and conscious of how their buying behaviour can have an impact on the environment. Recent research has revealed that of the Filipino households surveyed, 75 percent were actively looking for environment friendly brands or manufacturers (Figure 8.2, Kantar, 2021). Moreover, 36 percent of the surveyed households believe that brands and manufacturers have the ability to make a difference in the country's fight against environmental degradation. The survey also revealed that Filipino consumers prefer to buy products that are made from natural ingredients and are locally produced.

Figure 8.2. Filipino consumers' attitudes regarding the sustainability credentials of brands.
Source: Kantar, 2021

In another study, a survey completed by Rakuten Insight revealed that around 43 percent of the Filipino respondents said that they would be willing to pay for organic products if they are the same price as conventionally grown food products (Statista, 2021).

8.1.7 What is the sentiment of businesses along the supply chain regarding the future of domestic supply (positive, neutral, negative)?

From our interviews, we noted various perspectives and signals regarding the role future milk supply from SHDs will play in Philippine dairy value chains.

Positive sentiments:

- The niche coffee sector has a positive attitude towards local supply. This is driven by the high quality of coffee drinks made from fresh milk as opposed to UHT, which is used by larger coffee chains. Bacterial contamination and certain quality aspects, such as frothing capacity and taints, are important;
- Nestle were keen to secure milk supply from SHDs. The high farm gate pricing relative to the opportunity pricing of imported commodities however was raised as a concern. We hypothesise that Nestle's social corporate responsibility and marketing of supporting small holders in other commodities, such as coffee, could be a reason for this strategy;
- Some of the commercial farms e.g., DVF Dairy were positive about supporting SHDs and their communities. It was unclear if this is used in marketing or some other value proposition to customers.

Negative sentiments:

- Although the project team did not have the opportunity to interview larger retailers or other multinational processors, online reviews of their product range and processing strategies showed limited opportunities for SHDs to supply milk into formal, large scale supply chains. Impediments are high farm gate price relative to imported dairy commodities, poor overall milk supply volumes, high bacterial contamination, low tariffs, consumer safety and a focus on long shelf-life ambient temperature products. There are examples from other countries such as Indonesia, where SHD inclusive short shelf-life ESL dairy products can have a presence in these supply chains. Cimory products in Giant supermarkets is an example.
- There were larger commercial farms that had historically sourced milk from SHDs but stopped due to poor quality (or other issues). They were not open to resuming SHD supply and have invested in other strategies to secure milk supply. This sentiment was also compounded by reduced sales through hospitality and restaurant supply chains caused by Covid-19.

Which businesses are looking at increasing sales/market share?

- Given the impacts of Covid-19 pandemic on sales and future business strategy, it was unclear in many interviews whether businesses were looking for growth based on pre-Covid-19 sales, or they were looking to regain sales lost because of Covid-19. Toby Coffee was on an expansion phase until the pandemic. It was servicing the professional sector and more affluent suburbs in Manila. They would like to resume this strategy going forward.
- There was a general sentiment across all co-operatives (including potential new entrants) that they would like to improve their milk sales and have greater access to higher value markets. The reliance of many on the SBFP and therefore the need to manufacture products outside of school terms was not raised directly as being a problem, but the sentiment from some was it was a challenge.

8.2 International trade

8.2.1 Exports

Philippine dairy exports consist mainly of value-added products manufactured from imported dairy commodities (USDA, 2020a). Volumes of products exported from 2017 to 2020 are summarised in Figure 8.4. Further information is available in Table A8.8 (p176). The value of these exports is shown in Table A8.8 while destination countries are shown in Table A8.9 (p176). Annually, exports averaged approximately ₱1.3 billion. From 2017 to 2020, cream was the major exporter by volume followed by ice creams and frozen milk products.

There has been considerable annual variation in the volumes of export products year on year, suggesting that either businesses utilise Philippine's processing facilities tactically, sale contracts are very short term, or that Philippine exports balance other supply chains from other countries.

An observation of note was a significant exportation of whole milk powder during 2017 of over 205,000 tonnes. This would appear to be due to a commercial opportunity arising due to transitioning tariff agreements, with Malaysia being a significant customer. In 2020, 23 percent of the Philippine dairy exports went to Singapore, while 14 percent was shipped to the United States. Other major export destinations for Philippine dairy products in 2020 were Vietnam (11 percent) and United Arab Emirates (11 precent). USDA (2020a) reported that Philippine export volumes would remain low beyond 2020 mainly due to the cost of imported dairy inputs and increasing competition from other dairy producing countries. This may have consequences for SHD inclusive value chains in that processors may now use surplus factory capacity to service the domestic marketplace.

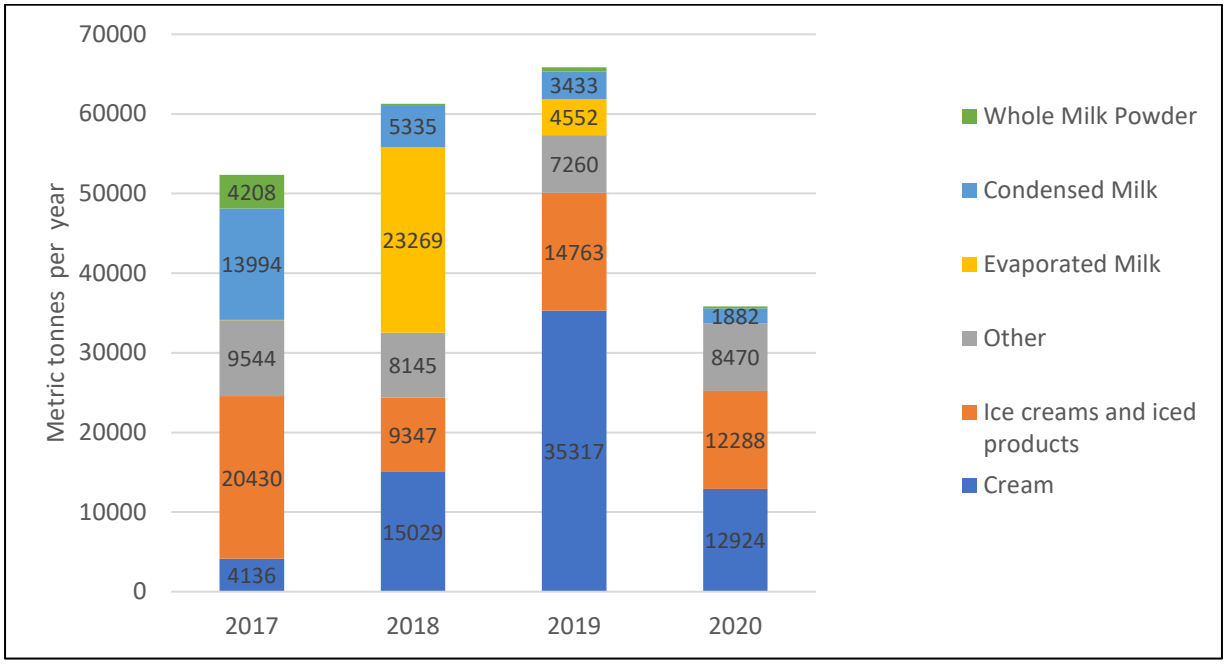


Figure 8.4. Volume of Philippine dairy exports 2017-2020.
Source: USDA

8.2.2 Imports

Milk and milk products are the fourth largest agricultural imports of the Philippines after wheat, soybean oil/cake, and rice. Import volumes of dairy products increased on average

by 12 percent per year over the last five years (2016 to 2020). It was projected that Philippine imports of dairy products would decrease in 2020 due to the economic impacts of Covid-19 (USDA, 2020a). Data from the NDA shows that total dairy imports in 2020 did decrease, but only slightly to 2.94 million metric tonnes ($1.13 billion USD).

In terms of product type, skim milk powder and whole milk powder accounted for over 50 percent of the total dairy imports by volume (Figure 8.5). Other major dairy imports were whey powder and buttermilk/buttermilk powder (Table A8.10 (p177)).

Over the five-year period between 2016 and 2020, major suppliers of dairy products (in terms of volume) were the United States with 31 percent average share, followed by New Zealand with 26 percent share and Australia with 5 percent share (Table A8.11 (p177)). In 2020, dairy imports from the United States accounted for 38 percent of value (worth $336 million USD), while New Zealand accounted for 23 percent ($325 million USD). Dairy imports from Australia accounted for 4 percent ($56 million USD).

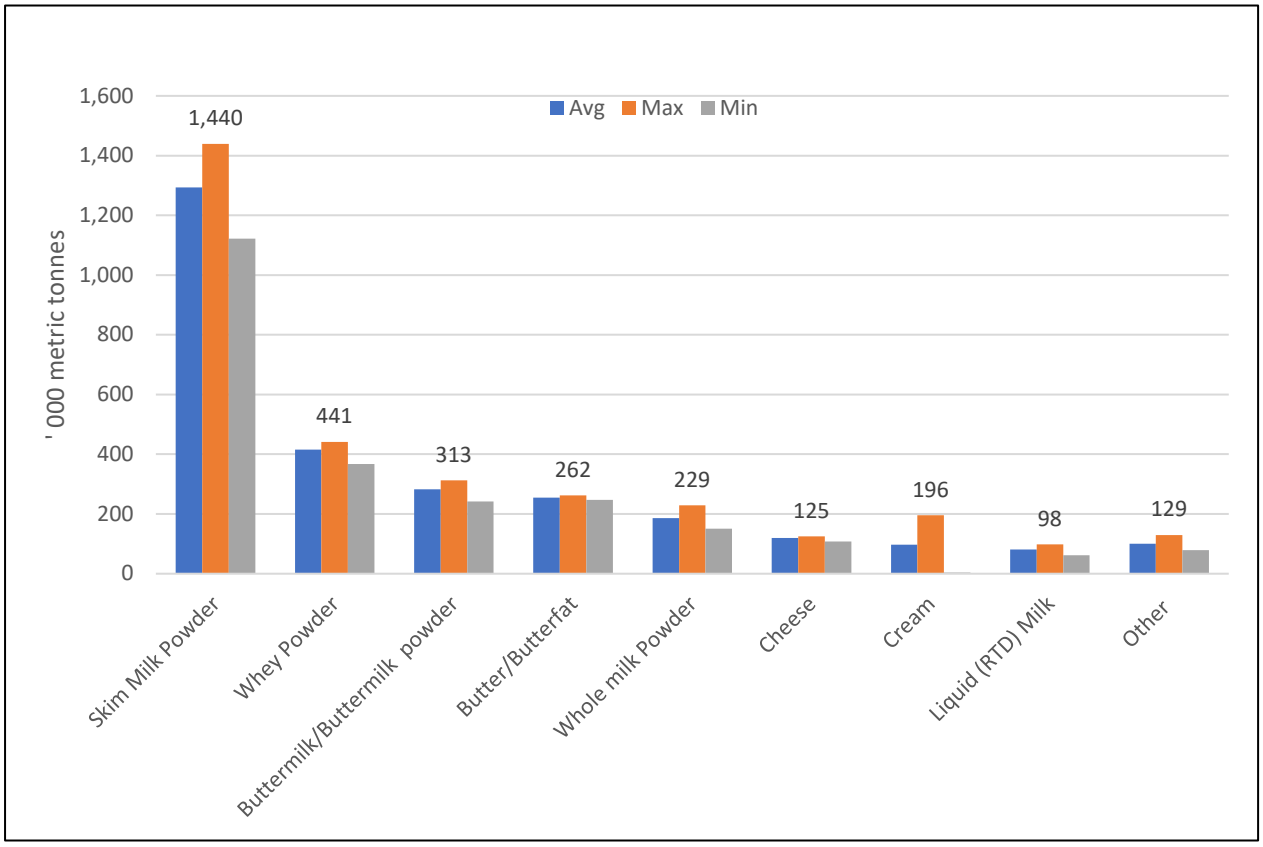


Figure 8.5. Volume of annual Philippine dairy imports 2017 to 2020.

Source:USDA

9 SHD inclusive value chains

Figure 9.1 provides an overview of four SHD value chains we identified during our research. As with other dairy value chains globally, these fell into two categories: co-operatives and private companies. SHDs were responsible for milk delivery to either factories or milk collection centres.

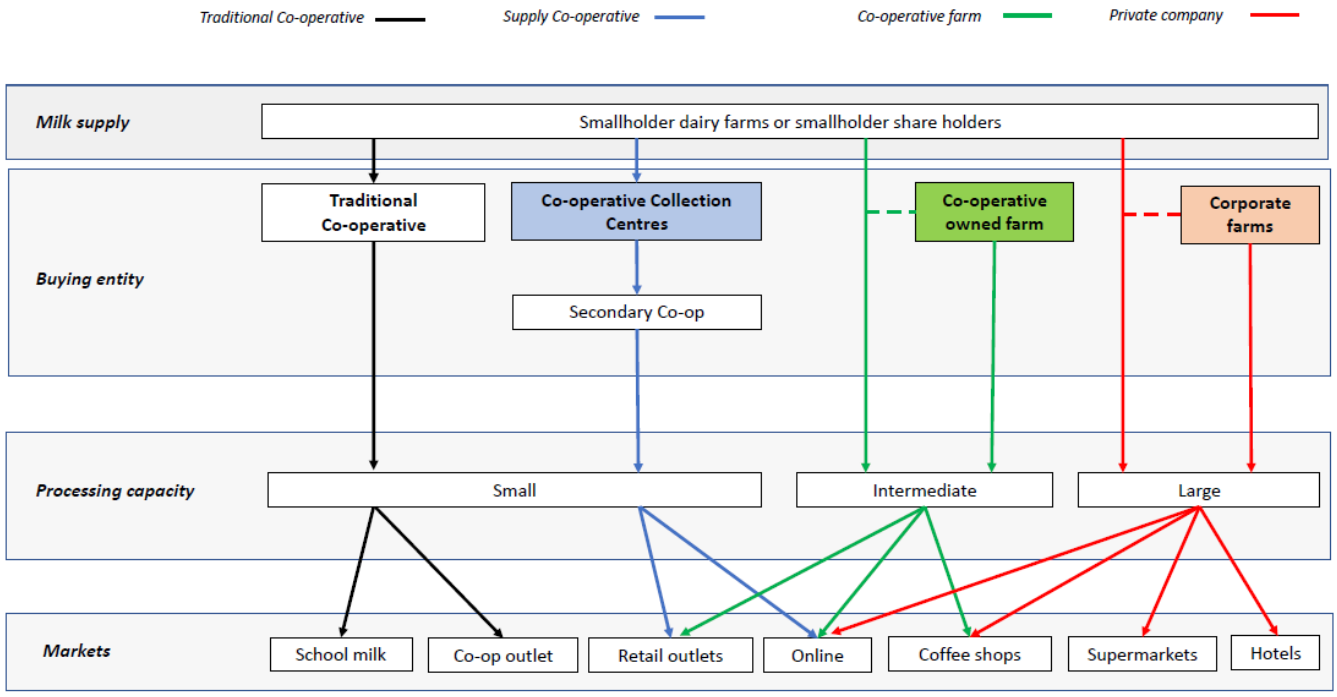


Figure 9.1 Four examples of Philippine dairy value chains inclusive of SHDs.

The following section describes these value chains in more detail and provides a comparative analysis of their strengths, weaknesses and opportunities going forward.

9.1 Types of value chains

9.1.1 Co-operative owned processing and retailing (Traditional Co-operative)

This value chain is typical of those found in SHD industries in developing countries, where the co-operative collects milk from SHD members, processes and markets milk direct to consumers. The two co-operatives in this analysis had been operating for 6 and 14 years, respectively. They are located in Luzon and Mindanao within servicing distance of large urban markets. Both co-operatives were established with support from the GoP in terms of providing dairy cows. One also received support from an international donor organisation. Issues raised during interviews were that herd genotypes provided by external organisations were not suitable for the biophysical environment and some farmers did not undertake any training in dairy management.

Each co-operative has approximately 200 members, but with only 20-25% currently supplying milk. Their ex-factory milk intakes were between 20 and 60 litres per day with a factory delivered price of ₱30 per litre. There was no price differentiation based on quality. Each co-operative has their own processing facilities. One co-operative had a small kitchen type processing centre with capacity of 30 litres per day, with the second having processing

capacity of 300 litres per day. Both undertake some testing of milk on arrival, but these tests are mostly organoleptic, sensory and visual, as opposed to quantitative analysis. One co-operative encourages SHDs to undertake Californian Mastitis Testing.

In terms of product mix, whole milk and flavoured milk are their main sales direct to customers. One supplied the SBFP while the second was waiting on approval from the GoP to supply the SBFP. One co-operative was heavily reliant on traveling customers. With the onset of Covid-19 and less travellers, sales fell dramatically leading to the temporary closure of their factory. They also have other product lines such as yogurts and ice cream, with one co-operative using whole milk and skim milk powder in manufacturing. Each have their own brand.

Both co-operatives provided limited services to their members, with one providing some loans. Both relied on government services for farm development. Members of one co-operative were engaged in other supply chains such as rice, corn and aquaculture.
In terms of capital raising, one co-operative had initial share subscriptions equalling ₱400 per cow. This equates to approximately ₱0.05 per litre.

9.1.2 A co-operative providing bulk milk supply to another entity (Supply Co-operative)

This value chain entailed a co-operative maintaining two regional milk collection centres (MCC), manufacturing their own retail products and on-selling bulk milk to another entity. The co-operative has been active for the last eleven years and had 38 members, with one MCC receiving milk from five SHDs. We were unable to ascertain the number of SHDs supplying the second MCC. Total milk intake was 400 to 500 litres per day. Milk price ex-MCC ranged from ₱31 to ₱33 per litre, however the price was reduced to as low as ₱20 per litre if quality issues such as water adulteration were detected (as indicated by low total solids (TS)). In addition to organoleptic testing, there was some quantitative testing for concentrations of milk fat and protein.

Pre Covid-19, the co-operative relied on the sale of its own manufactured products (fresh milk, yogurts and cheese), however despite the support of local government, the pandemic had reduced retail sales to unsustainable levels. It also participated in a development research project to sell directly to retail outlets, with this project still ongoing. Consequently, the co-operative commenced on-selling bulk milk to another co-operative (whose retail sales were eventually impacted by Covid-19), and then a second co-operative with a distribution network to urban retail outlets and also online sales.

The co-operative provides loans and some training for SHDs. It encourages members to take advantage of NDA programs, such as herd loans, but commented that members are sometimes challenged to meet loan requirements.

9.1.3 Co-operative ownership of large farm, processing and retail distribution (Co-operative Farm)

In this value chain, the co-operative owns and manages the farm, leases surrounding land, with members (27) owning stock within the farm. The co-operative farm is currently milking 100 cows (down from 300) with a daily milk supply of 1200 litres. The co-operative farm has herd sheds and a herringbone dairy, actively double (or triple crops) maize for silage, purchases commodities for inclusion in milking herd diets and sources concentrates from a commercial mill.

In addition, the co-operative also has direct supply from local SHDs with an average daily intake of approximately 100 litres. It pays a base price of ₱26 per litre with quality bonuses based on milk fat content raising the average ex-factory price to ₱32 per litre. There are no formal contracts between SHD direct suppliers and the co-operative.

In addition to pasteurisation, the factory also has ESL processing and a separator. It has a processing capacity of 1,000 litres per hour. It buys in plastic bottles from a third party. The major markets for the co-operative are food outlet and retailers in Manila, with coffee shops being primary customers. It sells milk in four litre bottles at an average wholesale price of ₱75 per litre. It also retails its own brands of fresh milk, flavoured milk and yogurt direct to customers. It has received complaints regarding the low frothing capacity of its milk from its coffee shop customers.

9.1.4 Proprietary companies with milk supply from SHDs (Private Company)

We reviewed two value chains (Company A and B) based on this model, both being located in Luzon and within servicing distance of Manila. Both have been established for over 20 years.

Company A

Company A purchased milk from 20 farms, including both corporate and smaller farms. The price per litre ex-factory was ₱27 for new suppliers and ₱33 for contracted SHDs. Once the quality of milk from new suppliers meets minimum standards, pricing is increased. Testing was undertaken for fat, pH, temperature and bulk density, with TPC being measured once a month. Higher pricing was paid for milk of better quality. Milk intake was 500 litres per day, with factory capacity (including a partnership with another processor) of 10,000 litres per day. Factory products included whole milk (both fresh and UHT), and yogurts. Company A supplied coffee shops, tea houses and retail outlets in Manila and also sold direct to customers online. It had a deliberate online market strategy of discounting its whole milk products ₱5 per litre less than major brands. Company A did not service major supermarket chains due to low margins. Regarding farm development, Company A provided loans and on-farm cooling tanks to contracted farms. It was currently developing farm extension and veterinary services.

Company B

In addition to its own farm, Company B purchased milk from 13 co-operatives with a combined total of 1000 members. Milk price ex-factory was ₱33 to ₱35 per litre, with milk tested routinely for fat, TPC, aflatoxins and other contaminants. It does not have written contracts with SHDs, just verbal agreements. Milk intake was 3000 to 4000 litres per day. The processing facility had a pasteuriser with semi automation. Products sold included whole milk, flavoured milk, yogurt drinks, candies and cheese. Company B's distribution was focused on servicing the hotel sector. This part of its distribution was impacted by Covid-19. It serviced over 200 supermarkets in Luzon with a number of these being in Manila. It also has direct consumer sales online. In addition to dairy products from milking cows, the business also focusses on products from carabao and selling manure for horticulture purposes. It has a company vision of supporting communities. Company B also funds youth scholarships and traineeships in undergraduates studying dairy science.

9.2 What are the opportunities and limitations provided by these supply chains?

9.2.1 Analysis

Table 9.1 provides a comparison of farmgate price and milk intake from SHDs, and retail pricing from the four value chains described above. Table 9.2 provides further analysis based on a range of aspects of SHD development and commercial competitiveness.

9.2.2 Opportunities to access a higher milk price for SHD farmers

Despite the diversity of value chains reviewed, there was relatively little difference in average price paid for fresh milk paid ex-factory or milk collection centre. We did see however that as the co-operative or company has greater exposure to urban customers, whether through direct sales or via wholesaling, there was a greater focus on payment systems including milk quality. These payment systems start at qualitative simple measures, progress to milk components such as fat and protein (based on the final product) and then progress to bacterial contamination, with ultimate ramifications for consumer safety, shelf life and inhibiting some dairy processing such as yogurts and cheese making.

As noted earlier, higher retail prices were being achieved by some local entities for fresh milk products and speciality cheeses. Despite the higher premiums associated with these products, we are not seeing this margin share being returned to SHDs. As is often the case globally, co-operatives will often set a competitive farm gate milk price (in this case often underwritten by the SBFP) with propriety companies paying a small premium to secure farm milk supply.

9.2.3 Is there support from the value chain to improve the profitability and sustainability of SHDs?

Excluding the internal technical support provided for the co-operative-owned farm, there was little direct support provided by value chains to assist SHDs to be more profitable under current farmgate pricing

Given the current extension support provided by government, there is no business case to invest in farm services, unless there was the view that alternative services, or services of a higher technical quality, warranted investment. Of the value chains described here, none manufactured concentrates for SHDs. We did note however that other dairy co-operatives did provide this service.

9.2.4 Is there an opportunity for a SHD to supply more milk to a value chain?

A fundamental problem with SHDs delivering their milk to either a milk collection centre or a factory is the capacity limitation of their transportation. For a SHD delivering on foot or by motorbike, it is difficult to deliver more than 20 litres per trip (or 40 litres a day for twice-a-day milking). This equates to a maximum milking herd of 3 to 4 cows. Herd sizes can be increased significantly when a SHD uses a small truck for delivery with payloads of 750 litres in milking cans (e.g., 40 litres). The use of collection truck ex-farm has seen the average size of Thailand dairy herds increase significantly.

Excluding the current impacts of Covid-19, market size, the number of SHDs supplying milk and factory processing capacity were major limitations noted for the Traditional Co-operatives. Given the low consumption of milk in some provinces, markets would quickly become saturated, especially where poor milk quality was a problem. Even if local consumption could be increased, the low daily processing throughput of the Traditional Co-operatives would then be a limitation to market growth and therefore allowing SHDs to grow their farms.

The solution to overcoming market and processing limitations for the Traditional Co-operative value chains shown here is to service either a secondary larger peri urban co-operative or proprietary company with access to urban markets. As shown in the analysis below, it is unlikely that this would result in a higher farm gate price for co-operative SHDs, however it would allow SHDs to grow their milk production. The ultimate solution for Traditional Co-operatives is to upgrade their milk quality, and distribution network, to supply these markets directly and generate higher returns to their members through higher farm gate pricing or share dividends. To achieve this however would take significant training and support.

9.2.5 Limitations and risk from lack of milk supply contracts

The lack of milk supply contracts for SHDs supplying co-operatives (who they are not members) or companies is a risk from a milk sale perspective and also a pricing perspective. It does not provide a SHD with any certainty and hence would be a threat to any investment to grow their farm. The risk is heightened for SHDs supplying entities that also have their own farm supply. It is highly likely that these entities would reduce milk intake from SHDs before they would reduce their own farm milk production. The alternative perspective however is that entities with their own farm means milk supply security. This would mean these businesses have the capacity to service longer term wholesale or retail sale contracts.

Table 9.1. Farmgate price, milk intake and retail pricing from four SHD inclusive value chains.

Parameter	Average (Range)	Traditional Co-operatives	Supply Co-operative	Co-operative Farm	Private Company
Farm gate price (₱ per litre)	**32** (26 to 35)	30	32 (31-33)	32 (26-32)	34 (33-35)
Milk intake (litres per day)	**710** (20 to 2250)	40 (20 to 60)	450 (400 to 500)	100	2250 (500 to 400)
Retail pricing (Whole milk ₱ per litre)*	**85** (80 to 90)	85	90 (retail price not wholesale)	85	80

**NDA SBFP milk pricing;*
Colours indicate comparative ranking: *low* | *intermediate* | *high*

Table 9.2 Post-farm gate characteristics of reviewed SHD inclusive value chains (VCs).

Parameter	Co-operative owned processing and retailing (Traditional Co-operative)	Co-operative providing bulk milk supply to another entity (Supply Co-operative)	Co-operative ownership of large farm, processing and retail distribution (Co-operative Farm)	Proprietary companies with milk supply from SHDs (Private Company)
Assistance with farm development	Limited with some loans	Limited with some training and loans	Good support for SHD members within co-op farm. Low for external SHD suppliers	Limited. Cooling infrastructure and youth scholarships
Testing of milk quality ex-farm (versus international standards	Non quantitative and limited criteria	Some quantitative testing but below standards	Average - high given product mix and customer base	High given direct exposure to brand damage but still not to global standards
Supply security for SHDs	High	High	Low – no formal contracts	Average – verbal agreements
Farm gate price versus other SHD inclusive VCs	Low	Average	Average	High
Relative processing capacity	Limited (<1,000 litres)	Limited (<1,000 litres)	Intermediate (at least 3000 litres)	High (> 10,000 litres per day)
Product diversification (lines)	Average - 4	Average - 4	High with retail and wholesale products	High including non-milk products from dairy farms
Access to urban markets	High	High	High	High
Access to support	High	High	High	Low
Distribution network	Limited to regional sales or SBFP	Own is limited to regional, but has indirect access to larger network through secondary co-operative	Extensive with multiple outlets and wholesale customers	Extensive
Access to capital	Limited capacity from shareholders	Limited capacity from shareholders	Shareholders, but would also expect to be able access commercial capital	Commercial capital

Colours indicate comparative ranking: *low* | *intermediate* | *high*

10 Opportunities for improved farm productivity

This section reports on the findings from the SHD and CC farm survey described in the Methodology.

10.1 Farm assets and infrastructure

10.1.1 Land area farmed per SHD enterprise

Data obtained from our SHD survey showed that average total land area managed (as opposed to owned) by SHD farmers was 3.9 ha (Table 10.1). The largest farm recorded was 25 ha. On average, SHDs used 57% of their plots to grow grass for cut and carry, 27% of plots were used to hold stock (which were generally tethered), 14% of plots were used to grow crops and 5% were idle.

Table 10.1. Average plot areas in use (hectares) for smallholder dairy farmers interviewed.

Plot use area	Average (hectare)
Crops	0.4
Livestock	1.5
Growing grass	1.4
Idle	0.1
Other - Crops	0.3
Other - Growing grass	0.2
Total area	*3.9*

As a comparison with other global dairy industries, stocking rates were quite low at 0.7 milking cows per ha. However, our observations show that given that the numbers of dry stock, bulls and other livestock such as beef cattle, the true stocking rate was quite high (2.4 head per ha). When coupled with low pasture inputs, overgrazing was common. This has resulted in the persistence of weed grasses and forbs, and in some cases soil degradation.

Almost two thirds (64%) of farm plots were owned while 17% were borrowed. The remaining plots were rented (7%), share cropped (5%) or public land (6%). As discussed, CARP government policy regarding land tenure is a significant barrier for the expansion of SHD farms. However as noted on larger scale commercial dairy farms, securing long term leases for SHDs is an option to increase farm size.

Images captured showed that SHDs were often located on secondary non-cropping land or had access to forages within coconut plantations. Many of the farms however were adjacent to cropping farms. For SHDs looking to expand their herd, this is an opportunity to lease adjacent land or outsource forage production. Costs of corn grain production were ₱51 693, ₱57 339 and ₱42,629 per ha across Cayagan Valley, Central Luzon and Northern Mindanao, respectively. Assuming these crops were harvested for maize silage, they would be competitively priced feed ingredients.

10.1.2 Herds

The average total herd size managed by SHDs was 9.4 head, including 2.7 milking cows (Table 10.2). Out of the farmers surveyed 73%, owned their dairy cattle, with an average number of 9.2 dairy cattle per farm and 2.1 milking cows. Over the past 12 months 67% of farmers sold stock, whereas only 13% purchased stock during the same period. This may

have been a result of Covid-19, as means to access cash with reduced ability to sell their milk.

Table 10.2. Average number of dairy cattle managed and owned.

Animal type	average	min	max
Number dairy cattle managed/farm	9.4	1.0	15.0
Number dairy cattle owned/farm	9.2	1.0	15.0
Number of dairy cattle 12 months ago	11.3	1.0	23.0
Number dairy stock currently owned			
Milking cows (lactation)	2.1	1.0	5.0
Dry cows	1.7	-	5.0
Pregnant heifers	1.0	-	4.0
Heifers	1.8	-	7.0
Calves (heifers)	1.1	-	4.0
Calves (bulls)	0.9	-	3.0
Culling cow	0.1	-	2.0
Bulls (Dairy)	0.5	-	2.0

10.1.3 Buildings and machinery

Over two thirds of the SHD farms surveyed had a shed with concrete floors to milk cows. 20% of farms had earth floors. Timber construction of sheds was very common. Many of the sheds looked in a state of disrepair, with little upgrading in recent times. None of the farms used rubber matting in cow stalls. Given the majority of farms housed cows in paddocks, this is not surprising. Apart from shade provided by sheds, no additional herd cooling infrastructure, such as sprinklers or fans, were observed. It would be warranted in later studies to understand whether high environmental heat loads are limiting the productivity of cows with a higher proportion of *Bos taurus* genetics. Some examples of dairy sheds are shown in Image 10.1.

There was a range of herd feeding infrastructure for forages, from ground feeding, feeding behind a barrier e.g., bamboo, plastic feed troughs that could be moved between tethered stock, wooden troughs in feeding sheds, and concrete troughs. Concrete troughs were most common, followed by plastic then wood.

Wastage from ground feeding of forages can range up to 25%. Wooden feeding boxes provide challenges regarding providing enough capacity for larger stemmy forages. Cleaning wooden boxes properly can also be problematic, especially if wet supplements are fed, and pose a potential mycotoxin risk.

Only 40% of SHDs scraped manure from sheds twice or more a day. There was no evidence that farms had effluent management infrastructure in place nor did any farms have biogas plants.

With the exception of one farm, all other farms (93%) owned at least one bike or trike. 47% of farms owned a car while only 13% owned trucks. Only 13% owned hand tractors. 33% of farms had an electric generator while 20% owned portable forage choppers.

Some examples of different farm infrastructure observed on Philippine SHD farms.

Image 10.1.

10.1.4 On farm milk collection infrastructure, practices, cooling and storage infrastructure

Overall cleanliness in milk collection areas was variable. It is particularly challenging to keep milking sheds with earth floors clean. Concreting these areas would be a priority. 73% of farms scraped manure from milking harvesting areas, with 26% of farms washing down areas after scraping.

Our observations indicate the lack of hot water in SHD milking sheds is a major contributor of high TPC (Image 10.2). Experience from Australia (BC Granzin pers comm) show that dairy farms experience high TPC counts when hot water systems malfunction. Similar observations from Canada (Perkins et al., 2009) show a 53% correlation between coliforms in water and milk TPC. This observation is consistent with World Health Organisation (WHO) recommendations (WHO, 2015) which summarises bacteria are particularly sensitive to heat with 90% mortality at temperatures above 65 °C for one minute and 99.99% reduction above 70 °C.

Two thirds of all SHDs surveyed had portable milking machines (PMM), with one third hand milking. For SHD systems globally and given the small milking herd size recorded during our survey, the proportion of PMM ownership is high and suggests that at some stage donor or government funding was used to purchase these for SHDs.

While PMM are a labour-saving device, they can be a source of bacterial contamination unless lines and receival containers are cleaned properly between milkings. Photos (Images 10.3 and 10.4) show milk residues sitting within lines, possibly caused by the use of domestic household detergents and cold water during cleaning. Given that domestic dishwashing cleaner is pH neutral, it lacks the cleaning power of acid and alkali-based cleaners as used in large scale dairies. Evaluating alternative cleaners in combination with hot water should be evaluated under Philippine SHD operating conditions.

The use of stainless steel milk collection vessels (73% of SHD farms surveyed), as opposed to plastic, is a positive for controlling bacterial contamination. We did note however in one

interview that when provided with stainless steel buckets by a processor, farmers sold these and reverted to plastic buckets.

The practice of having tethered cows lie in mud is problematic from a milk quality perspective. Teat contamination from mud, especially with improper washing practices leads to both mastitis and milk bacterial contamination (Image 10.5). Introducing fencing and allowing cows to move around paddocks would help with this issue as well as improve forage production.

In terms of pre-udder preparation, the use of cold-water washed cleaning cloths, and/or sharing cloths or brushes between cows can lead to the transfer of mastitis-causing bacteria between teats and cows. Our survey showed that 53% of SHDs owned teat dippers, but we are unclear regarding their use or access to teat dip, or if teat dip was formulated correctly.

Of the 15 SHD farms, 40% of farms milked once a day (OAD) with 60% milking twice-day. Once a day milking herds tended to be those with lower milk production per cow. Once a day milking is generally not recommended for farms servicing drinking milk markets, unless the average herd lactation length is very late e.g., >250 days. While OAD will increase the fat and protein content of milk, it will reduce milk yield per cow by an average of 34% (Dairy Australia), and also increase somatic cell count. Understanding why SHD farmers milk OAD, and its associated impact on productivity, requires further investigation.

Two thirds of SHDs surveyed had milk cooling vats or cooling infrastructure, however only 20% cooled milk. There was anecdotal evidence from reports that cooling infrastructure was not being used due to the cost of electricity. From a global SHD perspective, this is a high proportion and indicates that there has been historical government or donor funding regarding supplying SHDs with this infrastructure.

Overall hygiene in milk processing areas (Images 10.6 and 10.7) and the presence of milk fat on buckets and machinery would be an additional area of attention.

87% of SHDs consumed milk from their farms. This averaged approximately 9 litres per month or around 1% of annual farm milk supply. 9 out of 13 SHD respondents said they boiled their own milk before consuming.

- The lack of hot water in SHD systems is a global problem and is a contributor to poor milk quality.
- The testing of propane, solar hot water or biogas heating systems should be evaluated in future research.

Image 10.2

- Despite good intentions, the use of cold water and household detergents do not adequately clean cups and lines.
- Introducing alkali and acid detergents, with hot water (>70 C), running through lines would reduce bacterial contamination significantly.
- The application of this technique in Australia sees TPC counts of under 10,000. When one part of this cleaning system fails e.g. a hot water system stops working, TPC will exceed 50,000 within 24 hours.

Image 10.3.

- A number of farm surveyed had single cup milking units. It is likely these have been distributed by government or a donor.
- If lines are not cleaned properly between milkings, they will develop fatty deposits that can grow significant colonies of bacteria very rapidly.
- Similarly if vacuums are not calibrated correctly, cows will not be milked out completely posing a mastitis risk.
- Black rubber components also need to be replaced at least once a year to maintain teat pressures.
- This is an example of a technology which has been introduced without adequate training or understanding the full impact of improper servicing on milk quality and cow health.

Image 10.4.

- Cows housed in muddy conditions (top left), with contamination of the udder (bottom left), with over washing and not drying teats before applying cups will lead to mastitis and high TPC.
- Hyperkeratosis (growths on the end of teats) is also a sign of uncalibrated cup vacuums.

Image 10.5.

- The use of stainless steel milk cans on SHD farms is a positive.
- Research is needed into the feasibility of using disposable paper filters in portable single cup milking units as used in larger multi cups milking systems.

Image 10.6.

The overall level of hygiene and product appearance in smaller processor units would probably not meet the expectations of middle income urban customers.

Image 10.7.

10.2 Feeds and herd nutrition

Table 10.3 shows a summary of the different feeds fed to milking herds.

Table 10.3. Milking herds: Feedstuff usage, average and maximum intakes (kg dry matter per cow per day) from SHD farm survey.

Feedstuff	Herds feeding (%)	Average when fed	Maximum
Forages/grass	100%	5.5	10.0
Concentrates	80%	2.2	5.3
Tree forages	47%	1.0	2.5
Legumes	47%	0.4	0.9
Silage	33%	2.4	4.3
Rice bran	13%	1.8	1.8
Hay	13%	1.8	1.8
Molasses	13%	1.2	1.4
Copra meal	13%	0.6	0.9
Tofu Waste	13%	0.5	0.7
Mineral mix	13%	0.015	0.020
Sugarcane	7%	2.0	2.0
Crop straws	7%	1.7	1.7
Soya waste	7%	1.3	1.3
Cassava vines	7%	1.3	1.3
Brewer's grain spent wheat	7%	0.7	0.7
Banana peels	7%	0.3	0.3
Pineapple peelings	7%	0.1	0.1
Iodised salt	7%	0.059	0.059

10.2.1 Forages

Perennial grasses

All SHDs surveyed fed perennial tropical grasses to their milking herds including *Pennisetum purpureum* (Napier grass), *Brachiaria* hybrids (Mulato, Mulato II), *Panicum maximum* (Mobasa grass) and *Urochloa decumbens* (Signal grass). These species are common to higher rainfall tropical regions, with extensive international research focusing on Brachiaria hybrids currently underway.

Calculated daily forage intakes of milking cows averaged 5.5 kg dry matter (DM) per cow per day, or approximately 22 kg as fed (fresh). This feeding rate is around half of the target feeding rate of fresh forages in other SHD industries (10% of cow liveweight). This low value can be explained by the feeding of other forages (silages, legumes and browse trees) in milking herd diets. We calculated that 90% of milking herd diets were protein deficient and high dietary fibre concentrations were limiting intakes. The higher incidence of *Bos indicus* genetics would also be contributing to a lower physiological drive for feed intake. Given that perennial tropical grasses are a cheap resource, increasing their production and utilisation by SHD milking herds warrants further investigation.

Average distance to forage paddocks was 230 metres, with a maximum distance of 1000 metres. The relatively close proximately of these forage sources makes them suitable for grazing.

Management practices of perennial tropical forages

Our survey showed that the majority of SHDs hand-harvested forages and fed these to milking cows on the ground or in troughs (Image 10.8). As with other SHD industries, we observed that forages were harvested late in their growth cycle to allow for maximum height per cut (harvesting efficiency) as opposed to cutting at an earlier growth stage with higher nutritive value. 53% of SHDs chopped forages prior to feeding, with the majority chopping by hand. Although this practice can reduce feed residues, it forces milking cows to eat lower quality stem (as opposed to leaf) and reduce the nutritional quality of the diet.

60% of SHDs (out of 10 respondents) were currently using commercial fertilisers, with an additional 9% using these historically. Forty-seven % of farms used manure to fertilise forages, with its application concentrated on swards used for cut and carry. Although not specifically surveyed, we noted that one SHD used irrigation. Our survey did not find any evidence of SHDs conserving tropical grasses as silage. With the exception of some new Brachiaria varieties on a couple of SHD farms (Images 10.9 and 10.10), there was little evidence of pasture renovation.

The practice of rotationally grazing intensively managed pastures was not observed with some farms tethering stock to stakes in paddocks (Image 10.11). We noted that overgrazed swards had reverted back to unproductive species such as *Elymus repens* (Couch grass) and *Axonopus spp* (Carpet grass), often with woody weed infestation (Images 10.12 to 10.14). Subdividing paddocks to allow rotations of 14 to 21 days with integrated fertiliser management and using dry stock to graze pasture residues from milking herds would have the potential to significantly improve milk production and profitability from moderate genetic merit herds.

The use of cut and carry forages is commonplace across Philippine SHD farms.

Image 10.8.

There were a couple of SHD farms where forages were grown in coconut plantations. Forage production and quality were variable. In conjunction with specialised ensiling techniques, surplus grass from these plots could be conserved during the wet season.

Image 10.9

It was noted that in one region that improved perennial tropical grasses had been introduced and were performing well.

Image 10.10.

Having tethered animals in tropical pasture systems leads to the evolution of grass species such as couch and carpet grass with low growing points that cattle cannot easily harvest. Because of constant grazing pressure, more productive upright species don't survive.

Image 10.11

- It was common on SHD farms to have an area for Napier grass propagation (for cut and carry) and then having tethered stock in the remainder of paddocks.
- In this case, the farm is overstocked and has lead to significant soil degradation.
- Renovating this paddock and introducing sustainable grazing practices would lead to better total farm milk production and herd health.

Image 10.12.

Overgrazing and lack of pasture management has seen the proliferation of low performing prostate tropical grasses

Image 10.13.

Weed infestation in tropical grass swards from overgrazing and lack of management was noted on some farms.

Image 10.14.

Legumes and tree forages

Well-managed tropical legumes and tree forages (noting some anti-nutritional factors) are regarded as high-quality forage sources in tropical dairy systems. Compared to tropical grasses, their higher digestibility and protein content, greater concentrations of calcium, and comparatively higher intake potential (especially of leaf) are all positives for their inclusion in

milking herd diets. From an agronomic perspective, they complement perennial tropical grasses by providing soil nitrogen.

Our survey showed that two-thirds of farms fed either legumes or tree forages to milking herds, however on average their intakes only comprised around 7% of the total diet. Farmers were able to access these for free, suggesting their feeding was opportunistic as opposed to being managed. Exploring options to grow more legumes is an opportunity for Philippine SHDs. As with other tropical dairy industries, legume productivity can be problematic due to their susceptibility to grazing pressures and disease such as nematodes. These risks would need to be managed.

10.2.2 Concentrates and non-forage supplements

Our survey showed that 80% of SHD fed concentrates, with average feeding levels of 2.2 kg DM (2.5 kg as fed) per cow per day. The majority of these were purchased from commercial mills. Based on cow liveweight and other practices in other SHD industries, this feeding rate is approximately half of recommended intake. Other non-forage supplements, such as rice bran and molasses were fed but at low levels. Although nutrient analyses were not available, images showed that concentrates contained significant levels of non-grain fibrous by-products (Image 10.5), therefore lowering their energy content. Seventy-five % of farms fed pellets; a manufacturing process which can be used to mask fibrous ingredients effectively.

Image 10.15.

Prices for concentrates averaged ₱19 per kg (range of ₱17 to ₱21 per kg). This equates to $513 AUD per tonne which is comparable to average prices for bagged milking cow concentrates in Australia. Our research in Indonesia in 2017 recorded concentrate pricing of 2,600 Rp per kg, which equates to ₱9 per kg.

An advantage Philippine SHD farms have is access to maize (corn grain), which is the base feed resource for monogastric industries. This is unique in tropical SHD systems as usually grains are restricted for human consumption. Average corn grain pricing at the time of this

review was ₱14 per kg. Even allowing for milling costs and noting the need to balance for some nutrients (e.g., an additional ₱3 per kg), it would be a cost-effective high energy feed for milking cows. It would result in higher milk production than feeding pellets comprised of high fibre by-products, particularly at low feeding rates. The benefit/cost of feeding ground maize (preferably milled through a disc mill) on milk production should be explored.

10.2.3 Conserved forages

Silages and hays

For dairy industries servicing SSL dairy markets, maintaining milk production in rain-fed fresh forage systems during the dry season and in some cases the wet season can be challenging. In the longer term, droughts and floods also have significant impacts. Given the feeding limits of non-forage feeds such as concentrates, conserved forages play a key role in maintaining cow productivity in these systems.

We recorded that almost half of the farms fed conserved forage such as maize silage during times of low forage production. Maize silage was being purchased ₱2000 ($54 AUD) per tonne. In comparison, contract grown maize silage on Australian dairy farms is priced between $70 to $100 AUD per tonne. SHD farmers were also able to access hay and straw for free. It was noted during our interviews that maize silages contained low ear to stem ratios, which would result in a lower than expected milk conversion efficiency.

There is an opportunity for SHDs to develop more productive relationships with contract maize silage growers, with a particular focus on increasing silage quality (Image 10.16). There may also be an opportunity for local grain growers to diversify into other crops which may be more viable under marginal conditions, such as grain forage sorghums.

A major opportunity for Filipino SHD farmers is the presence of productive cropping land adjacent to their farms. Contract corn silage production or other high value legume forages for expanded SHD herds would make a major difference.

Image 10.16.

Other feedstuffs

Mineral supplements

The feeding of mineral and vitamin supplements was not regularly practiced amongst the SHD farms surveyed, with only 13% feeding a mineral additive and 7% feeding a salt supplement. 87% of farms did use injectable vitamins (A,D and E) injected either quarterly,

every six months or yearly. Our survey also showed that 27% of farms also purchased mineral lick blocks. It is not clear if these were fed to all livestock. Lick blocks can be used to supplement heifer and dry cow nutrition in conjunction with other supplementation, however they would not be recommended for pre-calving or milking cows. A challenge is their variable intake which can range up to 400% between cows. They can also be softened by heavy rainfall leading to abnormally high intakes and mineral toxicity.

Milking herd diets based on tropical perennial forages are inherently deficient in calcium and sodium, with other macro minerals such as phosphorus, magnesium and sulphur in variable quantities. Micro minerals such as copper can vary regionally. Balancing diets requires feed testing and ongoing reviews of diets when core ingredients change.

The ongoing use of injectable vitamins as surveyed here is rare for SHD systems. It is common in commercial farms to use injectable vitamins pre calving to bolster vitamin reserves in the liver, however injections during lactation are not practiced. This is because some vitamins are not stored and require daily intake (often from the core feedstuff or in a concentrate premix) or the liver provides a long-term storage reserve over lactation. We noted that the injection of vitamins is part of ongoing NDA veterinary consultations. We would recommend that the practice of ongoing vitamin injections within lactation is reviewed.

Other commodities

We observed during our survey that a number of other commodities were also fed on SHD farms. These (and the percentage of farms feeding) were copra meal (13%), tofu waste (13%), soya waste (7%), cassava vines (7%), brewer's grain (7%), banana peels (7%) and pineapple peels (7%). While these commodities have limits to their inclusion in milking cow diets, none of them have particularly high levels of anti-nutritionals. The major risk they pose is one of mycotoxin poisoning due to their high water content and hence relatively short storage life at ambient temperatures (Image 10.17). We did not see any evidence of the feeding of mycotoxin binders by SHDs. The productivity benefits of feeding mycotoxin binders needs to be reviewed for SHD farms feeding high moisture by-products.

Over the last 10 years, mycotoxins have been recognised globally to cause subclinical health issues in lactating herds and lower milk production. Moist feeds and unclean troughs as noted here on Philippine SHD farms have been identified as sources of moulds.

Image 10.17.

10.2.4 Feed management of heifers and dry cows

The range of feeds offered to heifers and dry cows were similar to milking herd diets with the exception of mineral mixes and some fruit by-products. For both groups, perennial forages and grass were the dominant feedstuffs, with concentrates, tree forages and legumes also fed. The offering of a range of feedstuffs to heifers is a desirable practice, especially for feedstuffs fed to milking herds. It allows heifers to become accustomed to their taste and helps to avoid their refusals later in their lives with milking herd diets.

From the SHD survey, the average age of heifers at first calving was recorded as 36 months. A better result was recorded for the CC farms of 29 months. The benchmark in developed countries is 24-26 months. Further research is required to understand whether this delay is caused by biological factors, or it is a deliberate decision not to mate heifers.

Our analysis estimates that the average milking mature cow size was approximately 440 kg with a range from 425 to 525 kg. Given the presence of Holstein crossbreds, we would expect an average mature cow liveweight in excess of 500 kg. This would suggest that there may be opportunities to focus on improved calf and heifer nutritional and health management going forward. Increasing feeding rates of concentrates for heifers offers an opportunity for them to be of larger frame at calving and also calve at an earlier age.

10.2.5 Water management

Water is a critical component of dairy herd nutrition. Based on feed intakes and milk production of milking herds from this survey, recommended water intakes would be between 60 to 70 litres per cow per day, subject to the water content of forages and commodities.

73% of SHDs had their herd's water supply in separate troughs, with 87% of these requiring manual refilling. Our survey of SHDs showed that only 47% of milking herds had access to *ad libitum* water, with the remaining herds having access to water once- (13%) or twice- (40%) a-day. Given the physiological importance of water, further research would be warranted to determine if lack of water availability is contributing to low milk production.

In regard to SHD farm water sources, 46% of farms used groundwater, 27% had access to surface water and 27% were linked to reticulated water supply. A review in 2003 showed that 58% of ground water in the Philippines is contaminated with coliforms and that many areas were experiencing water shortages during the dry season (World Bank Agency, 2003). From a herd health perspective, the presence of coliforms would be problematic for calves. Water quality from both herd health and milk quality perspectives should be investigated.

10.2.6 Wastage

Survey data indicated minimal feed wastage across farms, with average refusals (kg as fed per head per day) of 0.4, 0.6 and 0.6 for milking cows, dry cows and heifers, respectively. Refusals of up to 2.5 kg were noted on one farm for milking cows and 5 kg for dry cows and heifers. Typical refusals on well managed dairy farms are approximately 10% unless restricted feeding practices are in place. The levels recorded during this survey are within acceptable limits. As seen in Image 10.18, there was forage wastage noted with ground feeding.

On the ground and trough feeding were the two main ways forages were offered. Both had issues with wastage.

Image 10.18.

10.2.7 Nutritional opportunities to improve the productivity of milking herds.

A summary of nutritional reviews of surveyed SHD milking herd diets are shown in Table 10.4. Overall dry matter intake of milking herd was low at an average of 2.3% of liveweight (range of 1.7 to 3.2%). A target for average producing dairy cows is 3.5% of liveweight. Our analysis also showed that intake is being limited within SHD milking herd diets by high fibre dietary intake content (47% of farms) and protein deficiency (93% of farms). None of the SHD farms were feeding high quality protein meals such as soyabean or canola meal. It is also known that diets based on tropical forages are generally deficient in water soluble carbohydrates (WSC). Molasses is a good source of WSC at low feeding levels. However, we observed only 13% of farms were feeding molasses, despite its competitive price (and local availability) versus concentrates on an energy basis (₱1.2 vs ₱1.9 per megajoule metabolizable energy). Our previous research in Indonesia has increased milk yield from 14 to 17 litres per cow day when tropical forage-based diets fed in early lactation are supplemented with soyabean meal and molasses.

Table 10.4. Nutritional adequacy of surveyed SHD milking herd diets.

	Avg	Min	Max	Target	Target met (% Farms)
Dry matter intake (%LW[a])	2.3	1.7	3.2	3.5	0
Crude protein (CP) content (%DM[b])	14.0	11.8	17.0	Above 16	7
Neutral detergent fibre intake (%LW)	1.2%	0.8%	1.8%	Less than 1.2%	53

[a] *Liveweight* [b] *Dry matter*

10.3 Herd performance

10.3.1 Breeds and milk yield

Despite best endeavours, no definitive data on the proportion of different dairy breeds in the Philippine dairy herd could be found. Holstein cross with Sahiwal or local native breeds was regularly mentioned. The proportion of Holstein genetics within herds ranged from 50% to 91%. Jersey Holstein crosses were also used, but they were not as prevalent on farms that exposed herds to heat stress, poorer quality feedstuffs and parasites.

Of the SHD farms we surveyed, three major genotypes were observed: >75% *Bos indicus* (Zebu) crossbreeds; >75% *Bos taurus* (European) of a low genetic merit; and first cross (F1) crossbreeds of each species. Average daily milk yield for each genotype were 6.8, 7.5 and 9.5 litres, respectively, with average daily milk yield per cow from all SHD farms being 8.4 litres.

The three CC farms we surveyed had consistent genotypes comprising of 65-75% *Bos taurus*: 25-35% *Bos indicus*. Milk production from these farms ranged from 9 to 14 litres per cow per day, with a weighted average of 10.8 litres per cow per day. The higher milk production from these farms can be attributed to feeding more concentrates and by-products such as brewers' grain. Average concentrate feeding for surveyed SHDs averaged 2.5 kg per day where CC farms averaged 4.3 kg per cow per day. By-products were also fed on CC farms at moderate levels (e.g., palm kernel meal (9 kg per cow on one farm) and brewers' grain (average of 12 kg as fed (4 kg DM) across two farms).

Hacienda Macalauan Inc averages 22 litres per cow per day with genotypes ranging from 50:50 *Bos taurus: Bos indicus* up to 90:10 *Bos taurus: Bos indicus*. The higher milk production from this farm can be attributed to the higher proportion of *Bos taurus* genetics and also the feeding of high-quality forages (including imported lucerne and oat hay), maize silage, protein supplements and imported wheat. It is highly likely this farm has a greater focus on herd reproductive performance, with less cows with extended lactations.

- On SHD farms, Bos taurus (European cattle) breeds are predominantly Friesians. Jersey and Guernsey crosses were also noted. The cow on the left is approximately 75% Friesian and 25% Zebu as noted by the elongated muzzle, larger ears and lighter rear confirmation.
- In terms of confirmation, the European breeds are more typical of mid quality genetics, typical of the 1980s and 1990s.

Image 10.19.

These images show dairy cows and steers on SHD farms that are Bos indicus (Zebu) dominant (80 % plus). It was common across surveyed farms to find herds comprised of Zebu dominant livestock and also Bos taurus dominant (European) genotypes, as opposed to a similar herd genotype within one herd. Different management strategies should be applied to each breed type. The heifer on the bottom left is a local Philippine native breed.

Image 10.20.

10.3.2 Milk components

Only three out of 15 SHDs were provided with results for total solids at their milk collection point with only two providing values (range of 7 to 8%). Four out of 15 SHDs knew their milk protein content, with only two providing values (range 2.5 to 3%). Better results were noted for fat content with 9 out of 15 having this routinely measured. Four results were obtained ranging from 2.4 to 4.5%. Due to the limited data provided, no conclusions could be reached regarding the components of SHD farms.

10.3.3 Milk quality (bacterial) and transportation

Of the 15 SHDs surveyed, two did no further processing after milking, 10 filtered milk, while three filtered and cooled milk.

Four farms noted that they had somatic cells routinely measured ex-factory while one reported that TPC was measured. No specific values were reported for either parameter. Only one farm reported that bulk density was measured with no value recorded.

Eleven out of 15 SHDs knew that if they improved the quality of their milk, they would get paid a higher price. Twelve farms were aware that they would be paid less if their quality dropped. Seven had milk rejected at some stage. Three instances were for sour milk, two failed to meet factory standards, one was for low specific gravity (possible water adulteration), and one had chemical residues.

Four farms had their milk collected from their farm while 11 delivered their milk to a collection centre or factory. The average distance from farms to their milk collection point was 1.8 km (range: less than 20 meters to 7km) and took 10 minutes to travel (range: less than 1 to 35 minutes). Half of SHDs interviewed delivered milk on motorbike/tricycle, while the other half deliver milk on-foot. Three farms reported milk delivery costs of between ₱3 and ₱15 per day.

10.3.4 Cow longevity

Average cow age recorded during the SHD survey was 73 months. This is quite comparable to longevity of cows in other SHD industries and developed countries which typically are 60 to 72 months. Average calvings per cow were 3.4 with an inter-calving interval of approximately 12 months. This result would be comparable to international benchmarks. However, this data was not supported by the average days in milk (DIM) from surveyed SHD farms (227 days) versus a benchmark of 160 days. A better DIM result (202 days) was recorded for the CC farms.

10.3.5 Ratio of milking cows:replacements & dry cows

Of the SHDs surveyed, the average number of milking cows managed per farm was 2.7. On average, the total of dry cows and heifers (pregnant, yearlings and calves) was 6.0. Overall, this represents a ratio of milking cows:non-milking females (MC:NC) of 0.45. A similar result for MC:NC was recorded for the CC farms, with an average value of 0.45 (range 0.37 to 0.61).

A benchmark used in commercial Australian herds for MC:NC is 1, unless the herd is in an expansion phase or contraction phase, or the herd is breeding additional heifers for sale. A low MC:NC value can indicate several scenarios:

- There are issues getting cows back into calf. This is indicated by a high ratio of dry cows to milking cows;
- There are problems getting heifers into calf. This can be indicated by an above average age at first calving and a low ratio of pregnant heifers in a herd;
- The herd has a high culling rate of milking cows, especially first calf heifers often due to poor reproductive performance;
- The herd has problems with the health status of replacements, especially high calf mortality, leading to a low proportion of weaner and yearling heifers;
- The business retains dry cows for fattening to service the meat industry.

Some further benchmarking analysis is shown in Table 10.5. For both SHD and CC farms it suggests the following issues:

- The high proportion of dry cows suggests problems with getting milking cows in calf;
- The low proportion of pregnant heifers also suggests reproductive issues;
- The low proportion of calves not reaching weaning suggests higher mortality rates. Alternatively, it also may reflect that bull calves are being retained for growing out and sale.

All of these issues warrant further investigation.

Table 10.5. An analysis of milking and non-milking dairy livestock on surveyed SHD farms.

Class	Number	% non-milking stock	Benchmarks
Small holder farms			
Milking cows (MC)	2.7		
Non milking females (NC)	6.0		
Ratio MC:NC	0.45		1
Categories of non-milking females:			
Dry Cows	1.7	28	17
Pregnant heifers	1.4	23	25
Weaners and Yearling heifers	1.9	32	50
Calves – heifers	1.0	17	8
Commercial/Communal farms			
Milking cows (MC)	84		
Non milking females (NC)	188		
Ratio MC:NC	0.45		1
Categories of non-milking females:			
Dry Cows	75	40	17
Pregnant heifers	27	14	25
Weaners and Yearling heifers	43	23	50
Calves – heifers	43	23	8

10.3.6 Calf and heifer management

Calf rearing

Images captured during this project showed a wide variation in calf rearing infrastructure from fully housed to tethered calves being reared with minimal shelter (Image 10.21). Similarly, these images showed a range in calf health condition, from healthy through to a very poor health status.

An analysis of data from the SHD survey showed the following:

- Over 80% of farms fed colostrum within the recommended time (6 hours of birth);
- Only 53% fed colostrum more than two times within 24 hours. The benchmark is four times;
- We were unable to ascertain total levels of colostrum fed per calf;
- On 66% of farms, male calves were retained until 12 months of age for sale to the beef market;
- 26% of farms did not feed concentrate to calves. Concentrates should be offered seven days after birth;
- Milk feeding levels per calf averaged 3.5 litres per day. Average intake between birth to weaning should be approximately 6 litres per day;
- Only 13% of farms fed a milk replacer formula;
- As a benchmark, if more than 10% of calves are showing symptoms of disease, then action should be taken. The following table (Table 10.6) shows the results from our SHD survey of health issues that were seen **Occasionally or Often.**

Table 10.6. The incidence of health problems of calves in SHD survey.

Disease or health problem	Percentage (%) of SHD farms	
	Seen Occasionally	Seen Often
Diarrhoea	80	7
Mange	33	13
Indigestion	47	0
Respiratory	40	13
Poor growth	80	7
Death	73	7

In summary, improving calf management and their health offers potential productivity gains for some SHDs. Our observations would indicate that the following disciplines are opportunities for improvement:

- Colostrum feeding and quality;
- Feeding levels and quality of milk, milk replacer and concentrates;
- Infrastructure and pen hygiene;
- Disease management and prevention;
- Implementing a monitoring system to track performance.

Image 10.21.

Other herd composition information

On average, each SHD had 1 bull calf per farm. Every second farm had a herd bull.

No specific data was recorded in the SHD survey regarding other ruminant breeds, however images show beef cattle and goats grazing with dairy cattle in mixed farming systems. Some of these cattle are used as draught livestock.

From a tropical pasture management perspective, goats are not recommended to graze with cattle. This is due to their ability to graze close to the ground and kill off more productive pasture species with high growing points.

10.3.7 Herd improvement

As a component of the Philippines-New Zealand Dairy Development project, heifers 3 to 4 months of age were imported that had the Slick gene. The Slick gene results in cows having shorter coats, and a greater ability to sweat during heat stress. Research has shown Holsteins with the Slick gene have vaginal temperatures 0.5^{o}C less than non-Slick gene cows during periods of high stress. They also experience a lower rate of milk production decline from thermoneutral to heat stress conditions (3% decline versus 10% decline, Dikmen et al., 2014).

NDA inseminators determine the bull semen provided to farms. These are generally US based genetics. No specific details on how bulls are selected by NDA could be found. There is no quantitative herd improvement scheme in the Philippines. Typical international herd improvement programs examine the breeding value of sires and dams through a process of measuring phenotypic responses under local operating conditions. The evolution of genomic breeding values is seeing dramatic improvements in the rate of genetic gain in countries such as Australia.

The use of *Bos indicus* crossbreeds in tropical dairy herds has been met with mixed success. Despite significant R&D investment spent on developing a tropical dairy cow between 1970 to 1990, they have disappeared in developed countries such as Australia. Their inherent low milk production and poor temperament are limitations, with developed tropical dairy industries choosing to overcome productivity constraints by mitigating heat stress loads through infrastructure such as shade, fans and sprinklers, and reducing the proportion of tropical grasses in herd's diets by feeding starch-based silages and concentrates. There has also been a focus on breeding from *Bos taurus* lines more genetically suited for tropical climates identified through herd performance evaluation programs and the development of genomic breeding indexes such as a Heat Stress Index. In countries that are evolving from SHD systems to larger scale commercial farms, such as Thailand, herds typically are based on 80% *Bos taurus* genetics and 20% local *Bos indicus* based genetics.

The introduction of *Bos taurus* genetics into SHD herds by NDA through AI programs is a positive, however this needs to be supported by quantitative evaluation of progeny. Reproductive failure (and subsequent culling) caused by excessive liveweight loss in early lactation due to genetic potential for milk production being greater than nutrient intake has been observed in countries like Australia. The low body condition of some cows on surveyed SHD farms (Image 10.22) may be an initial symptom of this issue.

Body condition of milking cows and replacements were quite low on a number of farms. Under the Australian dairy body score system (1-8), all of these cows and heifers would be below 2, with some below 1. Milking dairy herds should have a body condition score of between 3 and 5.5 subject to stage of lactation.

Image 10.22.

10.3.8 Financial and business management

Physical farm analysis

For the 15 SHD farms surveyed, physical farm data was collected on milk production and feed, as well as financial data including income and costs allowing for a farm financial analysis. Physical indicators can be seen below in Table 10.7 below. Concentrate costs accounted for the highest feed cost of 67%, with the remainder as forage costs.

Table 10.7. Summary of physical farm performance for the 15 SHD farms surveyed.

Productivity indicators	Average	Min	Max
Milk production and efficiency			
Number of milk cows	2.7	1	6
Litres per cow per day	8.4	2.0	12.5
Litres per lactation	2,520	600	3,750
Litres per farm per year	8,180	2,555	27,375
% forage feed costs per litre	33%	8%	100%
% concentrate feed costs per litre	67%	0%	92%
Land efficiency			
Litres per ha per year	8,108	608	40,150

Revenue from the dairy farm

Farm business analysis was conducted including total costs, revenue and profit for the year.

The average revenue derived from fresh milk sales (milk income) was ₱233,708 per annum, which is an average of ₱ 31 per litre. Other aspects of the dairy operations were considered when calculating total farm income, including livestock sales ₱ 69,399 (₱ 11 per litre) and

milk consumed domestically and fed to calves of ₱ 19,260 annually (₱ 2.4 per litre). The average total income for the 15 farms was ₱ 317,367 per annum or ₱ 44/litre (Table 10.8).

Total costs include variable costs of feed (forage, concentrate and feed delivery costs) and herd costs, as well as overhead costs of paid labour, other costs such as electricity plus business costs including family labour. None of the farms had any interest or lease costs associated with production.

On average, across the 15 farms, the average total variable costs were ₱103,799 per annum and total average annual costs were ₱224,990.

The total cost incurred by dairy farmers for producing a litre of milk was ₱ 31 per litre. The largest cost for farmers is related to feed costs, consistent with dairy operations globally. The overall high cost of concentrates (₱ 8.66 per litre) is the largest feed cost reflected in these figures, accounting for 67% of the feed cost. Benchmarks used in developing countries are that total feed cost (including concentrates) should not be greater than 50% the farm gate price of milk. We recorded a value of 42% which under this benchmark.

The cost of paid labour varied between farms, with an average of ₱ 3.75/litre but ranging from zero, with some farms hiring paid labour up to ₱17.10 per litre. All farms had varying amount of family labour at an imputed labour cost and was calculated based on the wage rate for the farm with hours over the year.

Profitability

The total average profit per farm was ₱ 92,377 and per litre was ₱ 13.65 shown in Table 10.8. Farm 9 had the highest profit of ₱ 47.5 per litre, which was partly attributed to other sources of income including livestock sales. Whereas Farm 11 had very high total costs impacting on overall profit, resulting in a loss of - ₱ 12.6 per litre (Figure 10.1).

Table 10.8. Breakdown of annual sources of farm income, costs and profit per annum for 15 surveyed SHD farms.

Financial Performance	Farm average	Min	Max
Farm Cash Income			
Total milk product income (net milk delivery)	₱ 233,708	₱ 73,000	₱ 821,250
Milk consumed by household and calves	₱ 19,260	₱ 0	₱ 36,000
Livestock sales	₱ 69,399	₱ 0	₱ 352,000
Other Farm Cash Income		₱ 0	₱ 0
Farm Cash Income	₱ 322,367	₱ 73,000	₱ 915,820
Variable Costs			
Forage costs	₱ 19,437	₱ 4,380	₱ 52,560
Concentrate and supplement costs	₱ 71,338	₱ 0	₱ 285,795
Feed delivery costs (concentrates, forages)	₱ 6,524	₱ 0	₱ 72,000
Total Feed costs	₱ 97,299	₱ 10,950	₱ 314,265
Total Herd Costs	₱ 6,500	₱ 0	₱ 48,550
Total Variable Costs	₱ 103,799	₱ 10,950	₱ 314,265
Cash Overheads			
Employed Labour Cost	₱ 26,350	₱ 0	₱ 118,998
Other Overhead Costs	₱ 13,599	₱ 0	₱ 76,728
Total Overhead costs	₱ 39,948	₱ 0	₱ 119,298
Other Business Costs			
Interest	₱ 0	₱ 0	₱ 0
Land lease	₱ 0	₱ 0	₱ 0
Owner's labour	₱ 81,243	₱ 9,885	₱ 282,100
Total Other Business costs	₱ 81,243	₱ 9,885	₱ 282,100
Total Costs (variable, overheads and business costs)	₱ 224,990	₱ 34,071	₱ 670,365
Income over Feed Costs	₱ 225,068	₱ 58,478	₱ 741,200
Income over Variable	₱ 218,568	₱ 55,628	₱ 692,650
Net Profit (income minus total costs)	₱ 97,377	-₱ 87,234	₱ 520,112

Note: Other overhead costs include electricity, cooperative memberships, other expenses. Other business costs include interest, land lease and owner labour.

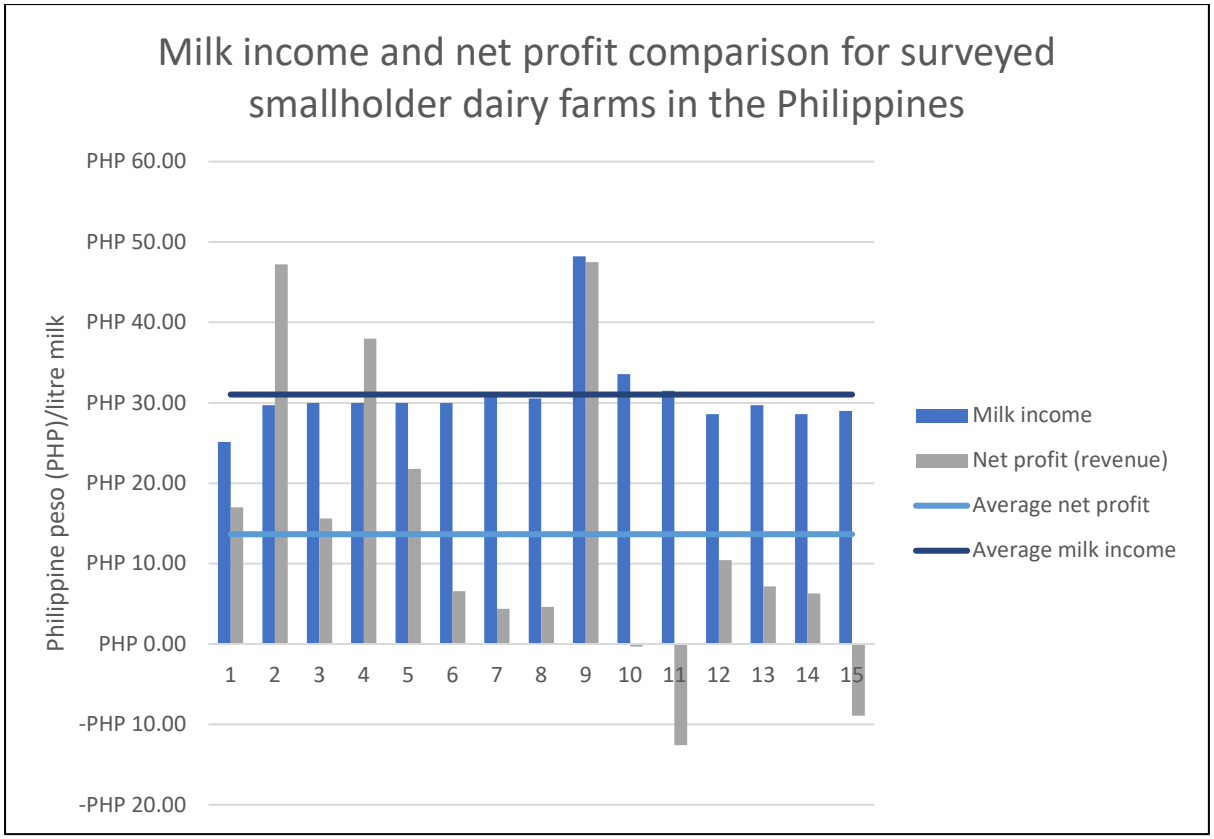


Figure 10.1. Showing the range in milk income and profit per litre for the 15 dairy farms surveyed. Average milk income was ₱ 31.03 per litre, and average net profit was ₱ 13.65 per litre.

The key insights highlighted from this analysis include:

- On average, across the 15 SHD farms, the average total variable costs were ₱103,799 per annum and total farm costs were ₱224,990;
- Concentrates and supplements accounted for the largest share of costs, making up approximately 67% of total costs;
- The total cost incurred by dairy farmers for producing a litre of milk was ₱ 30.63 which was almost same as the average milk income received (₱ 31.03 per litre);
- Family labour equated to an average of ₱ 81,243 and hired labour ₱ 26,350 per annum which was included in total costs. The high family labour cost reflects the value and time of this in smallholder dairy production systems;
- The average total milk income (revenue) across the fifteen farm was ₱ 233,708 per annum and per litre was ₱ 48.20 per litre;
- The total average profit per farm was ₱ 92,377 and per litre was ₱ 13.65.

Access to credit

The main source of capital for the dairy business was through private savings (73%), with the remaining sources from government aid (20%) and cooperative input credit (7%).

Many farmers are aware of a place or person where they can borrow money (93%), and 86% of farmers said they have borrowed money at some point. Currently, 21% of the farmers have a loan or line of credit, where 100% said they had success in securing a loan when applied for one. In the last 12 months only 36% farmers tried to borrow money, other than from a friend or family. Table 10.9 provides some reasons why SHDs borrowed money. Only 60% of SHDs invested these loans into their businesses.

Table 10.9. Expenditure of loans by surveyed SHDs.

Item	% farms
For children's education fee	20
For renovating house	20
For other farming (crops/rice)	40
For vehicle repair	20

10.3.9 Human resources

Farm aspirations and attitudes

Of the SHDs surveyed, 67% said they aspired to expand, where 20% would like to remain the same and 13% were undecided. No-one indicated they wanted to exit the industry. Farmers expected the average future herd size to be 14 cows, which ranged from 4 to 30 cows from the farmers interviewed. This indicates farmers are positive about the industry, with a willingness to develop and grow.

However, farmers identified significant constraints to the industry, such as the cost of production being too high (73%) and low milk prices as the second largest constraint (60%). Reproduction was also identified as major constraint at 47% (see Figure 10.2).

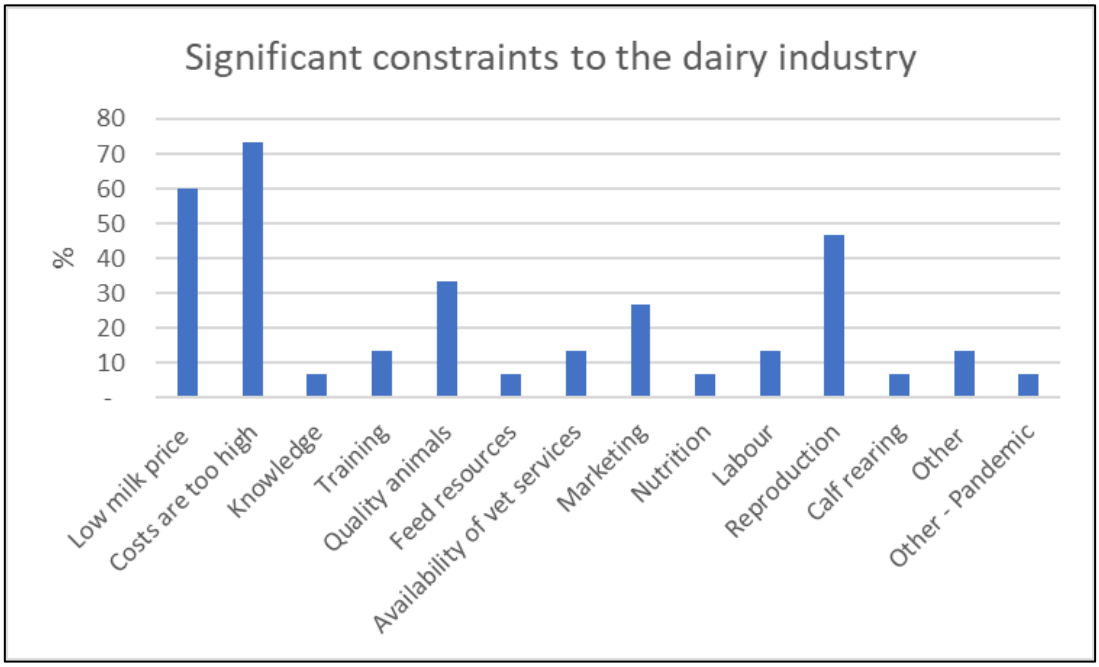


Figure 10.2. Dairy farmer's perspectives on significant constraints to the dairy industry, note was percentage of responses (Note: farmers were asked to choose up to three constraints).

In regard to policies to support dairy farmers, 67% of farmers said that the local or national government had introduced supporting policies, but 69% said that that more government policies were needed. The most popular policy suggested to be introduced was animal health (such as veterinarians and inseminators) followed by providing livestock and breeding programs (both 67%).

Farmer attitudes towards trying new technologies were mixed with 27% identifying as being always the first to try new methods or practices, 40% as one of the first and 33% to wait to see other's success before trying them.

Average risk-taking behaviour was 6.7 on a scale of 1 to 10 (with 1 as not taking risks at all and 10 as full prepared to take risk). The average likelihood of trying new dairy farming practices was 7.6.

Labour used (owner and employed)

The main source of labour (47%) on the farm was fulfilled by the farmer surveyed and their family, with smaller proportions from a mix of individual owner labour and hired labour.

For hired labour on farm, two thirds said it was easy to somewhat easy to find workers, whereas a third of farms said it was difficult. In the past 12 months, farmers hired 40% labour at the average daily rate of ₱ 340 per day but ranging from ₱167 to ₱1230/day, with two thirds paid in cash. The main activity carried out by hired labour is cutting and carrying grass, with an average of nine hours per week (range from 0 to 56 hours per week). The tasks and activities for owner labour were spread more evenly across a variety of activities to include, cutting grass, feeding, washing cows, milking and milk handling. A third of workers stopped working in the past 12 months due to alternative jobs offers, job loss on-farm or due to Covid-19 lockdown.

Level of education

The average household size was six people (including adults and children), and the majority of the head of households were male (80%). The average education level (in years) of the head of the household was 10 years, which ranged from 5-15 years. Only 27% had an undergraduate degree and 7% had vocational training (Table 10.10). Spouses of the head of the household had an average education level of 11 years with a range of 6–15 years. For the household head, 67% had dairy farming as their primary occupation.

Table 10.10. Breakdown of gender of household head and the level of education.

	number	**%**
Gender of household head		
Male	12	80
Female	3	20
Tertiary education of household head		
No	10	67
Undergraduate	4	27
Postgraduate	-	-
Vocational training	1	7

Access to information, skill development and service providers

Access and sources of information

Surveyed SHD farmers have received information on a variety of topics, with the most information received on milk quality (87%) and the least amount of information received on access to new markets (47%). The full list can be viewed below in Table 10.11.

Table 10.11. The percentage of farmers that have received information on the types of farm management topics, technologies and markets.

Information sources	% yes
Improve milk quality	87
Reproduction and AI	80
Milk sales (buyers, prices)	80
Increase milk yields	80
Knowledge sharing	80
Rearing heifer for replacement cow	73
Dairy cow nutrition	67
Forage and grasses	67
Cow's health	67
Provision of new credit	67
Concentrates	67
Feed supplements	67
New management practices	60
Government programs	60
Mastitis test	60
Applied of breeding plan/progeny testing	53
Information on new technology	53
Value adding of milk	53
Access to new markets	47

The main sources of information for these topics were provided by government extension offices. Secondary sources of information to a much lesser extent included cooperatives or a technical officer at a cooperative, veterinary offices, processors and universities. Given the resourcing and large regional presence of the NDA, the data reflects the higher level of engagement by farmers with government compared to other sources of information.

Farmers ranked the information from government extension offices as useful for many topics such as forage and grasses, cow health, new management practices, mastitis, government programs, value adding, knowledge sharing and feed supplements (100% of responses said it was useful). Milk sales (buyers, prices) were rated less useful compared to other categories, perhaps because government extension has little effect over sales and prices for milk.

More farmers said that information received has been less since Covid for most of the topics, which was expected given the restrictions of movement in regional areas. However, for some, such as new management practices, access to new markets and knowledge sharing were less or about the same.

Future training needs

When future training needs were analysed, 87% of farmers were willing to participate in farmer training and village workshops. The preferred methods of training were field practice and farm visits, with theory and written material as the least preferred option, which is consistent with adult learning and training theories in rural settings.

The top preferred technical disciplines for training included:

- Nutrition and feeding management (73%)
- Farm business management (67%)
- Animal husbandry (40%)

10.3.10 Farming trends in Isabela

It was identified in the province of Isabela that many farmers had ceased dairy farming at the time of the survey in December 2020 due to a number of factors, which were aggravated by the Covid-19 pandemic. Five farmers were surveyed and a few more contacted for anecdotal information.

The combination of factors challenging the sustainability of the industry in Isabela include:

- Limited access to forage and poor nutrition;
- Mismanagement of farm cooperatives (and reliance of foreign aid), causing them to close;
- Low conception rates, largely caused by poor nutrition;
- Lack of access to capital and limited uptake of loans;
- Poor calf rearing and herd management practices, largely due to poor nutrition impacting on herd health;
- Inconsistent demand from buyers of raw and processed milk products, making it difficult for farmers to sell.

The impact of these factors was exacerbated during the lockdown period in the Philippines due to Covid-19, disrupting transport of milk and farm inputs. Although some support was provided from the government during the initial lockdown period, through provisions of silage and purchase of milk, it did not cover the duration of the lockdown period forcing farms to sell their cows and close down their dairy operation. Some smallholder farmers sold cows to farmers who were able to continue their operation as they had a more reliable buyer, such as through the SBFP. Other animals were sold for slaughter, kept for household purposes or used as draft animals. As a result of ceasing dairy activities, some farmers switched to crop production such as corn, rice or higher value crops, switched to poultry or goat production and others sourced alternative off farm income where possible.

Three of the farmers interviewed indicated their intention to return to dairy farming and optimism, given the renewed government support and commitment of budget for the SBFP. Through this program, the government is encouraging expansion of dairy operations to meet the supply in the province, through guaranteed purchase of milk and provision of dairy animals to boost local herd numbers.

There has been a shift to further encourage communal dairy farming in Isabela, supported by the NDA in collaboration with local government units (LGUs) who assist in monitoring the farms and provide technicians to ensure proper management. There are currently three LGUs with a communal farm set up in Isabela, where 100 cows were delivered per LGU in the last quarter of 2019, with plans to import additional cows for two of the three LGUs in 2021. The LGUs are involved in setting up farms with 100 cows, which are purchased in cash or loaned from the NDA with a repayment scheme of pregnant animal payments. Possible reasons for the push to a communal farming set up is for easier monitoring and management of more animals in one location, which allows the LGUs to ensure a more consistent and direct supply of milk for the SBFP. This initiative also runs off the back of support provided by Heifer International in the province, who heavily invested in equipment for dairy processing, stock and training.

10.4 Greenhouse Gas (GHG) emissions

There is emerging global compliance to reduce GHG emissions in dairy supply chains, with many multinational processors setting a zero-emission target by 2050. Dairy farms are a significant contributor to the carbon footprint of dairy products with GHG equivalent emissions (CO_2e) from both carbon and nitrogen sources ranging from 0.8 kg to 1.1 kg per litre of milk in developed countries.

Dairy systems in subtropical and tropical countries produce a third of the world's milk supply but emit over half of the global dairy GHG emissions. The low milk yield per cow of diets based on tropical forages, and suboptimal reproduction performance leads to higher than global average emissions of methane per litre of milk produced.

The average emissions from the SHDs surveyed here equalled 1.9 kg CO_2e per kg Fat and Protein Corrected Milk (kg FPCM), with a range of 1.2 to 3.8. This value is approximately double the emissions from developed temperate dairy industries. There were some strong correlations between CO_2e per kg FPCM with the ratio of milking to dry stock, milk production per cow and a parameter combining these two variables; annual milk production per head of farm livestock (Figures 10.3, 10.4, and 10.5). Given the quadratic and cubic relationships identified, some thresholds were noted, with CO_2e increasing once the ratio of dry stock to milking stock exceeded 1 (60% of farms), when daily milk production per cow was less than 8 kg (47% of farms), and when milk production averaged per head of livestock was less than 1250 kg per annum (47% of farms).

These observations indicate that improving herd nutritional practices and addressing poor reproductive performance are options to reduce the GHG footprint of Philippine SHD farms. Focussing on these strategies will not only reduce carbon footprints but also have the potential to increase milk supply and farm profitability. The emergence of methane reducing rumen additives used globally also warrant investigation under Philippine SHD farm operating conditions.

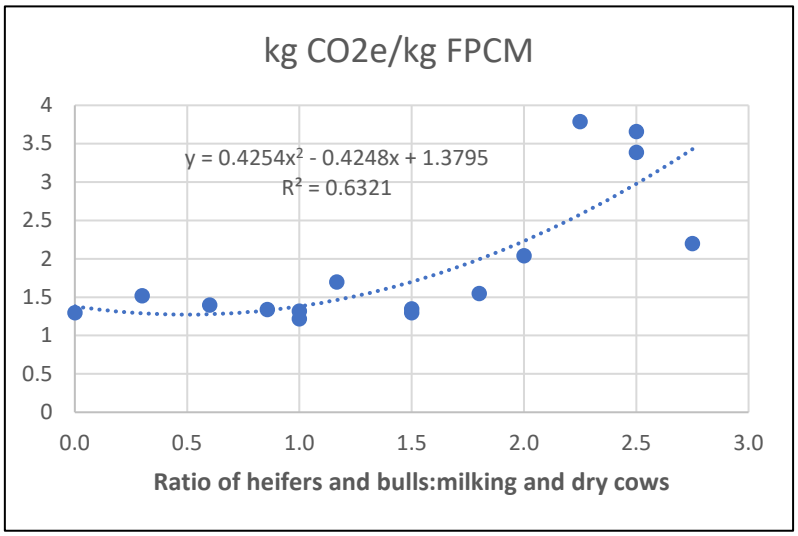


Figure 10.3. Greenhouse gas equivalent emissions (kg CO2e per kg Fat and Protein Corrected Milk (kg FPCM)) versus the ratio of milking to dry stock.

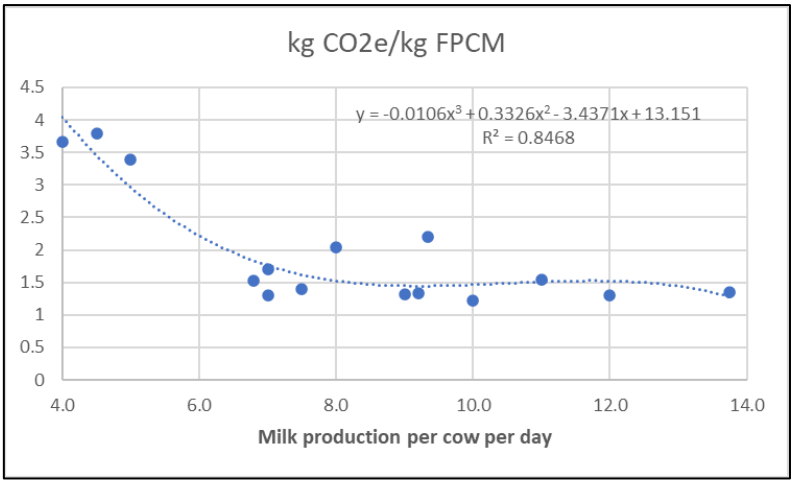


Figure 10.4. Greenhouse gas equivalent emissions (kg CO2e per kg Fat and Protein Corrected Milk (kg FPCM)) versus daily milk production per cow.

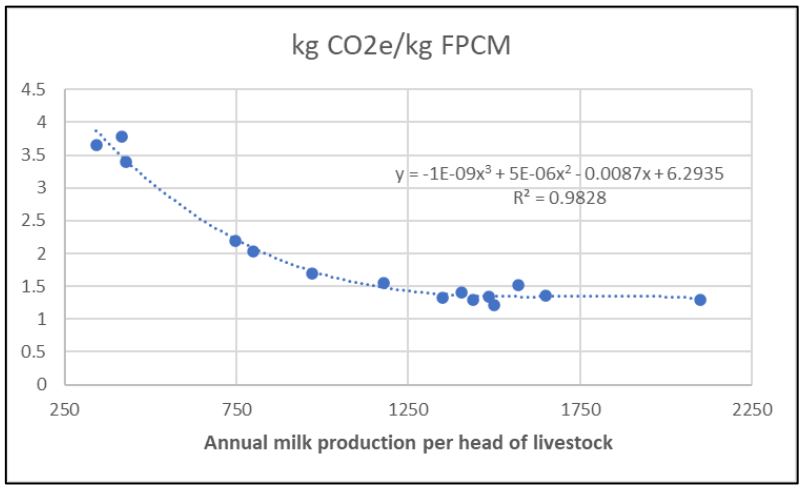


Figure 10.5. Greenhouse gas equivalent emissions (kg CO2e per kg Fat and Protein Corrected Milk (kg FPCM)) versus annual milk production per head of farm livestock.

11 Comparison of key biophysical and financial farm performance benchmarks from other Australasian dairying industries.

Table 11.2 provides a comparison of the performance of surveyed Philippine SHD farms with benchmarks from another tropical SHD industry (Indonesia) and a developed dairy industry based in the tropics and subtropics (Queensland, Australia).

In terms of biophysical parameters, Philippine SHD farms have lower milk production per cow than other industries. Some of the reasons for this have been discussed earlier. The numbers of non-milking cattle also are higher than other industries, however this does contribute significantly to revenue from livestock sales.

Financially, milk revenue per litre is high versus global standards, however this is somewhat offset by feed costs. This is primarily caused by feed being provided to non-lactating stock, but also low feed conversion efficiency caused by low milk production per cow. The relatively low farm size of Philippine SHD farms leads to high owner labour costs per litre.

Annual profitability per milking cow (EBIT (Earnings before financial costs and taxation) on Philippine SHD farms ($726 USD) compares favourably to developed Australian tropical and subtropical dairy systems ($169 USD) and provides an opportunity to profitably grow herd sizes (in addition to increasing milk yield per cow). This difference can be attributed to high milk price ($454 USD) and additional livestock sales ($424 USD) but is offset by higher owner-labour expenses on a per cow basis (-$454 USD). It is likely that growing the milking herd size on Philippine SHD farms will reduce the carrying capacity of non-lactating animals retained on-farm and hence reduce this revenue stream, unless greater productivity can be achieved from current forage production or contract grown forages are bought on farm. Further comparative advantages and opportunities for development for Philippine SHD farms versus Indonesia and northern Australia are shown below in Table 11.1.

Table 11.1 Comparative opportunities & opportunities for Philippine SHD farms versus other country's industries.

Advantages	Opportunities
Farms have access to land grown forages	Increase milk production per cow
Milk price is high versus other industries	Reduce the proportion of non-milking cattle
Feed costs per litre are relatively cheap	There is scope to grow farm milk production
Margins per litre and per cow are high	Reduce labour costs per litre
Compared to Indonesia, farm profit is high	Dilute overheads per litre through increased farm production

Table 11.2. Biophysical and financial farm performance benchmarks from the Philippines, Indonesia and northern Australia.

Parameter	Philippines	Indonesia[a]	Queensland[b]
Period	2021	2017	2019/20
Biophysical			
Per milking cow (L/cow/day)	8.4	14.7	20.5
Farm milk production per year (L)	8,180	12,789	1,605,150
Farm area (ha)	3.87	0.23	286
Milking herd size (n)	2.7	2.9	261
Non milk herd size (n)	6	2.8	233
Total herd size (n)	8.7	5.7	494
Farm area per head (ha)	0.44	0.04	0.58
Proportion non milking herd (%)	69%	49%	47%
Financial USD			
Income			
Milk income (net delivery, farm & domestic use) ($/L)	0.63	0.33	0.47
Livestock sales ($/L)	0.17	0.09	0.03
Other income ($/L)	0.00	0.23	0.01
Total Income ($/L)	0.80	0.23	0.51
Costs		-	
Feed costs ($/L)	0.24	0.16	0.28
Herd Costs ($/L)	0.02	0.01	0.02
Employed Labour Cost ($/L)	0.07	0.01	0.06
Owner's labour ($/L)	0.20	0.15	0.05
Other Overhead Costs ($/L)	0.03	0.01	0.08
Total Costs (excluding lease interest &tax) ($/L)	*0.56*	*0.19*	*0.49*
Milk income over feed costs ($/L)	0.38	0.16	0.19
Milk income over feed costs per cow ($/cow)	1164	927	1142
EBIT[c] per litre ($/L)	0.24	0.04	0.03
EBIT pre cow ($/cow)	729	300	169

[a] IndoDairy AGB/2012/099 [b] Murphy et al. 2020 [c]Earnings before financial, lease, interest and taxation.

12 An overview of commercial providers of SHD inputs and services

12.1 Introduction

Foodlink identified 89 businesses that were or potentially could service the SHD sector with services or inputs (Table A12.1 (p178)). This analysis excludes those provided by co-operatives and private processors. Our research noted that with the exception of some loans and limited concentrate manufacturing, co-operatives and private processors relied heavily on government services predominantly provided by NDA, DA and local government.

Commercial service providers were predominantly located in Luzon (84) followed by Mindanao (3) and Visayas (2). Some Luzon businesses have outlets into other regions. For example, Aljay Agro-Industrial Development Corporation, a business primarily servicing rice and corn farmers with seed and fertilisers, has 1,000 direct accounts across the Philippines.

An analysis of the main services provided by these companies are shown in Figure 12.1. Feedmill (and associated input providers) and veterinary supply sectors comprise of the majority of businesses identified (93% in total). Given the scale of the monogastric industries in the Philippines, this is not surprising. In comparison, the seed and fertiliser sector had a smaller proportion of companies, however it does have large multinationals such as Bayer Crop Science servicing corn growers with globally competitive, contemporary products.

We could find few suppliers providing services in herd improvement and genetics. Given the active role government has in providing AI services, this is not surprising. We also only found one company involved in the sale of silage and bagged total mixed ration (TMR – fodder and concentrate combined). Due to the logistical challenges of the relatively high moisture content of silage and TMR, and their relatively short storage life once exposed to air, this is a challenging commercial landscape. We were unable to find suppliers of general agricultural merchandise used in SHD operations such as milking shed consumables.

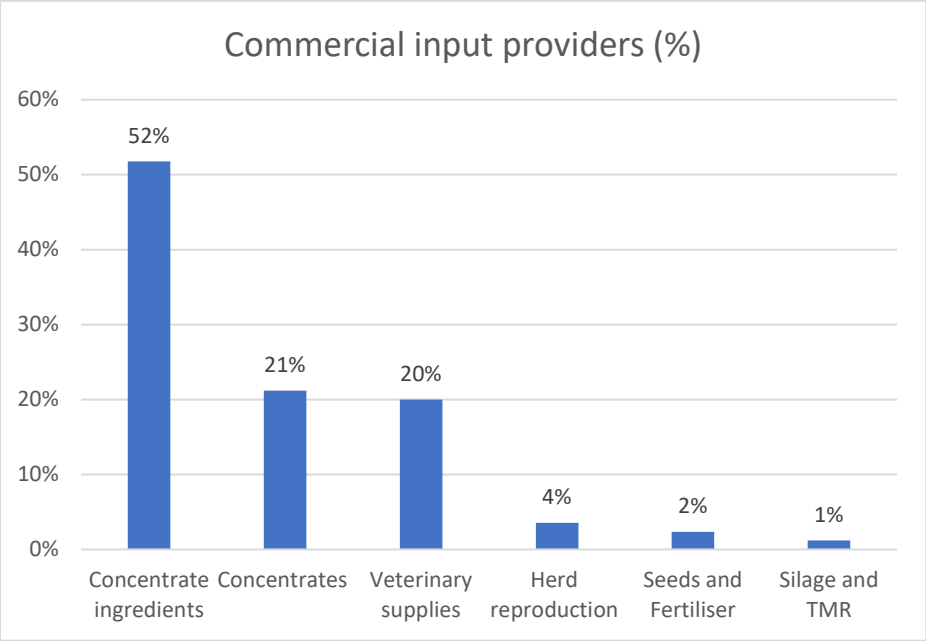


Figure 12.1. SHD input provision by Philippine businesses.

It was encouraging to see some businesses take an active role to assist farms with their own development or to further develop their own products to improve their productivity when used on SHD farms. The following provides an overview of this intent from two companies we interviewed. Further information can be found on other providers in Section A12.1 (p152). Partnering with businesses with similar development strategies would be beneficial in a multi-year project.

Aljay Agro-Industrial Development Corporation (Aljay)

Based in Isabela, Aljay Agro-Industrial Development Corporation has been operating for 33 years primarily servicing primarily rice and corn farmers with seed and fertilisers. Aljay have 10% of the market share and 1,000 direct accounts. Only one of their clients in Isabela produces corn silage. The company works through small dealers and offer credit programs to small farmers. Their products include fertiliser and crop chemicals. They have partnered with Bayer Crop Science to trial new products targeting Fall Armyworm, which is a significant pest for corn.

Aljay provides extension of its products through Learning Centres to demonstrate new products. This in the form of one hectare demonstration plot on a client's land, with the remaining land acting as the control. Other farmers are invited to observe the results. Their goal is to achieve a 20% yield increase compared to the previous (traditional) product/practice – e.g., for rice cost of production ₱12 PHP per kg, so they aim to lower cost to ₱8 to ₱10 per kg. Aljay has 117 Learning Centres across the Philippines. Additionally, Aljay offers a Young Farmer Program to focus on younger generation (less than 40) and integrates digital learning.

Bioseed

Bioseed is a Philippines-based subsidiary of an Indian company called DCM Shriram Consolidated Limited. They sell hybrid seed products such as genetic modified organisms, including varieties produced by Monsanto. They are the fourth biggest hybrid seed company in the Philippines and sell to their product through distributors and conduct demonstration trials with farmers. Their farmers are typically small-scale with roughly 0.5 ha and servicing the feed industry. Only a small number produce corn for silage. They have varieties resistant to Corn Earworm and Common Cutworm. There is a new variety from Monsanto which is resistant to Fall Army Worm.

Bioseed have a team of roughly 100 field technicians across the Philippines, who are all Agricultural Science graduates. Each farmer engages with 8 to 10 farmers per day. Bioseed run trials for their products to demonstrate yield improvements and return on investment. Prior to Covid-19 they would engage with farmer group meetings. These meetings would happen once per season and have at least 50 farmers attending.

12.2 Milking machine servicing

As noted earlier, two-thirds of SHD farms surveyed had portable milking machines. We could not find any information regarding government or businesses that supported SHDs to service these machines or provide detergents.

12.3 Inputs used and uptake of commercial services by SHDs

12.3.1 Information sought from commercial input providers.

Few SHDs sought advice from commercial input providers. Although information was provided on a range of topics within technical disciplines (Dairy cow nutrition; Feeding of concentrates and supplements; Reproduction and AI; Breeding plans and progeny testing; Improving milk yields and Herd health), less than 10% of SHDs sought advice from businesses. The exception was Feeding Concentrates were 20% of SHDs sought advice from feed mills.

Of the SHDs surveyed, all were members of cooperatives which was the primary source of their dairy related information. Three farmers were also members of farmer groups, which also provided information on credit sources and concentrates.

12.3.2 Use of inputs

Forages and supplements

Despite tropical grasses being fed on all SHD farms surveyed, only 20% of SHDs were provided with seeds of more productive varieties by government extension officers, while one received seeds from a non-government organisation (NGO). We could not find an international commercial provider of tropical grass seed such as Barenbrug, however their varieties (Mulato I and II Brachiarias) were observed in the field.

Historically, the breeding and provision of perennial tropical grass seed globally has been the role of government. Given that many swards have lifespans in excess of 20 years, there is little commercial incentive to play an active role in plant breeding, as opposed to trading in annual crops which generate sales on a yearly basis. With the emergence of plant breeding technology, such as gene editing, which offers step-wise improvements in productivity, we may see a change in this commercial landscape in tropical dairying systems. It will remain highly likely however that the GoP will remain the main provider for tropical grass germplasm for SHDs. Assisting the GoP develop relationships with a company such as Barenbrug would be advantageous.

Our SHD survey showed that 40% of farmers were using fertiliser from commercial providers. We are unclear of the type, amounts and costs of fertiliser purchased and how it was used. Of the farms using fertiliser, 83% were also using manure as fertiliser as well. There was no recording of SHDs applying lime to counteract soil acidification caused by nitrogen fertilisers. The majority of images taken of forages on SHD farms show nitrogen deficiency and variable growth within paddocks. We would recommend that soil fertility on SHD farms should be reviewed going forward.

Forage quality and quantity are key fundamental drivers of herd productivity and profitability globally. Our observations recorded in this project would agree with this statement. The highest average herd milk production per cow we recorded during our project was 22 litres per day from a private commercial farm. This compares to the average of 10.8 and 8.4 from our survey of CC and SHD farms, respectively. The use of high-quality starch containing conserved forages (e.g., maize silage) was a key factor in achieving this higher cow productivity. As we were unable to access the financial records of commercial farms in this project, we are unclear regarding the financial outcomes of pursuing this strategy, however when we look at other developed tropical and subtropical dairy industries such as United States and northern Australia, their use has grown significantly over the last 20 years, with perennial tropical grasses being a smaller proportion of milking herd diets due to their inherent lower quality.

We see in other developing countries such as Indonesia, private companies play an important role in procuring and supplying quality forages for SHDs. Nestle for example supply maize silage to SHDs in East Java. In developed countries, we see either consultants, silage contractors or inoculant suppliers (such as Lallemand) play an active role in securing forages for dairy farms. It is however fairly rare to see companies that deal exclusively in the trading of silages, given their transportation and storage constraints. This service is usually provided for strategic reasons e.g., to secure milk supply or as a value-add to core businesses e.g., selling an input. We could not find evidence of either companies or government playing an active role in supporting SHDs to integrate high quality conserved forages into their systems. Given the ready access to cropping enterprises adjacent to SHD farms, this is a major opportunity for the SHD sector to develop in the Philippines. For this to be realised however will take significant intervention.

As noted earlier, there are various opportunities to improve the productivity of non-forage feeds used in SHD systems. These include the use of low energy by-products (as opposed to grains) in pellets, the inclusion of higher quality protein sources in milking herd diets, the strategic use of additives such as mycotoxin binders and better total diet formulation,

especially from the perspective of individually formulating diets for milking cows (as opposed to feeding one diet across a herd). Building win-win relationships with commercial service providers either directly or through co-operatives offers some opportunities for the SHD sector going forward.

12.4 Competitors of resources and inputs for SHDs

12.4.1 Intensive animal industries

Intensive animal industries such as swine, poultry and beef feedlotters are competitors with the dairy sector for feedstuffs such as grain and commodities.

Chicken industry

The Philippines chicken meat industry produces close to 2 million tonnes annually (PSA). While pork had traditionally been the main meat source for Filipinos, chicken consumption per capita overtook this in 2019 (USDA, 2020c).

Domestic chicken meat production from 2012 to 2020 is shown in Figure 12.2. The sector continues to grow. In 2020, 12% of domestic chicken meat requirements were imported, indicating further domestic sector growth is still feasible. The Philippine broiler industry is composed of 20% backyard (less than 100 birds) and 80 % commercial farms.

At a feed conversion efficiency of 1.6, the national feed requirement of broilers equates to approximately 3.1 million tonnes annually or approximately 27% of national feed grain usage. Given that the Philippines is a net importer of grains for its livestock sector with only approximately 60% self-sufficiency (USDA, 2021b), the chicken meat sector would provide competition for local corn supply with the dairy industry with prices reverting to import parity minus freight and handling.

Figure 12.2. Domestic chicken meat production 2012 to 2019.

Swine industry

Meat production from 2012 to 2020 from the Philippine swine industry is shown in Figure 12.3 (PSA). The industry has been severely impacted by African Swine Flu (ASF) which was first detected in July 2019. Over three million pigs have been destroyed from the national herd. As the spread of the disease continues throughout the Philippines, the future

of the local industry is unknown. The industry is dominated (64%) by backyard producers (less than 10 sows) (Cabantac, 2018). At a feed conversion efficiency of 3.0, the feed requirements for the Philippine pork industry equates to approximately 6.6 million tonnes annually (equivalent to approximately 60% of national grain supply). Subject to the ultimate impacts of ASF, the decline in the swine industry offset by the growth in the poultry sector may see some easing of stockfeed pricing from commercial mills.

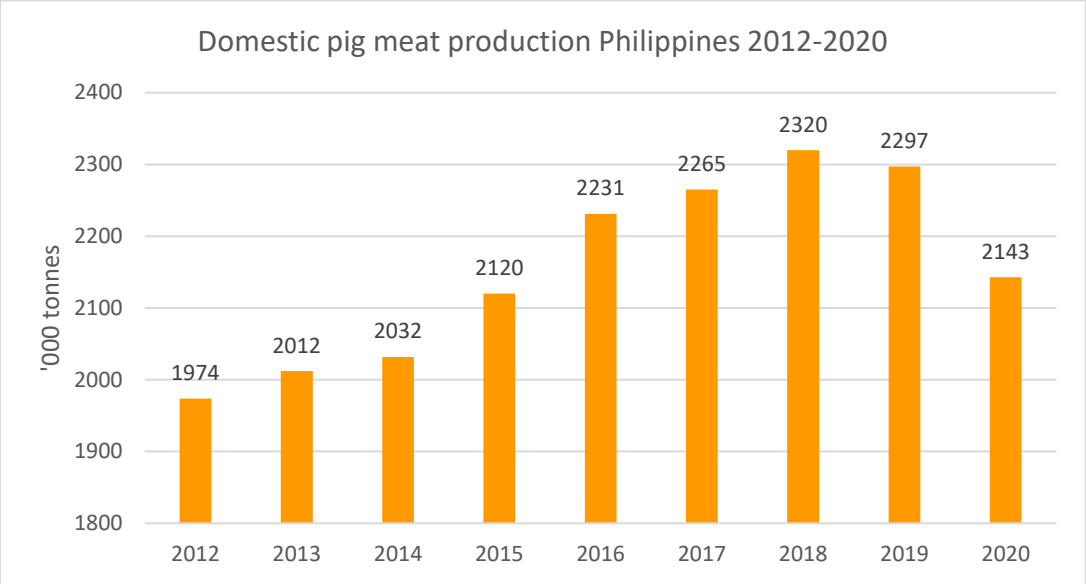


Figure 12.3. Pig meat production in the Philippines from 2012 to 2020.

Beef industry

The beef industry in the Philippines is dominated (94%) by small farms (less than 10 head) with larger commercial farms providing specialised fattening operations (PSA various references). During 2020, domestic production was estimated at 229,127 metric tonnes (MT), with imports of 89,500 MT. There were also 18,000 cattle imported during 2020.

Domestic beef production from 2012 to 2020 is shown in Figure 12.4. Production has declined over the last five years. Given the relatively small scale of commercial fattening operations, the beef feedlot industry is unlikely to provide significant competition for grain availability for the dairy industry. Grazing livestock however do provide competition for land.

Labour

As of February 2021, unemployment in the Philippines was 8.8%. This has improved significantly from 17.6% in April 2020. It was concluded that there is no shortage of labour in the Philippines. However, as is the case in many countries, careers in agriculture, and especially dairy farming, are not seen as preferred career choices, especially for younger generations.

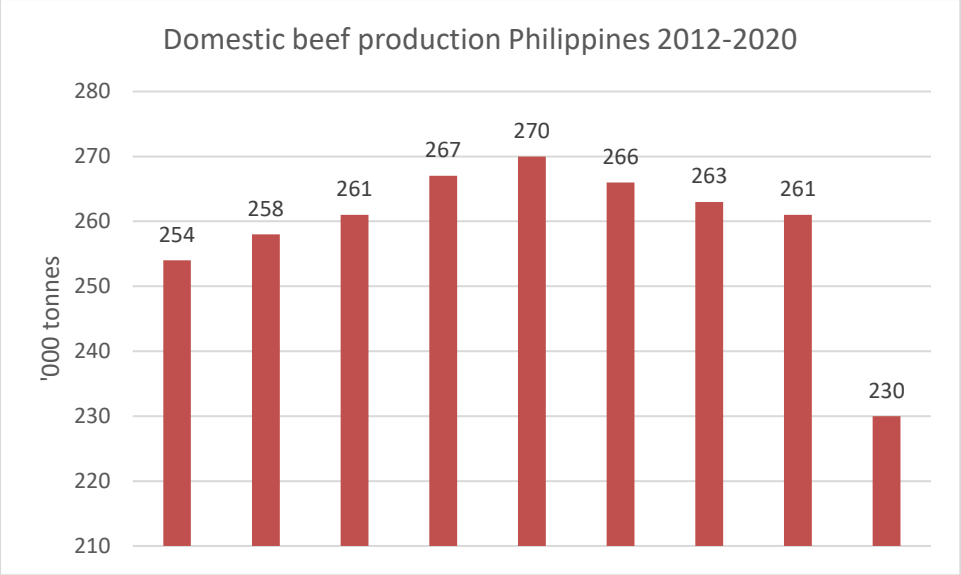


Figure 12.4 Domestic beef production in the Philippines 2012-2020.

13 Key findings from other dairy development projects

13.1 New Zealand-Philippine's dairy project

The New Zealand-Philippine's dairy project commenced in 2014 for five years, with the goal of developing a profitable, equitable and sustainable dairy sector. The project was a funding arrangement between New Zealand Ministry of Foreign Affairs and Trade, and the NDA as the main GoP partner, with the Philippine Minister for Agriculture at the time strongly advocating for dairy self-sufficiency.

The project had a focus on increasing smallholder milk production and farm productivity with four main outputs:

1. Infusion of heifers and improved nutrition and feeding practices;
2. Improved on farm production and management recording systems;
3. Dairy sector human capacity development (farmer and service provider training);
4. Enabling environment for dairy growth.

A Philippines Dairy Industry Strategy was developed after extensive consultation with dairy stakeholders, which summarises the current dairy industry situation and constraints identifying the main issues and options for addressing the issues.

A Chief Technical Advisor was appointed to design and implement the project. Activities included establishing 24 focus farms located mostly in Batangas (Region 4A province) and northern Mindanao due to the greater population of SHDs. Focus farmers were supported to improve profitability and act as a study site so other farmers could view and learn from activities. Focus farms were also expanded to Visayas and northern Luzon.

Key findings:

- Despite positive on-farm results and receiving relatively high milk prices, most of the focus farmers still struggled to break even;
- The project was well established in terms of its staffing, administration and governance, strategic direction and operations to deliver short-term outcomes;
- Longer term outcomes, including increasing local milk production, was dependent on GoP firming up their commitment and adoption of a strategy;
- Success and effectiveness of the project outputs were largely influenced by the political entity engaged;
- The project did not have established linkages with other development partner projects working in the sector and a donor coordination mechanism was not identified;
- The sustainability of the project's outputs and outcomes were dependent on a properly resourced, strategic commitment being made by the NDA, which was lacking;
- There was no internalisation of the project functions by NDA in its resource allocations and without this, it is unrealistic to expect that project activities and functions will be sustained once grant funds are no longer available.

Key recommendations from the project evaluators include:

- Institutional reform and a stronger commitment by GoP was needed if the momentum created by this project (and others) is sustained;
- Better industry leadership (which the NDA is not currently configured or resourced to provide) to maintain and develop further farm and herd management, extension and training initiatives initiated by this project;

- Build partnerships with emerging firms for potential co-investment to ensure the demand side of the dairy sector is represented and involved;
- There is a greater need to focus on business models and sustainability;
- More attention is needed on the management and monitoring of gender and emerging environmental issues;
- Consider use of digitalisation within the dairy sector with a focus on finance creating linkages between the banks and finance system. Scale and outreach can be achieved by including banks to build profitability through village loan savings, financial literacy, insurance and development finance;
- Establish partnerships with dairy cooperatives to be involved in a future project to increase industry involvement for sustainability of project impacts and deliverables;
- Improved governance arrangements of implementing government partners. In the future governance could be restructured following a more conventional model that aligned single point responsibility, authority and accountability.

13.2 RMIT led ACIAR research focused on extension in the Philippines

An ACIAR funded project in the Philippines, led by RMIT University entitled ASEM/2012/063 (ACIAR, 2020) 'Improving the Methods and Impacts of Agricultural Extension in Conflict Areas of Mindanao, Philippines' is a collaboration between the Landcare Foundation of the Philippines, University of the Philippines Los Banos and Mindanao.

The aim of the project was to develop an improved model for agricultural extension in conflict areas of Mindanao with the objectives to:

- Determine the livelihood impacts of conflict on agricultural communities and extension services in case study conflict-affected areas;
- Implement a pilot program of improved extension and livelihood innovations, making use of principles and methods largely derived from previous ACIAR projects;
- Analyse the impacts of the pilot extension and livelihood innovation program;
- Engage more broadly with relevant conflict area extension and other agencies outside of the case study areas to communicate project methodologies and findings.

The agricultural extension model that the project developed was titled the LIFE Model – Livelihood Improvement through Facilitated Extension. The LIFE model had two foci 1) the farm level and 2) the institutional level. The model recognises the important role of 'facilitation' in enabling farmers to pursue the three essential elements of the model:

- Access to technical innovations;
- Improvement in social capital; and
- Building effective partnerships with extension agencies.

A key to the success of this program was the participatory-based approaches within the community using a Landcare-based methodology that brings farmers together in groups, coordinating what they want to do. The LIFE model was implemented in three conflict areas in Mindanao, using a 15-step approach that started with the appointment of a facilitator who lives in part of the community, fostering local relationships.

Evaluation of the LIFE Model at the six pilot sites showed that the approach can produce rapid and significant livelihood improvement for farmers and their communities. The project explored how best to scale out this model by integrating it within PCAARRD programs, mentoring conflict area agencies to test and validate the model within their own institutional structures, and continue incremental scaling out from the pilot sites.

Lessons from this approach could be applied to the dairy sector, rather than using the traditional based extension approach frequently observed in government institutions.

13.3 What types of inputs have these projects provided? How sustainable were these changes when the project concluded?

Evaluators of the New Zealand dairy project were critical of its sustained impact, which is often seen with the range of international development projects after they expire. The approach of the RMIT project, is more likely to have sustained impact through its use of a community-based participatory approach, empowering farmers to identify what they want to improve in their farming enterprises and allowing them to tap into their social capital to help them achieve it.

13.4 Other International co-funded projects

- NDA - Asia Dairy involvement in a multi-stakeholder partnership aimed at building a sustainable dairy sector in Asian and the Pacific region.
- NDA - Czech Republic project in partnership with Geotest was funded under the Aid for Trade of the Czech Republic Development Cooperation entitled *Expert Assistance on In-Depth Analysis of the Supply chain of the Philippine Dairy Industry.*
- NDA – Argentina through the Argentine Fund for South-South and Triangular Cooperation (FO.AR) which included technical missions, training workshops on dairy production, feeding and recording.
- NDA – Israel through Mashav, Israel's Agency for International Development Cooperation had two seminars on tropical dairy production for NDA field personnel, dairy farmers and stakeholders.

14 Opportunities and interventions to develop small holder dairy sector inclusive value chains

The following sections summarises the opportunities to grow the Philippine SHD sector we have identified over the course of this project. Some of these are not SHD exclusive and would apply to commercial entities or communal farms. We have also identified some constraints which we consider addressing would have a low benefit/cost and as such should be of lower priority.

There is little doubt that Covid-19 has impacted the Philippine SHD dairy sector. Our recommendations are premised that many of these changes will be short term and that pre-Covid-19 trends and drivers will continue on their trajectories once the pandemic has passed.

14.1 Farm gate price – a key factor

Farm gate price is a key determinant that shapes dairy value chains globally. From the perspective of a farmer, it drives the scale and efficiency of their business. From a processor perspective, they view farm milk price as one of their manufacturing costs. Their business is only sustainable if they can manufacture a product that will provide a preferential value proposition to consumers either directly or through a third party, either domestically or internationally.

The farm gate price in the Philippines versus other countries is high (Table 14.1) and consequently limits the opportunity for the dairy farming sector to provide a competitive input for value chains focussed on globally traded commodities. The easing of tariffs under a more liberal global trade environment will mean more competition from imports for local SHD inclusive value chains. The second major limitation for establishing commodity-based value chains would be processing efficiencies. Milk plants in New Zealand have the capacity to process over 20 million litres of milk per day which is a key factor in their global competitiveness. This volume of milk almost equates to the annual production of milk in the Philippines. Although there are large dairy factories in the Philippines, these are designed to receive dehydrated (or concentrated) commodities, not fresh milk. If the Philippines SHD sector is to grow, it will be by focussing on the domestic marketplace and servicing value chains such as SSL that can't easily be replicated by imported dairy commodities. As we noted earlier, high farm gate price is leading to high profitability per cow compared to neighbouring industries and sets a good platform for domestic expansion in farm supply.

Table 14.1. Average farmgate milk price in Australasia.

Location	Price (USD)	Year	Source
Philippines	$0.63	2021	Project stakeholder interviews and SHD farm survey
Thailand	$0.59	2021	USDA 2021c
Australia Queensland	$0.47	2020	Murphy et al., 2020
Australia Victoria	$0.42	2020	Waterman 2020
New Zealand	$0.42	2021	www.fonterra.com
Indonesia	$0.33	2017	IndoDairy 2021

14.2 The School Based Feeding Program (SBFP)

The SBFP has significant influence on SHD inclusive value chains. As a market for 20 to 30% of national milk supply, it underwrites the marketing and revenue strategy for many co-operatives. It's payment system has significant influence over the retail price of fresh and flavoured milk. While both of these factors are positives for the SHD sector, it does come with some challenges:

- It doesn't utilise milk all year round, and creates challenges regarding how to balance milk sales for the remainder of the year outside of school terms;
- Despite its intent to utilise fresh milk, UHT and reconstituted milks are being sold. This provides direct competition for SHD inclusive value chains and also conditions children to drinking non-fresh milk products;
- The lack of refrigeration in some schools means that fresh milk may be less palatable during consumption and may bias children from consuming fresh milk later in life. It also poses a potential health risk.

Regardless of the constraints, the Philippine SHD sector benefits from the SBFP. Our recommendation would be that co-operatives should compare their overall annual revenue from their participation, with developing value chains with all year-round sales.

14.3 Opportunities in the domestic marketplace

The low level of dairy self-sufficiency (0.8%), increasing per capita consumption of dairy products and a growing economy are positive drivers to grow the Philippine SHD sector. In 2020, the overall marketplace was 2.3 billion litres of milk equivalents versus 24 million litres of domestic supply. So why isn't domestic growth occurring and what interventions are needed to realise this opportunity?

Food safety is paramount for any brand or product. This is especially the case when consumers have purchasing options, especially involving trusted brands. As noted, TPC contamination from the SHD sector in the Philippines is a challenge that needs to be addressed.

As noted earlier, if growth is to occur, it will be in SSL lines, not those that can be manufactured domestically from imported ingredients. This market growth opportunity is much smaller at 28 million litres of fresh drinking milk, however the Philippines also imports 97 million litres of UHT or reconstituted RTD milk, which is sold as ambient temperature dairy products through formal supply chains in supermarkets. There is a real opportunity to change the buying habits of a consumer from buying ambient temperature long shelf life drinking milk, to purchasing fresh milk on a regular basis.

While not impossible, it will be very challenging for SHDs to enter formal supermarket supply chains in SSL dairy products without significant support from a processor with a trusted brand and supermarkets willing to provide marketing support and chilled shelf space. Large retailers build their businesses on consumer safety, low margins and use their substantial bargaining power to great effect. Unless these impediments can be overcome, developing a shorter higher value supply chain such as e-Commerce with additional consumer convenience, such as customer delivery, may be a more profitable strategy for the SHD sector and their co-operatives to pursue.

As noted, fresh milk is not the only market opportunity. Soft and speciality cheeses are another opportunity and with longer shelf lives that could complement milk supply to the SBFP program. Their high retail pricing and their lack of presence in formal value chains is a potential opportunity for SHD inclusive value chains. Our research however has shown

that there are some lines, such as yoghurts, that are relatively low value and should not be pursued in the short term.

There are also other value chains emerging such as servicing the speciality coffee market. Premium coffee outlets have specific milk quality requirements. Milk needs to maintain steam frothing value, have a milkfat derived lustre and be free of taints and odours (linked to milking herd feedstuffs). Given today's processing technology, these attributes cannot be met by large companies due to the physical damage created by factory fat/skim separation and excessive pumping of milk. Reconstituted and UHT products also have inferior quality. In addition to addressing bacterial contamination, steam frothing capacity was also noted to be problematic for some SHD supply chains servicing coffee outlets. Our observations from interviews in this project indicate that there is a low tolerance by customers to any milk quality issues in coffee shops, which is driven by the higher prices paid for coffee beverages and therefore customer expectations. A comment by one coffee retailer noted that an education process was required for farmers to focus on product quality. There was also a sentiment expressed by one coffee shop regarding future environmental credentials of its supply chain. They would see a marketing opportunity for value adding to coffee sales by marketing milk from dairy farms that had high standard environmental management practices, particularly relating to their carbon footprint.

Despite the diversity of value chains reviewed, there is relatively little difference in average price paid for fresh milk ex-factory or ex-milk collection centre. We do see however that as the co-operative or company has greater exposure to urban customers, whether through direct sales or via wholesaling, there are bonuses/penalties based on milk quality. Despite the higher premiums associated with these products, we are not seeing this margin share being returned to SHDs. As is often the case globally, co-operatives will often set a competitive farm gate price (in this case often underwritten by the SBFP) with propriety companies paying a small premium to secure supply.

14.4 Logistical challenges

14.4.1 Sea transport

The Philippines is an archipelago comprising of 7,640 islands. Being an archipelago, transportation between islands in the Philippines via sea is more expensive than land transportation. Subject to further investigation, we were quoted transportation costs of ₱20 per kg from Mindanao to Luzon. This would make the transportation of bulk milk between these two locations unviable. Lower costs could be expected on ferries or barges between locations, however given the higher farm gate price already received and that milk quality issues would be exacerbated by long transits, it is unlikely inter-island transportation will be feasible. Some exemptions could be higher value finished products transported under refrigeration to islands with limited local dairy supply chains. The additional freight and logistical cost provide a stimulus for local production to develop to meet local demands. However, as we saw with NDA SBFP pricing, relative to Luzon (and its ability to service Manila) fresh milk is valued 20 and 30% less in Visayas and Mindanao, respectively.

14.4.2 Land transport to markets

The maximum distance for bulk milk transportation in the Philippines is estimated to be 300 km. This is due to a combination of tanker turn-about time (MCC to factory), quality deterioration during transit, and road conditions. For northern Luzon provinces such as Isabela and Cayagan, it is highly unlikely they would be able to service Manila directly, unless they were selling to secondary processors much closer to Manila. The conclusion from this is that for the exception of provinces closer to the NCR such as Bulacan, Batangas, Laguna and Quezon, other provinces would need to focus on their own domestic market.

14.4.3 Farm to factory

For a SHDs delivering on foot or by motorbike, it is difficult to deliver more than 20 litres per trip (or 40 litres a day for twice-a-day milking). This equates to a maximum milking herd of three to four cows. Herd sizes can be increased significantly when a SHD uses a small truck for delivery with payloads of 750 litres in milking cans (e.g., 40 litres). While this would not be an immediate opportunity to develop the Philippine SHD sector, it should be considered within the context of long-term development strategy.

14.5 Processors and co-operatives

14.5.1 Lack of contracts between SHDs and processors

It was surprising during the study the frequent incidence of informal or no contracts between SHDs (and co-operatives) and processors. This would prove challenging to manage milk quality parameters or to provide incentives to increase milk supply. It would also make it difficult for processors to secure longer term wholesale contracts as the SHD or co-operatives may choose to change processors at short notice. As noted earlier, there is also risk from the perspectives of SHDs/co-operative.

We have seen in Australia uncertainty of terms of milk supply (price and length) undermine industry confidence in SSL supply chains. This has mostly manifested in farmers not investing in their businesses, particularly in regard to spending operating capital on farm improvements.

14.5.2 Co-operative efficiency

If the total national milk supply from co-operatives is estimated at 5 million litres, and there are 66 co-operatives, this equates to an average annual milk supply per co-operative of approximately 76,000 litres or 200 litres per day. We also observed that many co-operatives (and proprietary businesses) had excess processing capacity. Given the overhead transaction costs of administering these entities, their small scale is problematic. This situation is exacerbated even further when some of the barriers regarding milk quality testing, processing efficiency, market development and managing transactions with larger third parties is considered. Amalgamating co-operatives to increase their business scale (such as KKMI) is one approach to address this issue. Another option is to shift the purpose of co-operatives to become a bargaining/milk supply group with a third larger entity e.g., a multinational processor, who could absorb these overhead costs.

The solution to overcoming market and processing limitations for the traditional co-operative VCs described earlier is to service either a secondary larger peri urban co-operative or company with access to urban markets. It is unlikely that this would result in a higher farm gate price for co-operative SHDs, however it would allow SHDs to grow their milk production. The ultimate solution for traditional co-operatives is to upgrade their milk quality, and distribution network, to supply these markets directly and return higher returns to their members through higher farm gate pricing or share dividends. To achieve this however would take significant training and support.

14.6 Milk supply limitations from SHDs

14.6.1 Quality

We had various reports that TPC of SHD farms was limiting their inclusion in supply chains focussing on SSL products. This is a major constraint and requires multifaceted interventions.

There are various underlying reasons for high TPC levels in raw milk from SHD farms. These include farmer attitude, a poor focus on hygiene due to poor market signals, contaminated water supply, mastitis, poor cleaning techniques, use of plastic buckets and lack of cold chain cooling, starting on-farm.

Our SHD survey showed that of the 87% of SHDs who consumed milk from their farms, 70% of SHDs boiled their milk before consuming, indicating their awareness of the food safety risk their raw milk poses. 87% of all SHDs surveyed had received information regarding milk quality.

There was also some evidence that part of the challenge is a lack of ambition or willingness to change farm practices. In one example, a quality bonus (20%) for low TPC was offered however no change in TPC levels was noted from SHDs. In a second instance, a processor (Daily Dairy Inc) bought SHDs stainless steel milk cans. These were sold by SHDs who then reverted back to using plastic containers for both milking and transportation to factory. In contrast, 73% of SHD farms surveyed used stainless steel buckets and cans. A general comment made during a number of interviews (including reference to agriculture generally) was that Philippine farmers do not focus on product differentiation or the potential to value-add to meet consumer expectations and are content with current farm gate price.

Provided SHD attitudinal constraints could be overcome, we would recommend a number of interventions could be researched for SHD farms to address high milk TPC concentrations:

- Evaluate a number of strategies that would require minimal practice change by SHDs but could significantly reduce TPC. This would include suitable hot water systems, the use of designed cleaning agents and portable milk machine cleaning;
- Evaluate the benefit/cost of more expensive (money or time) interventions. These would include: concreting milking areas; improving overall hygiene; stopping cows from lying in contaminated areas; improved udder washing techniques (such as avoiding the use of cold-water washed cleaning cloths, and/or sharing cloths or brushes between cows); and correctly using teat dippers.
- 2/3 of farms had on-farm milk cooling infrastructure in place but only 20% cooled milk. It was noted from our interviews that SHDs were not prepared to pay for electricity to run this equipment. Further investigation showed that electricity prices in the Philippines are comparable to other countries in Australasia and are not a direct cause of this behaviour. We hypothesis that the lack of a business case for SHDs to lower TPC levels is a driver of this attitude.
- The culmination of undertaking the above evaluations would be having a good understanding of the cost imposition to SHDs of changing their practices to improve their TPC levels. Milk quality premiums could then be designed to cover these costs.

The second major area of focus would be to improve the frequency and reporting back to SHDs of their TPC results. Measuring for TPC even in advanced dairy supply chains can be problematic. The Association of Official Analytical Collaboration (AOAC) international method is time consuming and labour intensive. More automated methodologies have high capital costs and require significant throughput to keep costs at a minimum per sample (approximately ₱260 to ₱300, $7 to $8 AUD). Given this cost, farms in Australia have their bulk milk sample measured once a week, however pooled farm samples e.g., in tankers are measured every load. Should a tanker fail a TPC test, retained samples of all farms are then tested to identify the source.

The NDA price for TPC analysis ₱285.60 is typical, however the large sample size (500 mLs) and turnaround time (2 plus days) should be addressed. Comments were made however during interviews that NDA only monitor co-operatives once a month which is

inadequate for ongoing quality assurance. Developing an indirect rapid, low-cost indicator of TPC levels would not only be of benefit to Philippine SHD inclusive value chains, but SHD industries globally. In the short-term, developing sampling methodologies that allow for monitoring of pooled samples followed by further analysis of retained samples should be a priority.

Another option to overcome higher TPC concentration in raw milk can be additional processing. UHT and sterilisation (canning) have been adopted by some larger processors in developing countries. It was noted in an interview with Nestle that they did not consider the quality of milk from SHDs to be problematic. A limitation in implementing UHT and sterilisation is minimum batch size needed to make this processing economically feasible. A minimum batch of 20,000 litres for UHT processing was noted in one interview. This quantum of milk supply would be beyond the majority of co-operatives in the Philippines.

14.6.2 Milk supply – intakes and seasonality

Based on NDA data, each Philippine SHD dairy farm produced 3,500 L of milk per year or 10 L per day. Annual farm milk production from our SHD survey was higher (~8,000 L p.a.). Covid-19 has had a major impact on SHD inclusive dairy supply chains in the Philippines. We have had reports of some co-operatives and processors losing up to 50% of sales. The postponement of the SBFP during 2020 was also problematic. In some cases, supply was reduced by farms drying off cows and processing plants reducing throughput. Some co-operatives started customer direct marketing, given the increased consumption of food at home.

There are two main aspects of SHD milk supply volume per farm limiting their inclusion in SSL chains; low overall milk intake and the seasonality of milk supply.

Total low milk intake offers challenges on various fronts:

- Scale of farm operation is correlated to total enterprise profitability. Smaller farms generate less profit and hence have less cash to invest in operational improvements;
- Low farm daily volumes makes milk collection by trucks unfeasible. In many developing countries, co-ops and processors establish regional MCCs. There were limited MCCs in the Philippines. Comments were noted that in some instances, SHDs complained about having to transport milk to processing factories;
- Increased administration costs for processors. Having 10 farms supplying 50,000 litres per year has significantly lower overhead administration costs rather than 100 farms supplying 5,000 litres per year.
- Securing wholesale contracts. Within supply chains, a processor will provide a commitment regarding the size of consignments, often driven by customer requirements. Small volumes from SHDs limits the ability of processors to confirm these sales.

Seasonality of milk supply from SHDs also creates constraints. We noted from our survey that both the dry and wet season affects farm supply and limits the availability of SHDs to service SSL dairy products which are often consumed all year round. The availability of maize silage and concentrates in the Philippines would offer some scope for a flatter annual milk supply profile, albeit with greater feed costs per litre.

14.6.3 Farm profitability and productivity

On a per litre and per cow basis, our surveyed SHD farms are more profitable than Indonesian and northern Australia dairy farms. The small herd size however means that farmers are paid below the minimum wage when their own time and farm profits are combined.

Of the 15 SHDs surveyed, the majority had visions of growing their farms to an average of 14 cows e.g., seven milking cows. No-one indicated they wanted to exit the industry. If these aspirations are replicated across the Philippines and viewed in combination with high profit per cow, then it is an excellent place to commence growing the industry. Growing a SHD from 2.7 to 7 milking cows in conjunction with improved cow milk yield and reproductive performance can triple the milk production from a farm and lead to significant improvements in profitability. In conjunction with improved milk quality, it can open new markets. It also has significant benefits in being able to access capital and reduce transaction costs post farm gate such as transportation and milk processing efficiency. It also generates cash flow to fund investment on-farm.

To realise this opportunity requires identifying SHDs who would like to change, improving their commercial focus from supply and quality perspectives, and upskilling their farm practices. The high proportion of non-milking stock and their subsequent trading by SHDs has ramifications for increasing milking herd numbers. Convincing farmers to reduce non-milking stock may be a challenge. Understanding why some farmers have chosen to practice OAD milking and convincing them to move away from this practice is also an opportunity to increase milk yield.

Land ownership due to government policy is a constraint, but the proximity of cropping land is an advantage. Farm development must be able to withstand the impact of climate change, with increasing temperatures, changing rainfall patterns, more droughts and typhoons.

Farming system and infrastructure.

The high level of milk production per cow (22 litres per day) on the Hacienda Macalauan Inc. farm demonstrates what is feasible under local operating conditions. The feeding of maize silage, improved genetics, better quality concentrates, good reproductive performance with good herd shed infrastructure are the fundamental productivity drivers of developed dairy systems in the tropics. While these farm practices are generally associated with larger herds, there are few reasons why they can't be replicated with herds of 5 to 10 cows, albeit at a smaller scale in terms of infrastructure. Having a *Bos taurus* dominant SHD herd fed a mixed silage-based diet during the day under shade (and possibly fans), then grazing low-cost tropical pastures at night would lead to significant increases in productivity and profitability.

Labour

Table 14.2 shows the average monthly minimum wages in Australasia. The Philippines has significantly lower wages than Australia and New Zealand, but higher rates than other Asian countries. As we noted in our SHD survey, owner operated labour costs on a per litre basis were quite high which was primarily driven by low herd sizes and milk yield per cow. It would be an expectation of SHDs in the Philippines they would at least derive a minimum wage ($3,816 USD per annum). Our SHD survey showed an average annual imputed owner labour cost of ₱81,243 ($1,624 USD) plus an annual enterprise EBIT of ₱92,377 ($1,848 USD); a total annual remuneration of $3,472 USD. Increasing the size of the farm from 2.7 milking cows to 10 would see total annual renumeration (based on annual surveyed EBIT per cow of $729 USD) increase to over $7,000 USD per annum.

Table 14.2. Minimum monthly wages (USD) in Australasia.

Country	Minimum monthly wage (USD)
Australia	2513
New Zealand	2355
Philippines	318
Malaysia	285
Thailand	274
Indonesia	184
Vietnam	133
India	62

Source: Euromonitor, Australian and NZ government sites

Lowering the environmental impact of SHDs:

The emerging global compliance to reduce GHG emissions in dairy systems is rapidly gaining momentum. We see today many multinational processors setting a zero-emission target by 2050. As we noted earlier, the carbon footprint of Philippine SHDs is high by global standards, but typical of small holders in the tropics. There are short term opportunities to reduce this footprint by focussing on improving herd productivity and consequently reduce carbon emissions from non-productive livestock.

Herd genetics, replacements and reproduction

The provision of *Bos taurus* genetics through AI by NDA and other GoP providers is an opportunity to overcome the low dairy productivity inherent to *Bos indicus* genotypes. This strategy could be increased by the importation of more live heifers. Improved genetic merit in herds will only be realised however by improved management practices, especially herd nutrition of replacements and milking cows, and herd health. Given the divergence in herd genotypes noted in this project, individually managing the herd nutrition of individual cows in SHD systems, whether through the preferential feeding of forages based on quality, varying rates of supplementation, and managing the ratio of grazing versus feeding mixed diets, are all opportunities. Similarly, focusing on better calf and heifer nutrition to grow larger more productive heifers at calving (e.g., 480 kg) would be beneficial. Upskilling SHDs and service providers in herd nutrition, associated feed management, and herd health skills will be needed.

Our benchmarking data suggests that further analysis into herd reproduction practices need to be examined. Identifying and overcoming anoestrus and silent heats through better herd nutrition and management, or the use of emerging technology such as low-cost rumen bolus sensors linked to smart phones, all warrant further investigation.

Herd nutrition

Forages

When the profit drivers of dairy farms internationally are compared, there are some common aspects which emerge. Forage quality, its proportion in milking herd diets versus non forage feeds, and cow milk yield are three major profit drivers. For any dairy farm in the world, maximising milk revenue minus feed costs on a per cow basis is a key performance indicator.

Home grown forages are generally the cheapest feedstuff available to a dairy farmer, as is the case with Philippines SHDs with tropical grasses. Maximising its utilisation on a farm is very important, however its ultimate inclusion in a lactating cow's diet will depend on milk price and the relative cost of other feeds that generally have the ability to produce more milk.

Research and farm practices in Australia have shown that cows grazing high quality tropical pastures and fed 6 kg of grain-based concentrate per day can produce 20 to 22 litres of milk per day. The management practices of these pastures however have been refined with research over the last 30 years with stage of grazing, forage species (including legumes), fertiliser and soil management, managing herd heat stress and supplements all very important. Understanding what economic benefit improving these practices with Philippine SHDs through on-farm research is important. Similarly understanding the tactical role maize silage (or other types) can have to improve cow productivity and also help SHDs to manage pastures better (e.g., not grazing pastures when too dry or too wet) is also warranted.

Better quality concentrates

Substituting maize grain for low quality by-products in milking herds concentrates is an opportunity to increase the milk yield of moderate to high genotype cows. The Philippines produced approximately 8 million tonnes of maize grain during 2019 (USDA, 2021a). It is estimated that around 1 million family farms produce maize grain. Despite this level of production, the large monogastric animal industries means the Philippines still imports approximately 600,000 tonnes of maize grain per year. Average price per kg of maize grain ex-farm in the Philippines was ₱13.8 ($0.28 USD). This is comparable to pricing in other Asian countries for the same period (e.g., China $0.275 USD).

In terms of nutritional quality, maize is a premium grain for dairy cattle. Its high energy content and slower rate of digestibility leads to improved feed conversion efficiency and components when fed with tropical forages (Granzin, 2004). At a target milk production of 20 litres per cow per day, feeding maize at moderate intakes (4 to 5 kg per day) would result in a feed conversion efficiency of 1.5 litres per kg fed, resulting in a milk income over feed costs of $0.68 USD per kg. Financial benchmarks typically target no more than 50% of milk revenue should be allocated to feed expenses in tropical and subtropical dairy systems. This benchmark for maize in the example above would equate to 27%, making it a competitive ingredient in milking herd diets.

Molasses

There are approximately 400,000 ha of sugarcane grown in the Philippines. The majority of production is located in Visayas, however production also occurs in Mindanao and Luzon (USDA, 2020d). While sugarcane forage is a poor-quality feedstuff for dairy cattle, molasses (a by-product of processing), is an important ingredient in milking herd diets based on tropical forages, due to its high content of sugars. It appears from our research that feeding molasses to milking herds is uncommon in the Philippines and offers scope for improved herd productivity, given its competitive price.

Balancing diets and water management

Overall dry matter intake of milking herds was low, with low quality and overstocking with dry stock being two causes. The lack of high-quality protein supplementation would also be contributing to this issue and needs to be addressed.

As noted earlier, adjusting macro and micromineral additives, as well as those designed for herd health such as mycotoxin binders, are all options to improve herd performance and profitability.

It would also be of value to better understand the limitations caused by water quality (through testing) and restricted water access is having on herds.

14.6.4 Farm input and service providers

At the time of writing this report, there is little global commercial activity regarding breeding tropical grasses although there is considerable activity in not-for-profit organisations. There

are prospective projects underway to use gene editing to reduce lignin concentrations, but these are seven to 10 years off commercialisation.

Given the earlier recommendations regarding opportunities to improve the quality of milking herd concentrates, undertaking research on-farm evaluating the benefit/cost of grain-based and high protein concentrates in conjunction with a feed mill would be warranted.

The lack of providers servicing portable milking machines and supplying correct cleaning agents needs to be addressed. It is highly likely this initially requires government or NFP intervention to support business development. Whether or not such a service business model will be sustainable without government support will be ultimately determined by a change in practice by SHDs, instigated by an improved attitude towards milk quality.

14.6.5 The enabling and policy environment

Labelling laws regarding the use of "fresh milk"

In Australia, state government laws stipulate the definition of fresh milk. We were unable to find reciprocal laws in the Philippines. The marketing of ambient UHT treated milk or reconstituted milk as "fresh" milk in the Philippines competes directly with local processors of pasteurised milk and needs government intervention.

Marketing support for SSL products for smaller processors

The marketing and branding of ambient UHT and reconstituted dairy products in formal supply chains given the power of large corporations is a huge battle for Philippine-owned processors and co-operatives. Having tactical information regarding customer needs and developing marketing opportunities is beyond the expertise and resources of many.

There would be benefit in the GoP or a NFP facilitating the development of a national pasteurised milk brand which could be used by co-operatives or contract packed under licence. We have seen in Australia regional NFP dairy advocacy groups establish their own brand in formal supply chains and use their profits to fund regional R&D. This model could be considered for the Philippines.

Introducing and imbedding contemporary approaches to Development and Extension

International dairy RD&E organisations such as Dairy Australia, Dairy NZ and Teagasc (Ireland) continually review and improve their development and extension methodology to improve return on investment. Many of these methodologies are similar and are proven to be effective under the varying operating conditions across these countries despite the different farming systems, terms of trade and farmer demographics. We would recommend that wherever possible the GoP looks at adopting some of these methodologies into their operating plans.

15 Mapping and characterising key stakeholders

Table 15.1 provides an overview of some organisations interviewed during this project that could potentially be major collaborators in a multiyear project. Further information is also provided in Table A17.1 (p180).

From a government perspective, developing the Philippine dairy industry falls within the remits of both DOST PCAARRD and NDA. DOST PCAARRD's mandate to undertake research in collaboration with university partners would be important in researching key knowledge gaps we have identified during this project. Given NDA's remit towards industry development and extension, they would play a key role in practice change, both on-farm and with processors, particularly co-operatives.

From a business perspective, Nestle and Batangas Dairy and Multi-Purpose Cooperative (BADACO) each have strategies and operational models that would be well suited to collaboration. Globally, Nestle has invested in farm supply support programs across a range of commodities including dairy in Indonesia and Pakistan, and coffee in the Philippines. Their investments in feed supply and cold chain infrastructure have been substantial and transformational. BADACO offers scope through its approach to innovation within their centrally owned farm, but also through their network of SHD suppliers in Luzon. This would be highly valuable in addressing some of the productivity and quality impediments limiting the participation of SHDs in SSL value chains.

Table 15.1. An overview of key organisations in the Philippines dairy industry and their possible involvement in a large project.

Key: Green – higher suitability for collaboration and yellow – possible collaborator/not major partner

Organisation	**Department of Science and Technology (DOST) - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)**	**National Dairy Authority**	**Nestle**
Interest and capacity to participate in a future multi-year project	**Yes, but may need to be linked through a regional university as well where PCCAARD is investing in capacity building.**	**Yes, subject to further review**	**Yes. Interested in having SHD supply but would need further investigation.**
Mission and strategic imperatives	*Mission*: Provide strategic leadership in promoting science and technology (S&T) as a platform for Agriculture, Aquatic, and Natural Resources (AANR) products innovation and environment resiliency. *Mandates*: Formulate policies, plans, programs, projects, and strategies for S&T development in the AANR sector; Program and allocate government and external funds generated for R&D efforts in AANR; Monitor R&D projects; and generate external funds for its R&D activities.	To provide leadership to the Philippine dairy industry in partnership with the private sector through the provision of well-crafted policy, science-based technical expertise, sound business support and effective management of dairy programs.	Unlocking the power of food can make the greatest difference to the lives of people and pets, protect and enhance the environment, and generate significant value for our shareholders and stakeholders alike.
Key areas of focus and projects	The Livestock Research Division (LRD) formulates S&T sectoral plan, as well as coordinates, evaluates and monitors R&D programs and projects, relating to livestock and poultry sector.	Herd improvement, market and processing development, school milk program, supply chain safety and quality assurance, limited research and development	Has over 2000 brands globally.
Regions serviced	All regions	All regions	All the Philippines
Major centres (R&D, farmer training, universities, vocational education)	Works through DOST offices located in 13 regions, NCR and CAR.	Has offices in all regions. Some of these appear to be embedded in DA facilities and universities.	NA. Has four manufacturing centres in the Philippines. Factory in Pulilan, Bulacan produces chilled dairy products e.g., yogurts, probiotics
Impact/outcomes delivered	Poverty Reduction and Empowerment of the Poor and Vulnerable, Rapid, Inclusive and Sustained Economic Growth, Integrity of the Environment and Climate Change Mitigation and Adaption.	Increase in national milk production and dairy regions, consultation and development of food safety programs, live animal distribution of approximately 100 head per year, delivery of extension training events (81 events delivered to 2418 farmers and service providers in 2018), delivery of large dairy promotion events (8 in 2018), partners in international dairy development programs.	Has strong brand presence in Philippines in ambient temperature products
Other background information	Has clean energy project for dairy and institutional capacity building programs linked to universities focussed on dairy	Although national programs are funded, delivery appears very regionally focussed.	Leading food and beverage processing company in the Philippines. Interested in developing SSL products, but this would not be consistent with Nestle's international operating model. Has trialled pasteurised milk sales in Pakistan. Employ extension staff to work with coffee growers. Mixed feedback regarding responsible sourcing of coffee locally.

References: NDA website, NDA Annual Report 2018, DOST PCCAARDD website, https://ias.cafs.uplb.edu.ph.

Table 15.1 continued.

Organisation	**Batangas Dairy Multi-Purpose Co-operative (BADACO)**	**Bureau of Animal Industry (BAI)**	**Institute of Animal Science (IAS – including the Dairy Training Research Institute), College of Agriculture and Food Science (CAFS), University of the Philippines Los Banos,**
Interest and capacity to participate in a future multi-year project	**Could be a key partner. Offers a model where SHDs are owners of stock within a large enterprise with processing and marketing support. Also has supply from external SHDs**	**Would not be a main project partner but would offer complimentary government services provision to NDA.**	**Not as a major partner. May offer scope for training.**
Mission and strategic imperatives	*Mission:* To tap agri-industrial human, scientific and technological resources thru ethical dairy enterprises as an engine of growth fired by Filipino sufficient positive values, faith, social responsibility and hope. *Vision*: A model dairy cooperative entity in the country, prime mover of viable local dairy industry, operated by motivated, self-sufficient, self-reliant Filipinos sharing cooperative resources and services, reaching out environs, employment, livelihood opportunity and nutrition. Goal: To become a model, premier, sustainable, dairy and development cooperative, setting the tone of the industry standards. To develop viable local dairy industry.	*Vision*: A premier agency for a vibrant and competitive animal industry towards food security by 2020 *Mission*: To make the animal industry productive and profitable under sustainable environment through sound policies, programs, research and services on animal production, post-harvest, health and welfare.	*Vision*: A world class academic institution of higher learning in animal science contributing to national development *Mission:* To produce highly competent graduates with deep sense of nationalism; advance knowledge and effective technology adoption among end-users; and advocate policies that will promote animal food security and safety based on sound social and ecological principles.
Key areas of focus and projects	Not applicable	Animal Feeds Standard, Animal Health, Laboratory Services, Livestock Development, Marketing Development and Research Development Division. Animal Welfare Division.	Undergraduate and postgraduate education. IAS has five technical divisions: Animal Breeding Division, Animal Physiology Division, Animal Nutrition Division, Animal Production Division, and Animal Products Science and Technology Division.
Regions serviced	Predominantly services retailers, with limited direct marketing	All regions. Services such as Provincial Veterinarians are embedded in provincial governments	NA
Major centres (R&D, farmer training, universities, vocational education)	Two farms in Batangas	Due to the animal health services of BAI, it has a significant number of offices and services	Main office, three farms, various teaching laboratories
Impact/outcomes delivered	Successful integrated supply chain with SHD ownership.	Has a key regulation and animal health role.	Bachelor of Agricultural Science, majoring in Animal Science. Masters and PhD programs in Animal Science. Has subjects in dairy processing and dairy production technology
Other background information	A communal model with a good governance framework. Subject to further investigation, would possibly attract further investment. Offers scope to replicate model throughout the Philippines.	As affiliations with NDA. Interviews suggested that BAI has a greater focus on animal health services for small holders	Offers short courses. Details unclear

References: Dept websites, Confederation website.

Table 15.1 continued.

Organisation	**Department of Agriculture (DA)**	**Dairy Confederation of the Philippines**	**DVF Dairy Farm Inc**
Interest and capacity to participate in a future multi-year project	**Would not be main project partner but would offer complimentary government services provision to NDA.**	**Would be important to engage from a project advocacy perspective. Has limited resources to deliver.**	**Would need to approach again with proposal. Maybe challenging to focus on dairy cattle.**
Mission and strategic imperatives	The DA is the government agency responsible for the promotion of agricultural development by providing the policy framework, public investments, and support services needed for domestic and export-oriented business enterprises. The DA envisions a food-secure Philippines with prosperous farmers and fishers. It shall collectively empower them and the private sector to increase agricultural productivity and profitability, considering sustainable, competitive, and resilient technologies and practices.	*Vision*: The DairyCon foresees the day that dairying shall be the top industry and agriculture the key partner in nation-building. *Mission*: Encourage people to go dairying to create wealth, livelihood and share the benefits of economic development nationwide. Utilize the God-given natural resources of the Philippines and conserve the country's foreign exchange. Create a permanent sector for dairy with globally competitive professional farmers and farm workers.	Product diversification, direct sales, servicing hospitality sector
Key areas of focus and projects	Agribusiness and Marketing Assistance Service, Agricultural Credit and Financing Programs, Bureau of Soils and Water Management (BSWM), Agriculture Training Institute.	Herd Build-Up and Genetic Improvement; Pasture Development and Nutrition; Milk Quality Standards and Collection System; Product Development and Processing Generic Marketing; Strengthen the Dairy Cooperative Structure Career Development and Professionalism	Product quality, community engagement, fresh ingredients
Regions serviced	All regions	All regions	Predominantly Luzon
Major centres (R&D, farmer training, universities, vocational education)	The DA has multiple agencies across regions. These are then dispersed further into provinces and barangays. A brief review indicates there is customised service offerings based on regional needs.	No significant infrastructure	Talavera, Nueva Ecija, and Manila
Impact/outcomes delivered	Broad service offering across various aspects of supply chain. NDA would appear however to be the lead agency for regional engagement for the dairy industry.	Provides a facilitation role	Has strong focus on jobs and engaging communities in supply chain
Other background information	PCCARRD and NDA are attached organisations and corporations	As the apex organization of all dairy cooperatives, associations and processors in the Philippines, it serves as an avenue for dairy farmers in the discussion of common interests affecting the dairy sector in particular, and the dairy industry in general. .	Online trading is important. Sees opportunity to have mixed coconut/dairy systems. Also outsources growing of replacements to SHDs. Strong focus on carabao. Also selling processed manure.

16 Develop a detailed plan of activities for a large, multi-year ACIAR dairy project.

16.1 An overview of opportunities, interventions, projects and partnerships to sustainably grow the smallholder dairy sector of the Philippines.

1. Sustainable farming systems			
Priority	**Recommended interventions**	**Potential pilot projects**	**Value propositions and prospective partnerships**
1.1 Moving from a subsistence small holder dairy (SHD) to a full-time resilient dairy business Growing a SHD from 3 to 10 cows in conjunction with improved cow productivity can triple the milk production from a farm and lead to significant improvements in profitability. In conjunction with improved milk quality, it can open new markets with the opportunity to be more competitive with imported dairy commodities. Increased profit and production can increase access capital and reduce transaction costs post farm gate such as transportation and milk processing efficiency. It also generates cash flow to fund investment in on-farm water treatment and milk cooling technology to improve milk quality and herd health. To realise this opportunity requires identifying SHDs who would like to change to improve their commercial focus from supply and quality perspectives and upskilling in farm practices. Having more secure longer-term milk supply contracts installs confidence in farmers and agribusiness to invest. Alternatively, access to land, either due to market forces or government policy is a constraint. Farm development must be able to withstand the impact of climate change, with increasing	Identify the drivers of change for SHDs who are prepared to grow their business and assist them to identify key management areas to improve profitability.	***Segmentation and benchmarking***. This project would initially undertake a baseline study focussed on farmer attitude, intent and key farm profit indicators. Business orientated discussion groups and 1:1 client focused services would be piloted.	1. This intervention would be attractive to local multi-stream input providers looking to establish long term partnerships with SHDs who are intent on growing their business. It would also be attractive for milk co-ops and processors seeking additional milk supply. Government entities would provide support regarding technical advice and discussion group activities. Potential partners include: Aljay Industrial; BADACO; PAKAMA, SAMABACO; Nestle; DVF Farms; NDA; PCAARRD; University of the Philippines.
	Introduce farm milk supply incentives that will provide commercial benefits for supply chain partners.	Following on from the quality incentive study in AGB/2012/099***, two new incentives would be piloted:*** a bonus related to the term of a milk supply agreement (e.g., three-year agreement) and a bonus that rewards incremental growth in milk supply (Farm growth incentive).	2. Milk processors and cooperatives seeking new milk supply and looking to establish milk supply security to underpin market development. Potential partners include Nestle and DVF Farms.
	Upskilling SHDs and service providers to make or assist in step wise improvements on-farm in forage production, quality and utilisation, herd nutrition and health, reproduction and milk harvesting hygiene.	• In conjunction with agribusiness, pilot demonstration sites on SHD farms ***examining forage varieties*** (especially starch containing) and ***contemporary fertiliser management***. The target of these sites would be to at least double digestible nutrient yield per ha.	3. There would be multiple partnerships under this initiative under the following categories: • Input providers within disciplines looking to demonstrate a benefit/cost of their product under local conditions. This would include seed companies (Pioneer);

temperatures, changing rainfall patterns, more droughts and cyclones.		• Pilot impact of ***forage cutting height*** on milk yield through farm demonstrations; • Evaluate alternative approaches to maximise milk income over feed costs through the development and evaluation of ***basic feed balancing apps*** (links to AGB LPS/2013/021 - *Profitable feeding strategies for smallholder cattle in Indonesia*) and ***remote diet formulation*** through the provision of farm captured information and images; • Upskill SHD and service providers ***nutrition*** management linked to ***herd reproductive*** performance; • Test the feasibility of ***replacing fresh milk*** fed to calves with ***powdered calf formula***; • Develop demonstration farms focussed on ***herd water supply and quality*** to increase milk production per cow.	• Animal health and nutrition (Elanco, Alltech, Rumen Nutrition and Solutions, Agricheckers); international companies with an intent to open new markets (Rabar, Maxum Foods) • Milk processors and government delivering practice change methodologies not linked specifically to a farm input (Nestle, NDA, PCAARRD).
	Work with agribusiness and co-operatives to provide more productive cost-effective milking herd concentrates and commodities.	• Imbed a culture of ***concentrate formulation*** based on ***cost-effective nutrients*** as opposed to low-cost underperforming nutrients. • Undertake environmental scans to identify cost ***effective protein and energy commodities*** that could be supplied directly to SHDs for integration into herd rations.	4. Proprietary feed mills with a focus on R&D (Agricheckers, Cargill) would be a starting point. In time co-operatives who manufacture stockfeed would be engaged once productivity benefits on farm are demonstrated (through Priority 1.1). Commodity traders serving other intensive animal industries would be engaged as potential suppliers to co-operatives or processors to facilitate farm supply.
	Model the impact of adverse seasons and climate events and pilot the introduction of farm practices to mitigate risk.	Provide farmers and their service providers with evidence-based knowledge, skills and confidence to ***reduce the risk and exposure to climate variability and extreme weather events*** utilising sustainable farming systems and practices. The development of a planning resource to estimate the sensitivity of employing a	5. Government would be engaged to undertake this analysis (PCAARRD and NDA), help develop a planning tool and pilot extension methodology. Milk processors looking to minimise year to year risk would be key contributors to the on-farm implementation of this initiative.

		range of strategies will be a crucial component of building this capacity.	
1.2 The seasonality of milk supply from SHD farms limits access to some markets: Low rainfall during the dry season and a lack of supplementary irrigation leads to low forage availability at this time of the year. This limits access to formal SSL markets with all-year dairy consumption e.g., drinking milk markets, coffee retail outlets.	Integrate conserved forage into SHD feedplans. This has the opportunity to provide a multi-year feed reserve in the event of drought or excessively wet conditions. Integrating silage into tropical dairy systems poses a risk in terms of mycotoxin poisoning which can impact cow productivity and pose a human health risk with mycotoxins being transferred to milk. As a risk measure, the efficacy of a mycotoxin binder in supplements would also be evaluated.	In conjunction with forage trials, a number of models would be researched: • ***Contract growing*** of maize or sorghum silage crops based on yield and quality incentives; • Small batch ***high moisture forage conservation*** of perennial grasses e.g., Napier utilising specialised high sugar fibrolytic inoculants and supplementing herds with mycotoxin binders. This project would also maintain linkages to the high forage subtropical and tropical systems project (C4 Milk) being funded by the Queensland Government and Dairy Australia.	6. Contract forage growers looking to produce a higher value silage would be potential partners. Co-operatives and milk processors in both countries would play a key role facilitating supply. Silage inoculant manufacturers and mycotoxin binders with a focus on R&D e.g., Lallemand and Alltech would be approached.
1.3 Improve milk quality and herd productivity to improve farm gate milk price and market access. Pathogen contamination of raw milk restricts access to local SSL markets. This is due to: • Poorly defined and understood bacterial contamination standards; • A lack of enforcement of standards during seasons of low milk supply; • Lack of access to pathogen testing; • Lack of feedback to individual producers in conjunction with financial incentives to improve quality; • Lack of cooling infrastructure on farm and within supply chains.	Reduce pathogen contamination by use of contemporary hygiene practices scaled for SHDs and evaluate on-farm milk cooling technology designed for SHDs.	• The project would engage with processors and co-operatives ***to scale out its milk quality incentive and pathogen testing pilot*** delivered in AGB/2012/099 (IndoDairy). • Pilot the effect of ***heating water*** (initially with gas, then either solar or biogas) used in milking procedures to destroy pathogens and reduce the incidence of mastitis.	7. Milk processors and co-operatives looking to overcome quality issues to access new markets are potential partners (Nestle).
1.4 Lowering the environmental impact of SHDs: • There is emerging global compliance to reduce green-house gas (GHG) emissions in dairy systems with many multinational processors setting a zero-emission target by 2050.	• There are a number of interventions to reduce GHG per litre from tropical SHD systems. These are: o Improve cow productivity; o Feeding science-based methane reducing additives such as iso-3-propanol;	• A demonstration pilot would be delivered utilising portable ***methane*** meters to evaluate ***herd nutritional interventions*** under SHD conditions. • A self-contained ***micro solar system*** would be evaluated as an energy	8. Manufacturers of known methane inhibiting nutrition supplements (e.g., Alltech, Elanco) would be approached to co-deliver on farm experimentation. An alternative pathway may be for the project to engage with an additives manufacturer

• Dairy systems in subtropical and tropical countries produce a third of the world's milk supply but emit over half of the global dairy GHG emissions. • SHDs lack the scale to trade in carbon offsets in current markets.	○ Installation of self-contained solar units as a source of electricity for farm use and milk cooling; ○ Integrate effluent into soils as a carbon sink, as well as a source of potassium and other nutrients. • Pooling carbon offsets from SHDs to deliver a tradable unit with private carbon traders.	source for heating water and cooling milk on farm. • A demonstration pilot would be evaluated using contemporary soil management practices to ***balance nutrients provided by composted solid effluent.*** The contribution of carbon from effluent into soil structures will also be accounted for.	or wholesaler looking to establish sales in this market. Local fertiliser companies looking to develop a specific blend suited to complement the nutrients available from effluent would be potential partners.

2. Processing to Retail			
Opportunity/constraint	**Recommended intervention**	**Proposed project**	**Value propositions and prospective partnerships**
2.1 Partnering processors with co-operatives and/or SHDs to realise urban market opportunities: • Many SHDs and co-operatives have poor relationships with processors or customers. This is fundamentally driven by the inability of SHDs and co-operatives to supply the right quality milk at the right time in the right volume to SSL markets. Restoring confidence in these relationships by providing the right incentives and feedback to SHDs, supporting co-operatives to focus on hygiene, and SHDs making the appropriate change to their farm is critical to fulfilling this opportunity. Many co-operatives have excess processing capacity; • While economic growth and urbanisation are high level drivers for the development of formal retail supply chains including chilled diversified SSL dairy products, entry can be problematic due to scale, quality and logistical constraints for SHDs. Similarly, a larger processor may have trouble securing milk supply to service this market.	Develop and broker business relationships and provide complementary support and advice such as marketing, logistics or technical support on-farm. An entry point for SHDs is to partner with a larger dairy processor to research and develop a product line. SHDs would have access to developed processing capacity, logistics, marketing expertise and brand power, while a processor has access to raw milk.	Research, develop and pilot a ***not-for-profit business development consultancy.***	10. Coffee For Peace (CFP) is an example of a not-for-profit in Mindanao which assists coffee growers with technology and marketing. CFP has expressed an interest to expand its model to include dairy, given the use of milk in coffee retail outlets.
2.2. Overcoming high transportation costs to urban centres by capitalising on local shorter supply chains. The logistics of milk transportation from rural to urban centres, whether in bulk or packaged, can be problematic and costly. The high cost of inter-island transportation limits trade.	Develop shorten regional supply chains using communication and support with micro compartmental processing plants	A feasibility study would be undertaken in each country to establish a contemporary SHD to customer pilot supply chain based on ***modular micro processing plants (fixed or mobile).*** Key attributes would be supply and quality interventions discussed above. In addition to processing support, additional support regarding establishing online marketing and business transactions would be evaluated.	11. There are farmers who have left co-operatives to establish their own supply chain through to customers. Our research has shown that these farmers could benefit from targeted support at various touchpoints in their supply chains. A NFP consultancy would be the business model developed to implement this intervention.

Linking local customers to micro-processors producing safe local milk products through the use of online apps and relocatable processing units built by international manufacturers provides an opportunity to shorten the supply chain and lead to greater margin share to SHDs and/or co-operatives.			
2.3 Servicing the speciality coffee market with high frothing, low taint milk. In addition to food safety requirements, premium coffee outlets have specific milk quality and supply requirements. The ability of espresso coffees to maintain steam frothing value, have a milkfat derived lustre and be free of taints and odours (linked to milking herd feedstuffs) are key requirements. Given today's processing technology, these attributes cannot be met by large companies due to the physical damage created by factory fat/skim separation and excessive pumping of milk. Reconstituted and UHT products are also of inferior quality.	Establish local fresh milk supply chains to service this market opportunity for coffee outlets, but also the hospitality sector.	Undertake market research to clarify the specific ***quality*** and supply requirements of milk required for ***espresso coffee beverages***. Develop specific processing and SHD operating procedures to deliver on these requirements.	12. Deploy the NFP business development consultancy discussed above to pilot this approach with a co-operative.

3. Enabling policy environment			
Opportunity/constraint	**Recommended intervention**	**Proposed project**	**Outcomes and impact**
3.1 Understanding of consumer's attitudes towards SSL dairy. The marketing and branding of ambient UHT and reconstituted dairy products in retail sectors is an overwhelming force for smaller processors and co-operatives. Having tactical information regarding customer marketing opportunities would assist with targeting further interventions.	Undertake consumer research regarding SSL dairy products in urban regions and communicate these outcomes to processors, co-operatives and SHDs in regions which can feasibly service these markets	***Consumer research*** will be undertaken within two urban centres (Luzon and Mindanao).	13. The findings of this research will be communicated across the project's stakeholder network. The outcomes from this intervention will be evaluated after six months.
3.2 Advising government regarding branding legislation The marketing of ambient UHT treated milk or reconstituted milk as "fresh" milk is problematic for local chilled pasteurised or ESL supply chains.	Develop a policy paper for national and regional government, subject to relevant legislation.	Undertake a ***review of relevant policies*** and regulations regarding ***branding of ambient*** temperature dairy lines, focussing particularly on their ramifications on SHD inclusive value chains.	14. These findings would be presented to government and industry stakeholders through forums. The outcomes from this intervention will be evaluated after six months.
3.3 Introducing and imbedding contemporary approaches to Development and Extension International dairy RD&E organisations such as Dairy Australia, Dairy NZ and Teagasc (Ireland) continually review and improve their development and extension methodology to improve return on investment. Many of these methodologies are similar and are proven to be effective in other countries despite the different farming systems, terms of trade and farmer demographics.	This project would look to continue the strategy from AGB/2012/099 of experimenting with contemporary practice change methodologies, communication platforms and capacity building.	AGB/2012/099 demonstrated significant impacts from introducing discussion groups, focus farms, online extension delivery and on-farm technology demonstrations. A key success factor in this approach was the employment of degree graduates as ***village level researchers (VLRs)*** who were upskilled in contemporary dairy farm technology, facilitated regional discussion groups and focus farms and liaised with local stakeholders. VLRs also played an important role in on-farm research and data collection.	15. Subject to further landscape evaluation and in country developments between July 2021 and June 2022, these extension approaches would be piloted in two provinces in Luzon (two VLRs in each province). Local government agencies, agribusiness, processors and co-operatives would all be potential partners.

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18 Appendixes

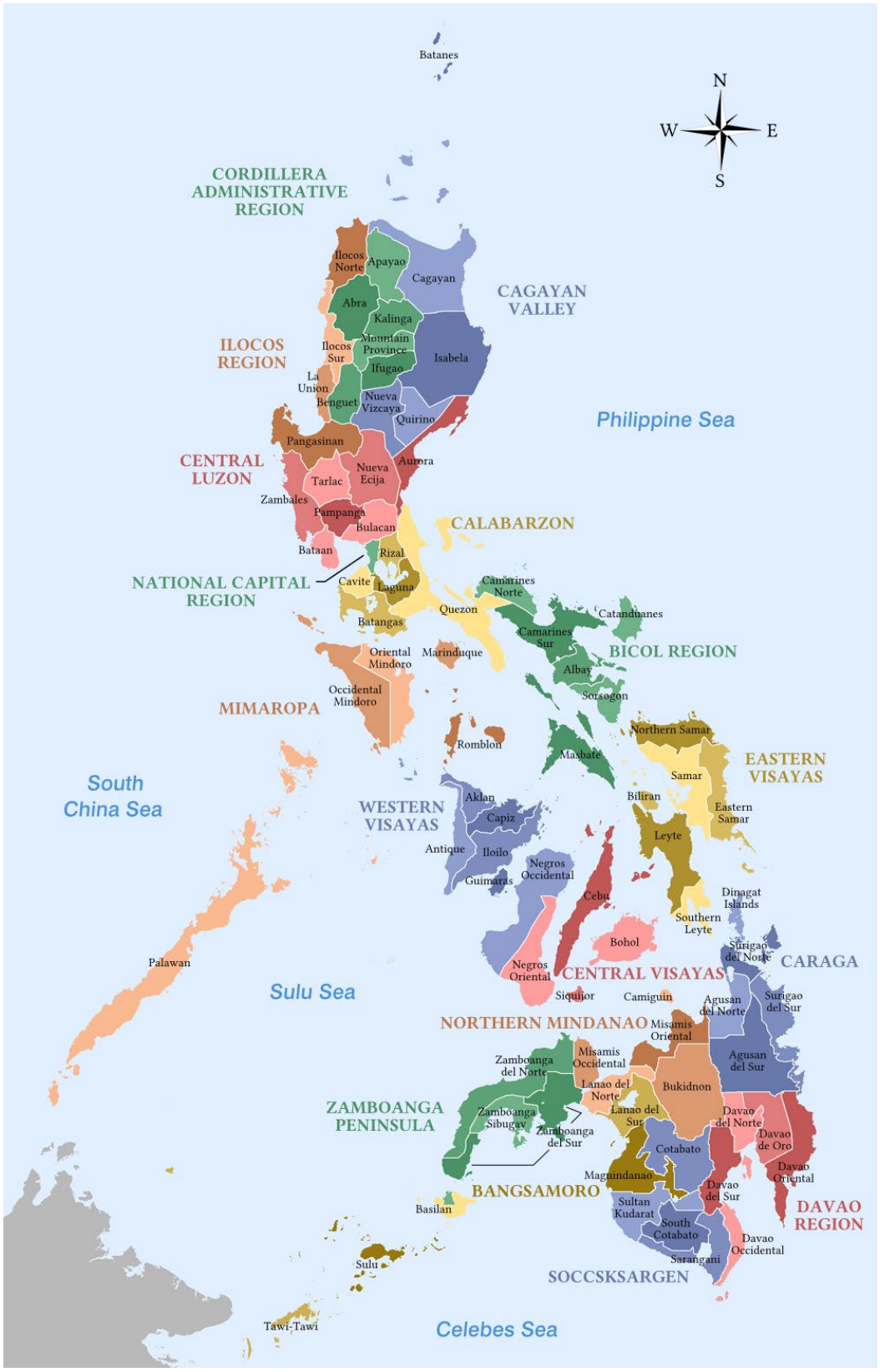

Figure A7.1 Provinces in the Philippines.

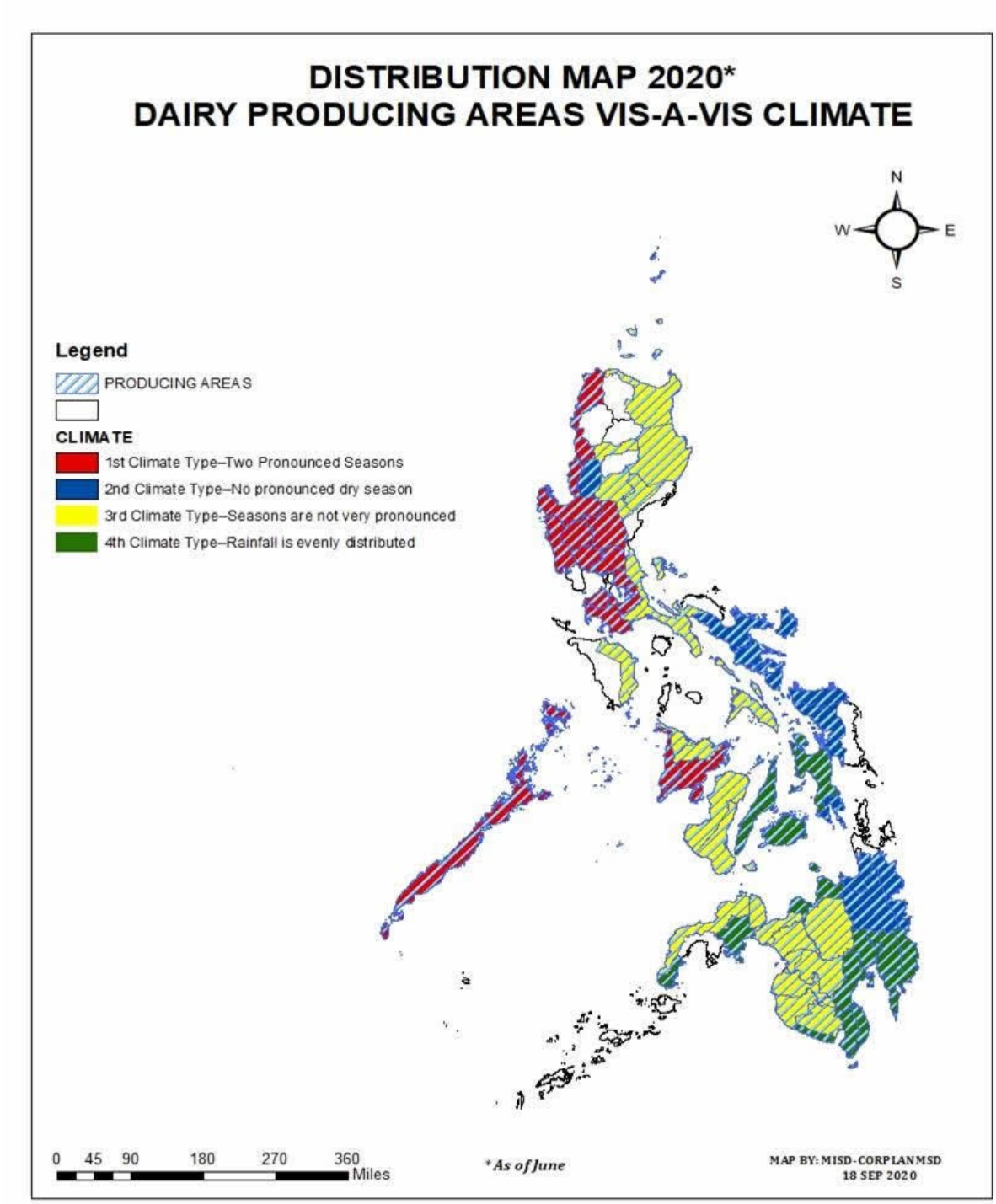

Figure A7.2. Dairying producing areas in the Philippines

(Source NDA website January 2021 data September 2020).

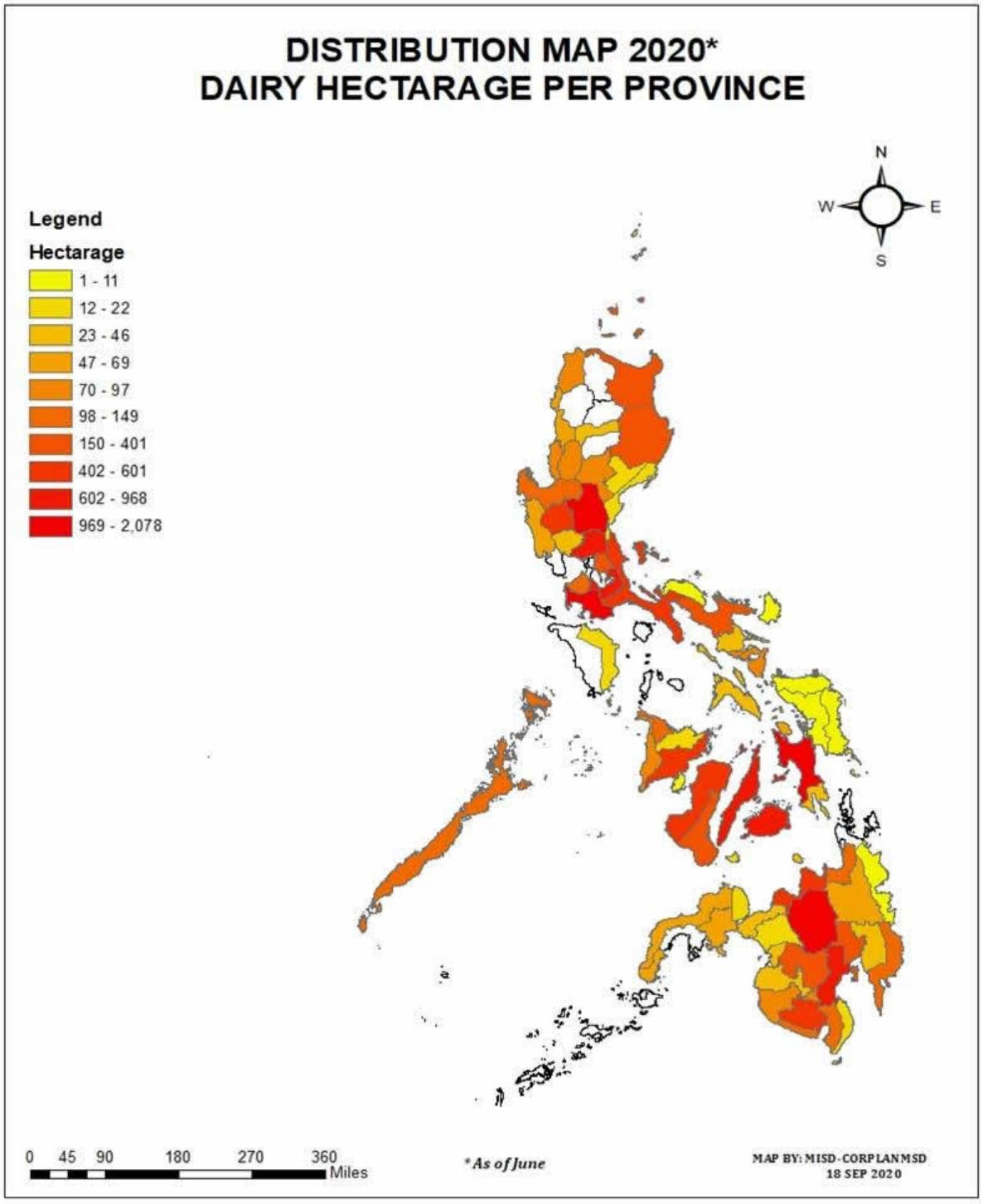

Figure A7.3. Dairying areas per province

(Source NDA website Jan 2021, data September 2020).

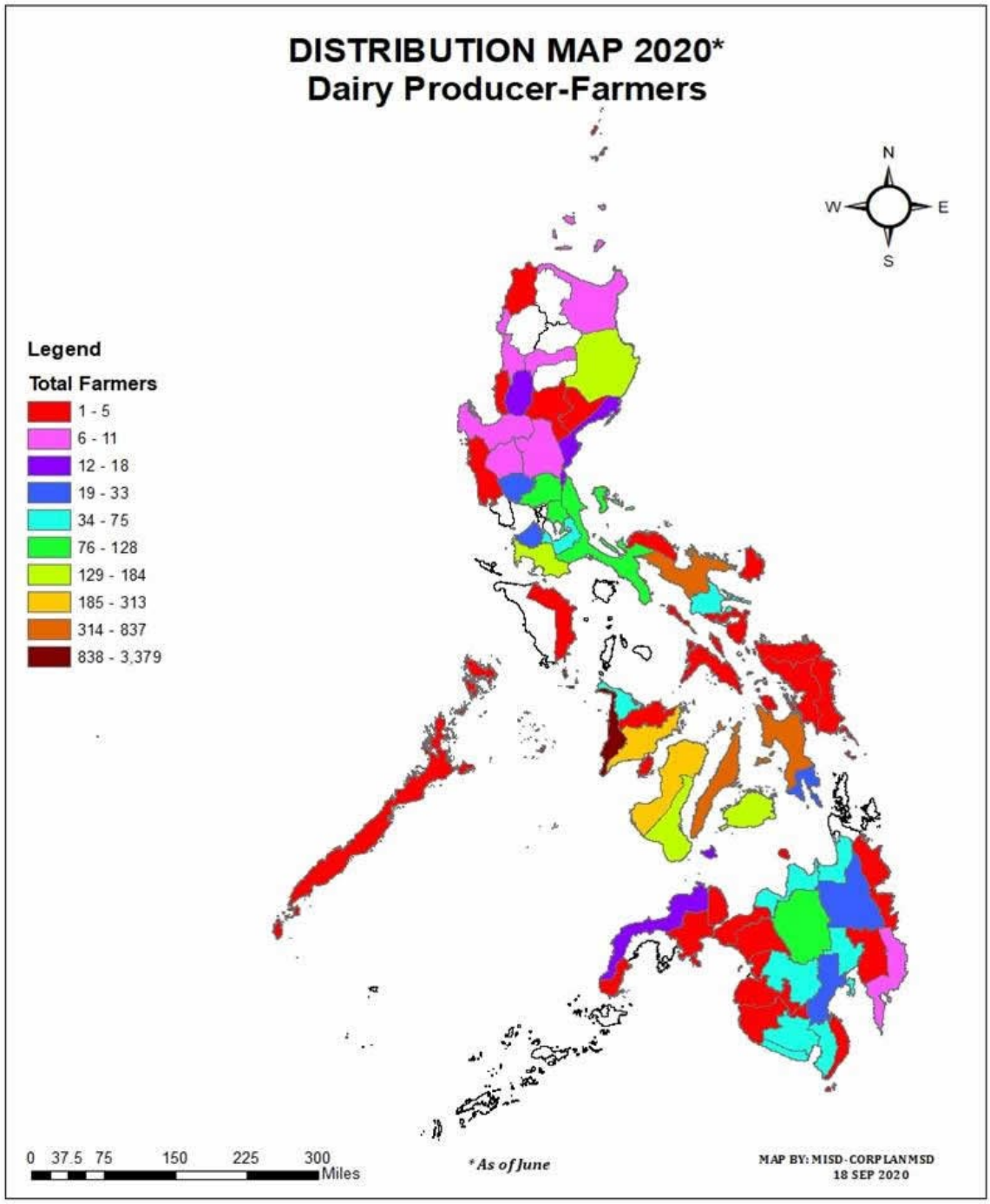

Figure A7.4. Numbers of dairy farms per province *(Source NDA January 2021, data September 2020).*

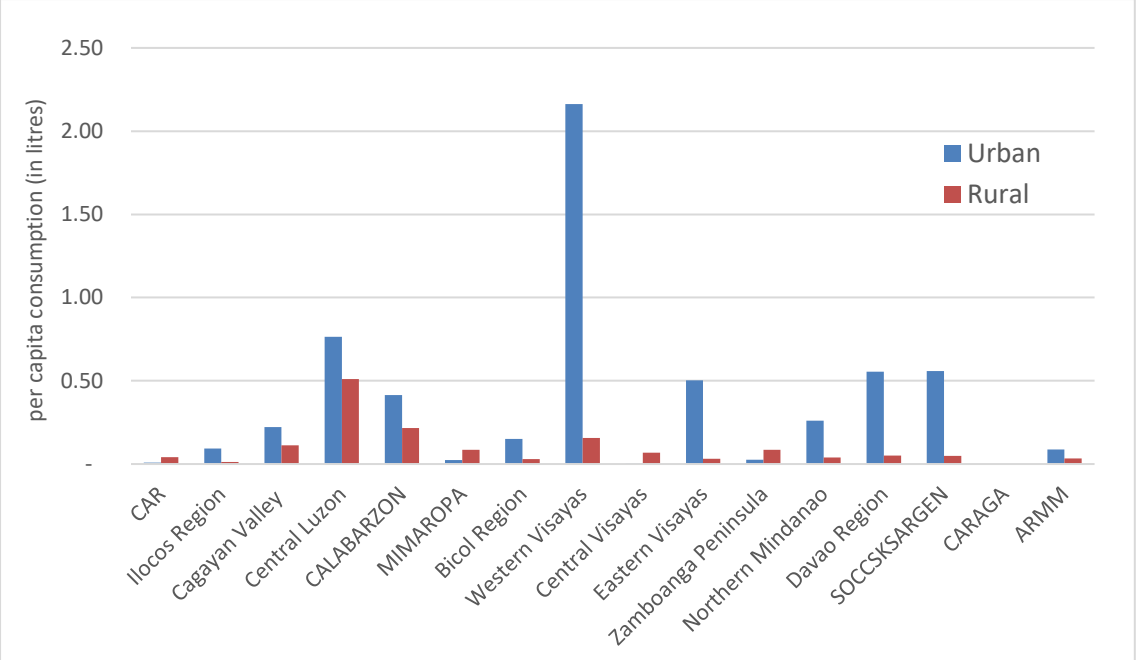

Figure A8.1. Per capita consumption of fresh/pasteurized milk, by region, 2015-2016.

Source: PSA, 2017

Section A6.1 Interviews with Philippine dairy stakeholders (date of interview).

- *Agricultural journalist*
  - Mr. Fermin Diaz, Livestock and Meat Business Philippines Magazine (22/9/2020)
- *Cooperative*
  - Dr Angelito Bagui, Soro-soro Ibaba Dev't. Cooperative (SIDC) (13/11/2020)
  - Mr. Greg Maluping, Samahan ng Maggagatas ng Batangas Cooperative (SAMABACO) (14/12/2020)
  - Ms. Gemma Apaap, Pangantucan Maramag Kalilangan Farmers Dairy Coop. (PAMAKA) (20/11/2020)
  - Mr. Jun Dom-Oguen, Quezon Dairy Farmers Cooperative (QUEDAFCO) (19/1/2021)
- *Development Project – International*
  - Mary Johnson LIFE (Livelihood Improvement through Facilitated Extension) (24/9/2020)
  - Mr. Warwick Thomson, Philippines New Zealand Dairy Project (11/11/2020)
  - Mr. Rune Ylade, Philippines New Zealand Dairy Project (19/11/2020)
- *Government*
  - Dr. Farrell Benjelix C. Magtoto, National Dairy Authority (NDA), Department of Agriculture (16/10/2020)
  - Dr. Romelito Marasigan, Provincial Veterinary Office (Batangas) (30/10/2020)
  - Dr. Jess Diez, Provincial Veterinary Office (Bukidnon) (10/11/2020)
  - Dr. Angelo C. Naui, Provincial Veterinary Office (Isabela) (11/11/2020)
  - Dr. Paul Limson, Bureau of Animal Industries (BAI), Department of Agriculture (19/1/2021)
  - Dr Maria Fe Cabullo, Bureau of Animal Industries (BAI), Department of Agriculture (22/2/2021)
- *Industry body*

    - Mr. Isidro Albano, Albano Stock & Dairy Farm and Dairy Confederation of the Philippines (19/11/2020)
    - Mr. Joey Tapay, Dairy Confederation of the Philippines and SAMABACO (4/12/2020)
- *Input supplier*
    - Mr. Gil Garcia, Agrichexers Corp. (20/1/2021)
    - Mr. Paul Alan Brucal, Rumen Nutrition and Genetic Solutions (10/11/2020)
- *Processor*
    - Mr. Arthur Baria, Nestle Philippines Inc. (23/11/2020)
    - Mr. Eduardo Soriano, Hacienda Macalauan, Inc. (HMI) (25/1/2021)
    - Mr. Bryan Katigbak, Daily Dairy Inc. (DDI) (11/12/2020)
    - Mr. Danilo V. Fausto, DVF Dairy Farm Inc. (3/11/2020)
- *Service provider*
    - Mr. Edwin Sanchez, ANSA Genetics Inc. (15/9/2020)
    - Mr. Carlitos Carmona, Consultant (23/9/2020)
- *Social enterprise*
    - Ms. Felicitas 'Joji' Pantoja, Coffee for Peace and Peace Builders Communities (22/2/2021)
- *University*
    - Mr. Sherwin Alota, Isabela State University (ISU) (17/2/2021)
    - Dr. Nilo Padilla, Isabela State University (ISU) (22/2/2021)

Section A7.1

DVF Dairy Farm

Named after the CEO and Founder Danillo V. Fausto, DVF Dairy Farm is based in Central Luzon. The business strategy is on carabao milk products including cheeses, yoghurts and candies as it is considered a delicacy. Cow's milk is also produced. The herd comprises 80 percent carabao (100 head) and 20 percent dairy cattle. On average, the farm is milking 10 to 15 cows each day.

One third of sales is in fresh milk (not UHT) followed by yoghurt (25 percent - up from 2 percent), cheese (17 percent), flavoured milk (15 percent) and candies. They are increasing their online marketing. Additionally, they produce organic fertiliser to sell in Manila.

Farm gate price:

- Carabao milk: 75 pesos per litre
- Cow's milk: 33-35 pesos per litre

DVF has a Dairy institution, which supports youth scholarships, employment and traineeships for graduates of animal husbandry, vet, microbiology and finance.

Their biggest issue is milk quality including mastitis, bacterial contamination and alcohol test. They have individual testing, quality assurance officers and provide training to farmers. Farmers can receive a 20 percent price premium for good quality.

As a result of Covid-19, there was a 30 to 35 percent drop in sales to hotels. In March 2020, there was no processing. In November 2020, they were back to about 65 percent of normal business.

Hacienda Macalauan, Inc. (HMI)

Based in Laguna, HMI started in 1995 with 100 cattle from Australia. Now they manage 500 cows comprised of 200 milking cows, 200 replacers and 100 steers. They have cross breed Friesian-Sahiwals averaging 22 litres per cow per day. During peak milking they are able produce 45 litre per cow per day.

HMI milk products include Extended Shelf Life (ESL) milk, cheeses, yoghurts and cream. HMI can process up to 8 tonnes per day. They have 100 customers, which includes major retailers such as McDonald's, Seattle's best and Jayco.

They have sourced milk from smallholders in the past but they stopped because of high levels of TPC. Their standard is 10,000 to 50,000 cfu/mL, and they consider milk at 100,000 cfu/mL a major issue. Smallholders would deliver milk between 300,000 to 700,000 TPC cfu/ML. HMI also provided SHD training and other support services, such as laboratory and AI services.

Batangas Agribusiness Centre (BAC)

A Lipa-based company (named Daily Dairy Inc) with a farm and processing facility which sells under the brand MILK JOY. They produce 10,000L per day. Their farm is 64 hectares. They also buy from 15 to 20 suppliers, averaging 500L per farm per day.

They have started selling online to end consumer and are able to sell it ₱5 per litre lower than other competitors. Their products include fresh and UHT milk, chocolate milk and yoghurts. Due to the high supply and low demand during Covid-19, they started to produce butter too.

Section A7.2. NDA Dairy Multiplier Farm Program options and conditions.

Source NDA: *https://nda.da.gov.ph/index.php/en/about-us/project-areas?layout=edit&id=133*

In order to access this program, farmers must meet the following conditions:

- Acceptability & readiness of farm site/location
- Capacity to provide the minimum animal-to-land area requirement (Stocking rate of three livestock per hectare);
- Have developed pastures at least 8 months before the arrival of stock;
- Have available & adequate farm/utility resources, with own production facility & equipment and adequate and accessible feeds resources;
- Have completed training in Dairy Husbandry Capability & Readiness;
- Capacity to provide clean, fresh water at all times (ad libitum supply);
- Agreeable to regular conduct of health tests, if and when applicable, especially for tuberculosis, leptospirosis, and brucellosis;
- Agreeable to regular conduct of vaccination/immunization of animals, if and when applicable, on haemorrhagic septicaemia, ephemeral and foot and mouth disease;
- Daily provision of feed equivalent to 10 % of the animal's body weight (minimum of 40 kg of fresh roughage and 2 kg concentrate);
- Commits to maintain technical and financial records and agrees to have these accessible to NDA;
- The organization/association to which the proponent is a member must be of good standing in accordance with the Securities and Exchange Commission and/or CDA rules and policies;
- Proponent who is an existing NDA farmer must have a good credit/updated loan standing with the NDA while new farmer-proponent must have a good track record with the cooperative;
- Must be able to pay the hauling cost of the animals being availed of from the local farm site to the point of destination

Source: https://nda.da.gov.ph/index.php/en/about-us/project-areas?layout=edit&id=133

Section A 7.3. Regional Animal Disease Diagnostic Laboratory Service

1. **Parasitology**
    a. Blood Parasite Examination (Surra, Anaplasia, Babesia)
    b. Faecalysis
        i. Floatation Technique
        ii. Sedimentation Technique
        iii. Larval Culture
        iv. Direct Smear
    c. Direct Microscopy for External Microscopic Parasite
2. **Pathology**
    a. Clinical Pathology
        i. Complete Blood Count
        ii. Blood Chemistry Analysis
    b. Histopathology
    c. Necropsy
3. **Microbiology**
    a. Bacterial Culture
    b. Bacterial Isolation and Identification
    c. Antibiotic Sensitivity Test
    d. Total Bacterial Count for milk and water
    e. Fungal Isolation and Identification

   f. Heterotrophic Plate Count
4. **Serology**
   a. ELISA (Avian Influenza, Brucella, Caprine Arthritis and Encephalitis)
   b. Card Agglutination Test for Surra
   c. Agar Gel Immuno Diffusion Test for Equine Infectious Anaemia and Blue Tongue
   d. Hemagglutination Inhibition Test for Avian Influenza and Newcastle Disease
5. **Virology**
   a. Rabies
6. **Polymerase Chain Reaction Test**
   a. Haemorrhagic Septicaemia
   b. ORF (Contagious Ecthyma)
   c. Blood Parasite (Babesia, Anaplasia, Surra or Trypanosoma)
7. **Laboratory Products**
   a. Biodewormer

Section A7.4. Regional Crop Protection Center- Plant Health Clinic Services

1. Plant Disease Diagnosis
   a. Plant pests symptomatology diagnosis
   b. In-vitro analysis *Microscopy
   c. Field Validation
2. Plant Pest Identification
   a. Plant pests symptomatology diagnosis
   b. Pest Identification
   c. Microscopy
3. Pesticide Residue Analysis (Colorimetric Rapid Test Kit)
   a. Carbamates
   b. Organophosphates
4. Laboratory Products
5. Bio-Control Agents
6. Earwig
   a. *Euborella annullata* (corn & vegetable pest)
   b. *Chelisoches morio* (coconut leaf/ beetle & *Brontispa sp*.)
7. *Trichogramma spp.*
   a. *chilonis* (vegetable, corn & tobacco)
   b. *evanescens* (corn borer)
   c. *japonicum* (rice)
8. *Metarhizium sp.* (rice black bug, grain bug, hopper & beetle)
9. *Trichoderma sp.* (soil-borne diseases)
   a. Mushroom (*Pleurotus/ Volvariella)*
10. Pure Culture
11. Mother Spawn
12. Fruiting Bag

Section A7.5. Analyses provided by Regional Soils Laboratory Services

1. Soil Analysis
   a. pH, N, P, K
   b. Trace Elements and Ca, Mg, S
   c. Fertilizer Recommendation
2. Fertilizer Analysis
   a. Total N,P,K Trace Elements

3. Plant Tissue Analysis
    a. Total N, P, K Trace Elements
    b. Trace Elements and Ca, Mg, S
4. Water Analysis
    a. pH, N, P, K
5. Mobile Soils Laboratory
    a. pH, N, P, K
6. Fertilizer Recommendation
7. Laboratory Products
    a. Legume Inoculant
    b. Compost Fungus Activator

Section A7.6. Regional Feed and Chemical Analysis Laboratory Services

1. Proximate Analysis
    a. Crude Protein
    b. Crude Fat
    c. Crude Fibre
    d. Moisture
    e. Ash
2. Mineral Analysis
    a. Calcium
    b. Phosphorus
3. Mycotoxin Analysis
    a. Mixed Feeds/Feed Ingredients (ELISA Test)
    b. Corn (ELISA Test)

Food Technology Development and Incubation Center Services

1. Proximate Analysis
    a. Crude Protein
    b. Crude Fat
    c. Crude Fiber
    d. Moisture
    e. Ash
2. Other Services
3. Consultation
4. Sensory Evaluation
5. Packaging Assessment

Source: Cagayan Valley Integrated Agricultural Laboratory - http://rfo02.da.gov.ph/

Section A12.1. In addition to notes in the report, a number of input suppliers were interviewed, including: Agrichexers Feed Corp, Rumen Nutrition and Genetic Solutions and ANSA Genetics Inc.

Agrichexers Corporation

Based in Bulacan, Luzon, Agrichexers Corporation is an animal feed manufacturer which has been in operation for 18 years. Their product range services the pig, poultry, layer, rabbit, ruminant and aquaculture industries. They are a medium sized business catering to smallholder farmers catering to Luzon, Visayas and Mindanao. They have three manufacturing facilities, two of which are owned by their company.

Agrichexers use a range of feed ingredients in the manufacture of their concentrates including copra meal, rice bran, spent grain, soybean meal, dried distillers' grain, wheat, corn, molasses, coconut and palm oil, micronutrients and meat and bone meal. There is no problem with sourcing raw materials. Nutrient specification for crude protein follows standards of the Bureau of Animal Industry (BAI).

The have nutritionist on-staff and a 6000m^2 research farm to evaluate and improve their concentrates. This facility also includes a training facility and processing centre. Their research farm does not have dairy cattle, however they work with a local customer who has 120 dairy cows near the facility.

Agrichexers sell through their distributors, but farmers or cooperatives can buy ex-factory for a discounted price. A discount is also provided for bulk orders.

More information: https://www.agrichexers.com/

Rumen Nutrition and Genetics Solutions

Rumen Nutrition and Genetics Solutions is based in Luzon and is an accredited livestock and genetic material importer, feed importer and distributor. They supply cattle concentrates and TMR for dairy farms, as well as lucerne and timothy grass hay. Additionally, they import live animals and semen from Australia and North America, including Holstein Jersey. They are the national distributor of Dairy Livestock Pty Ltd., an Australia-based exporter that specialises in beef and dairy exports. Their customers' farm sizes ranges are between 3 and 3000 cows. In addition to direct sales to farms, they also on-sell through co-operatives. They employ three vets and lease a TMR facility from Benacorn.

Rumen Nutrition and Genetic Solutions sources and sells corn silage to farmers. However, they have only been able to sell to ten customers due to inconsistency of supply, indifferent quality and high transportation costs. Cost on dry matter (DM) basis for silage is ₱30 per kg. However, negotiation is on fresh weight, which ranges from ₱3.5 per kg fresh weight for corn silage, up to ₱6 in dry season. Corn farmers are able to triple crop per year.

More information: http://rumnusol.com/about-us/

ANSA Genetics Inc.

ANSA Genetics Inc. is a cattle genetics consultancy company based in Batangas. Mr Edwin Sanchez has a strong background in beef cattle but more recently has been involved in dairy industry and has done some consulting for a local communal farm/cooperative. ANSA Genetic provide services in AI and Multiple Ovulation Embryo Transfer. They also procure and select of bulls from USA.

Section A17. Dairy Commodity pricing 2012-2020 and impacts on Philippine farm gate milk price

Figure A17.1 (p154) compares global trading prices for whole milk powder (WMP, a common ingredient in reconstituted dairy products) and farm gate pricing in Australasia including the Philippines.

Farmgate pricing of industries with a high reliance on export markets have a high correlation with global commodities. In this example, there is a correlation (R^2) of 83% and 65% for the New Zealand and Australian Victorian dairy industries, respectively with WMP pricing. There is a weaker relationship with Queensland in northern Australia, a milk deficient industry. Philippines farmgate price however has no correlation with global pricing for WMP, particularly after 2014.

There are various reasons for the divergence between international commodity pricing and farmgate milk prices in the Philippines. One we can disregard is currency movement with little change in the value of the PHP versus the USD and Euro, with some weakening versus the Australian and New Zealand dollars (Figure A17.2 (p154)). One factor that may have caused this divergence in the Philippines was a spike in export volume during 2015 and 2016 (Figure A17.3 (p155)). This export growth was driven by an easing of trade restrictions with ASEAN countries, particularly Malaysia and Thailand (USDA 2021c). It is unclear why these higher levels of exportation did not continue.

The lack of a relationship between farm gate milk price and imported commodity pricing could be due to various factors including:

- *Fresh drinking milk is a niche product and as such, can demand a higher premium.* This result in higher margins within the value chains, with some (albeit limited) distribution to SHD farm gate price;
- *The influence on wholesale price for drinking milk and flavoured milk paid by GoP in the SBFP.* NDA regularly annually surveys co-operative and private businesses regarding the retail price of their drinking milk products. This is used in the calculation of the price paid to entities for their SBFP milk supply, which as noted earlier is approximately 30 to 40% of milk supply from co-operatives. By default, this program contributes significantly to placing a floor in retail and hence farm gate price.
- *Value chains containing fresh drinking or reconstituted/UHT milk are segregated, especially at the point or purchase by consumers*. Given that the larger supermarkets and hypermarkets do not offer consumers fresh milk, there is no purchasing comparison made on the day. The strategy of local processors and larger co-operatives to sell online has also contributed to diverging value chains.

There is much discussion globally that the farm gate price of dairy farmers who supply fresh milk is linked closely to global commodity pricing. The commercial reality is that sea transport (as opposed to land transport) of fresh milk (or fresh milk final products) is generally commercially unviable and as such globally traded dairy commodities can have little influence on the local pricing of SSL dairy products. A processor in Australia who supplies fresh milk by air to China has commented that the cost of the whole product triples ex-factory Australia to point of retail sale in China. This would mean for a one litre bottle of milk ex-Australia at $1.20 AUD ex-factory would cost $3.60 AUD at the point of sale. Adding a 25% margin would see the retail price be $4.50 AUD per litre.

Regardless the drivers behind farm gate price in the Philippines, the farm sector operates under some of the highest farm gate pricing paid globally, even in comparison to heavily regulated countries such as Israel. We would not see farm gate pricing as an impediment to industry development.

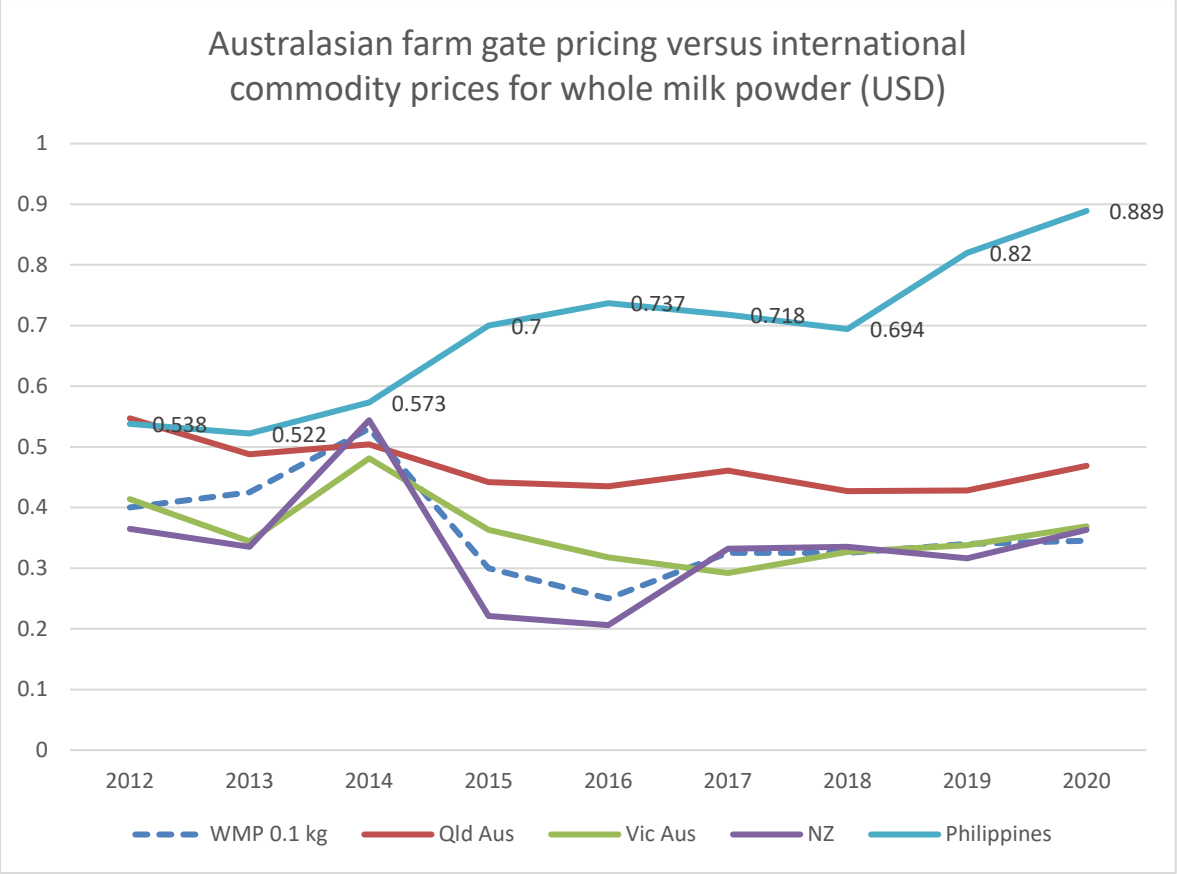

Figure A17.1. World trading prices for whole milk powder (WMP) versus farm gate pricing in the Philippines (all species), Queensland (Qld Aus), Victoria (Vic Aus) and New Zealand (NZ) from 2012 to 2020. *Source PSA, USDA, Dairy Australia and Fonterra.*

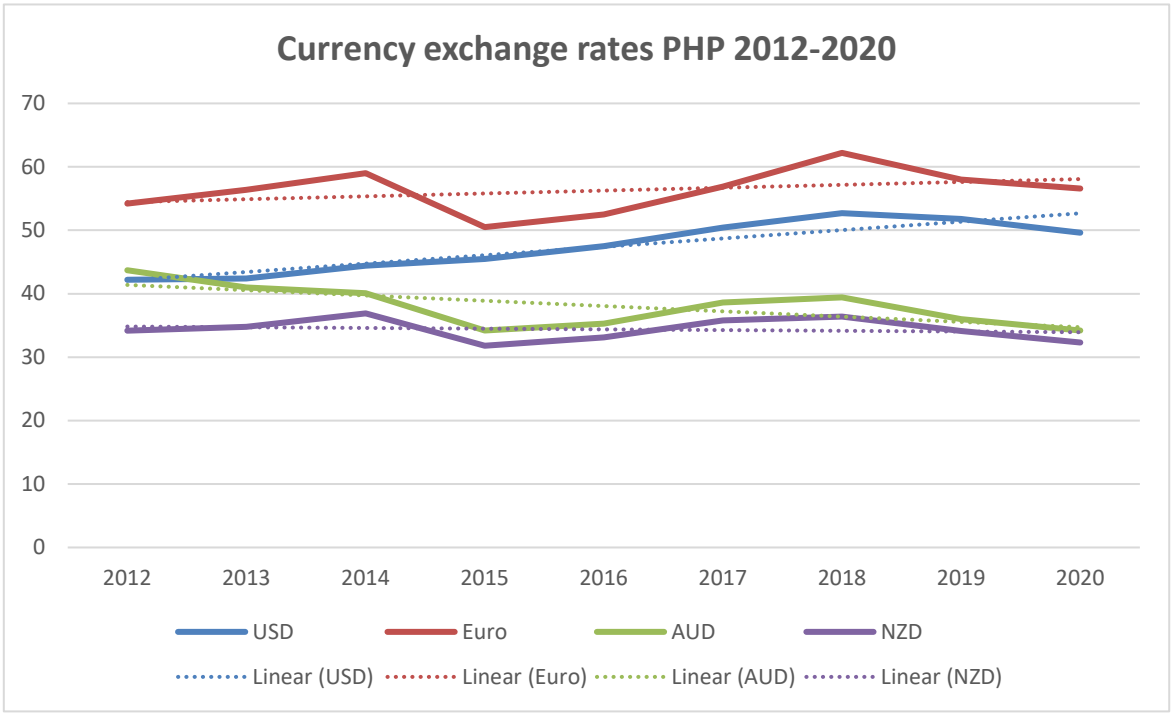

Figure A17.2. Yearly exchange rates for the Philippine peso (PHP) versus the US dollar (USD), Euro, Australian dollar (AUD) and New Zealand dollar (NZD) from 2012 to 2020.

https://www.exchangerates.org.uk/

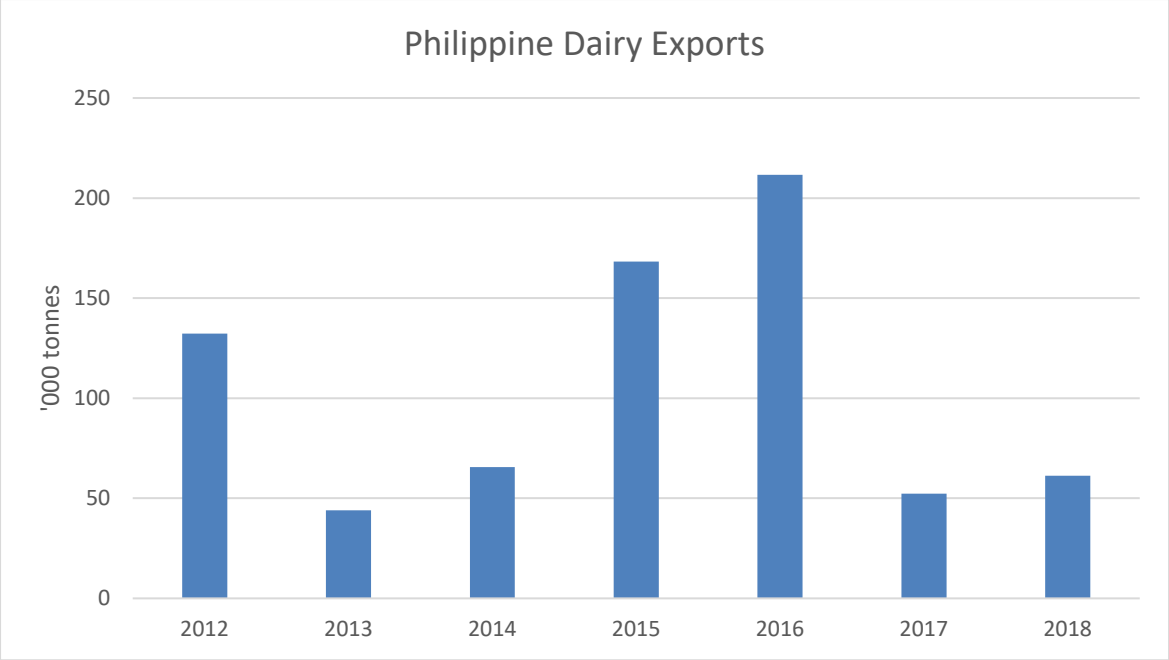

Figure A17.3. Philippines dairy exports 2012 to 2018

Source: https://psa.gov.ph

Table A7.1. List of cooperatives and associations involved in dairy sector in Regions 2, 4A and 10.

Entity/organisation	Comments
Region 2	
Cagayan Valley Development Cooperative	• Fresh milk • Federation-secondary coop / medium enterprise
Cagayan Valley Maunlad Cattle and Dairy Cooperative	• Fresh milk • Communal farm
Dairy Multi-Purpose Cooperative	• Fresh milk • Communal farm
Isabela Hograisers & Livestock Multi-Purpose Cooperative	• Fresh milk • Micro enterprise with 68 members operating on a regional scale
Malaya Development Cooperative	• Fresh milk, pasteurised milk, pastillas, candies, milk-o-gel, yoghurt • Communal farm, individual members • 1448 members
Quezon Dairy Farmers Cooperative (QUEDAFCO)*	• Pasteurised milk, flavoured milk, yoghurt (drink) • 200 members
Roxas Isabela Tobacco Farmers Credit Cooperative	• Fresh milk • Communal farm • 623 members
Dairy Farmers Association of Barucboc	• Not CDA registered
Hip-Alunan Dairy Farmers Association	• Not CDA registered
Hip-Mannga Dairy Association	• Not CDA registered
Hip-Namnama Dairy Association	• Not CDA registered
San Juan Dairy Farmers Association	• 623 members • Not CDA registered
Region 4A	
Batangas Dairy and Multi-Purpose Cooperative (BADACO)	• Fresh milk, chocolate milk and yoghurt • Engaged in marketing and trading with 27 members / medium enterprise with regional operations
Bulsa Multi-Purpose Cooperative	• Fresh milk • Small enterprise with 350 members with operations within the province
Katipunan ng Mga Kooperatibang Maggagatas, Incorporated (KKMI)	• Pasteurized milk, chocolate milk • Federation - secondary coop which is a medium enterprise with regional operations
Rosario Dairy Raisers Cooperative (Rosario Multi-Purpose Cooperative)	• Fresh milk • Small enterprise with 729 members operating within the municipality
Samahang Maggagatas ng Batangas Cooperative (SAMABACO)*	• Fresh milk • Micro enterprise with 38 members operating on a regional scale
Soro-Soro Ibaba Development Cooperative (SIDC)*	• The cooperative has 43,000 members over the Philippines – mostly swine, poultry, corn producers. • Dairy producers are not large proportion of members but hope to expand. SIDC have a small dairy farm of 10 head but are looking to expand to a more profitable size of 60 cows. • Website: www.sidc.coop/
Region 10	

Baungon Integrated Dairy Coop.	• Fresh milk
Dalwangan Multi-Purpose Dairy Cooperative	• Fresh milk • Small enterprise with 22 members operating at a barangay level
Maluko Multi-Purpose Dairy Cooperative	• Fresh milk • 30 members
Manolo Fortich Dairy Multi-Purpose Cooperative	• Fresh milk • Micro enterprise with 30 members operating within the municipality
Northern Mindanao Federation of Dairy Cooperatives	• Selling of processed and frozen dairy products
Pangantucan Maramag Kalilangan Farmers Dairy Cooperative (PAMAKA)*	• Fresh milk • Micro enterprise with 187 members operating within the municipality
Kisolon-Impasug-Ong Multi-Purpose Coop	• Fresh milk • 36 members

*Source: Foodlink database of key informants. *Interviewed in by the project team*

Table A7.2. Climate patterns associated with the top 10 dairy producing provinces and Isabela.

Dairy Zone Name (Dominant Climate Pattern and Location, Altitude location)		Average	Max	Min	Total
Batangas (Type 1)	Avg. Temp (°C)	27.6	29.2	26.1	
Ambulong (1951 to 2019)	Min. Temp (°C)	23.3	24.3	21.9	
14 m	Max. Temp (°C)	31.9	34.6	30.1	
	Rainfall (mm)	153	315	15	1837
Bukidnon (Type 3 and 4)	Avg. Temp (°C)	24.0	25.0	23.3	
Malaybalay (1961 to 2019)	Min. Temp (°C)	18.5	19.2	17.6	
597 m	Max. Temp (°C)	29.5	31.2	28.6	
	Rainfall (mm)	217	332	102	2606
Bulacan (Type 1 and 3)	Avg. Temp (°C)	27.2	29.1	25.4	
Meycauayan	Min. Temp (°C)	23.1	24.5	21.2	
8 m	Max. Temp (°C)	31.3	33.8	29.7	
	Rainfall (mm)	200	518	11	2402
Laguna (Type 3)	Avg. Temp (°C)	27.1	28.8	25.1	
Pagsanjan	Min. Temp (°C)	23.1	24.2	21.5	
41 m	Max. Temp (°C)	31.1	33.4	28.7	
	Rainfall (mm)	199	344	46	2384
Davao del Sur (Type 4)	Avg. Temp (°C)	27.7	28.4	26.9	
Davao City (1951 to 2019)	Min. Temp (°C)	23.4	24.1	22.8	
193 m	Max. Temp (°C)	31.9	33.1	30.9	
	Rainfall (mm)	151	192	96	1810
Quezon (Type 2)	Avg. Temp (°C)	27.1	28.6	25.2	
Alabat (1957 to 2019)	Min. Temp (°C)	23.2	24.1	22.1	
12 m	Max. Temp (°C)	30.9	33.0	28.4	
	Rainfall (mm)	270	633	81	3244
Cebu (Type 3)	Avg. Temp (°C)	28.1	29.4	26.8	
Mactan (1972 to 2019)	Min. Temp (°C)	24.8	25.9	23.9	
4 m	Max. Temp (°C)	31.3	32.8	29.7	
	Rainfall (mm)	133	201	49	1596
Misamis Oriental (Type 4)	Avg. Temp (°C)	26.7	27.7	25.6	
Balulang	Min. Temp (°C)	22.9	21.2	21.2	
94 m	Max. Temp (°C)	32.5	30	30	
	Rainfall (mm)	155	262	43	1859
Negros Occidental (Type 3)	Avg. Temp (°C)	27.4	28.5	26.5	
Hinoba-an	Min. Temp (°C)	23.4	24.2	22.9	
11 m	Max. Temp (°C)	31.4	32.8	30.2	
	Rainfall (mm)	201	415	17	2408
Iloilo (Type 1 and 3)	Avg. Temp (°C)	27.2	28.6	26	
Oton	Min. Temp (°C)	23.7	24.6	22.9	
22 m	Max. Temp (°C)	30.7	32.6	29.1	
	Rainfall (mm)	180	351	25	2156
Isabela (Type 3)	Avg. Temp (°C)	26.8	29	24	
Cauayan	Min. Temp (°C)	22.2	23.8	19.6	
51 m	Max. Temp (°C)	31.6	34.4	28.4	
	Rainfall (mm)	163	320	47	1959

Temperature and rainfall data from en.climate-data.org. Altitude from Google Earth, data from Alabat, Ambulong, Davao City, Mactan, Malaybalay from Government of Philippines.

Table A7.3. Status of irrigation development (NIA 2019)

Province	Estimated total irrigable area (ETIA ha)[1]	Current area serviced (ha)	Proportion currently serviced (%)
Batangas	8,774	5,197	59
Bukidnon	81,984	42,024	51
Bulacan	45,422	38,175	84
Laguna	24,147	16,751	69
Davao del Sur	32,773	18,308	56
Quezon	25,873	20,325	79
Cebu	7,128	8,224	115
Misamis Oriental	13,014	6,650	51
Negros Occidental	72,430	40,055	55
Iloilo	70,384	45,339	64
Isabela	238,410	146,077	61

1 Estimated total irrigable area is based on less than 3% slope.

Table A7.4. Major soil types found in the top 11 Philippine dairy provinces.

	Primary	Secondary	Tertiary
Batangas	Ultisols	Alfisols	Inceptisols
Bukidnon	Ultisols	Alfisols	Inceptisols
Bulacan	Inceptisols	Vertisols	Alfisols
Laguna	Alfisols	Inceptisols	Histosols
Davao del Sur	Inceptisols	Alfisols	Ultisols
Quezon	Ultisols	Inceptisols	Entisols
Cebu	Mollisols	Inceptisols	Ultisols
Misamis Oriental	Inceptisols	Ultisols	Alfisols
Negros Occidental	Ultisols	Inceptisols	Alfisols
Iloilo	Inceptisols	Entisols	Alfisols
Isabela	Ultisols	Alfisols	Vertisols

- **Utilisols** are strongly leached, acid forest soils with relatively low native fertility. Intense weathering of primary minerals has occurred, and much Ca, Mg and K has been leached from these soils. The high acidity and relatively low quantities of plant-available Ca, Mg and K associated with most Ultisols **make** them poorly suited for continuous agriculture without the use of fertilizer and lime. With these inputs, however, Ultisols can be very productive.

- **Inceptisols** are often found on fairly steep slopes, young geomorphic surfaces and on resistant parent materials. Land use varies considerably with Inceptisols. A sizable percentage of Inceptisols are found in mountainous areas and are used for forestry, recreation and watershed.

- **Alfisols** are moderately leached soils that have relatively high native fertility. Alfisols to be very productive soils for both agricultural and silvicultural use.

- **Entisols** are soils of recent origin. All soils that do not fit into one of the other 11 orders are Entisols. Thus, they are characterized by great diversity, both in environmental setting and land use. Many Entisols are found in steep, rocky settings.

- **Vertisols** are clay-rich soils that shrink and swell with changes in moisture content. During dry periods, the soil volume shrinks and deep wide cracks form. The soil volume then expands as it wets up.

- **Histosols** are soils that are composed mainly of organic materials. They contain at least 20-30 percent organic matter by weight and are more than 40 cm thick.

- **Mollisols** are the soils of grassland ecosystems. They are characterized by a thick, dark surface horizon. This fertile surface horizon results from the long-term addition of organic materials derived from plant roots. Mollisols are among some of the most important and productive agricultural soils in the world and are extensively used for this purpose.

Source: University of Idaho (2021)

Table A7.5. Philippine-owned dairy processors.

Entity	Business	Comments
Region 2		
Aljuron Farms (sells to Batangas Dairy Cooperative)	Producer / Processor	• Fresh milk, pasteurised milk, pastillas, candies, milk-o-gel and yoghurt • Farm Operations: Dairy and Beef Type Cattle; Swine; Poultry Layers; Fresh Water Aquaculture; Feed Milling; Biogas; Organic Fertilisers; etc.
QSU Dairy Farm	Producer / Processor	• Pasteurised milk, pastillas, candies
Region 3		
DVF Dairy Farm Inc.*	Producer / Processor	• Exports dairy products - cow's milk, gourmet cheese, etc. • https://www.dvfdairyfarm.com/
Region 4A		
Batangas Agri-Business Center, Inc.*	Processor	• Fresh milk and white cheese • The Batangas Agri-Business Center,Inc. (BAC Inc.) started marketing its fresh milk in plastic bottles under the MILK JOY brand. Milk Joy markets the biggest volume of fresh milk in Luzon. They are sourcing milk all throughout the country. Their farm operates under the name Daily Dairy Inc.
Moolk Creamery Corp	Processor	• Milk, yoghurt, milk bars • 155 peso per litre of milk • https://moolkcreamery.linker.store/?fbclid=IwAR10Tvm07Z6P-ZrTGlReNiv3zuE-awZyBtfP_ZI0fNujt87Bdt811Q_P_wk
Arce Foods Corporation	Processor	• Arce Foods Corporation is an enterprise in the Philippines, formally established in 1995 under the chairmanship of Mauro C. Arce Sr., and the presidentship of Faustito S. Arce. • It operates in the Food Manufacturing Industry with their primary product of ice cream from fresh carabao's milk and fruits which was initially conceptualized in 1935 by Don Ramon Arce, Sr. and Doña Carmen Arce. • https://arcedairy.com/
Rizal Dairy Farms	Producer / Processor / Wholesaler	• Dairy products - Kesong puti, Ricotta, Greek Yogurt, Low Fat Greek Yogurt, etc. • Established in 1992, with its farm in Teresa, Rizal Dairy Farms is a pioneer of small-scale dairy production in the Philippines through the development of high-quality dairy products following Swiss standards and recipes. Since 1994 Rizal Dairy Farms is serving the hotel and restaurant industry in Metro Manila, Boracay, Cebu and Davao with its great tasting, always freshly produced dairy products.
Hacienda Macalauan, Inc. (HMI)*	Producer / Processor	• Processed liquid milk, white cheese, ricotta, cottage cheese, yoghurt (live & Greek), cream (sour and whipping) • A dairy farm entity that started in 1995. • The farm operations began with just a handful of Magnolia dairy cows but quickly expanded into a

		small-scale dairy farm following the acquisition and importation of 100 heads of Frisian Sahiwal from Australia.
Laguna Creamery (Real Fresh Dairy Farms, Inc.)	Producer / Processor	• Fresh milk/Pasteurised milk, yoghurt, white cheese • It is a 27-hectare dairy farm located in Bgy Masaya in Bay, Laguna where it is home to roughly 200 Holstein-Sahiwal cattle from New Zealand. Their milk brand is Holly's Milk.
Juno Foods (LICA/Pinkie's Dairy Products)	Producer / Processor / Wholesaler	• Fresh milk (full cream and low fat) • Kesong Puti cheese and Scamorza cheese
Region 6		
Mercanti Veneziani Trading (Casa del Formaggio)	Producer / Processor	• In 2008, Mercanti Veneziani Trading was created and registered under the Countryside Barangay Business Enterprise under Republic Act 6810 known as Kalakalan 20. and with the sister company, Prism Import-Export, Inc.'s entry into cattle farming, our efforts were shifted to Dairy Processing. With unending research and development to try to be an equal or even better than its Italian counterpart, Mercanti Veneziani's goal is to be the first to locally produce quality Italian Style Cheeses in Negros and the rest of the Philippines. With more people aware of the health benefits of having quality products, our ultimate goal is to provide a stable income to the local community and emphasize the importance that we are capable of producing natural products right in our doorstep. https://news.abs-cbn.com/life/09/13/16/this-bacolod-dairy-farm-creates-artisanal-italian-cheeses
Region 11		
Malagos Farmhouse (Malagos Agri Ventures Corp)	Producer / Processor	• Blue Pepato, mildly aged cow's milk cheese with whole green pepper corn / CHEVRE, French style fresh cheese / Feta Cheese / Blue Goat Cheese / Fresh Goat Cheese Malagos Farmhouse Cheese, a produces natural farm fresh cheese proudly made by Filipino cheesemaker Olive Puentespina is now its 8th year. • Daily, anywhere from 350-800 litres of cow's and goat's milk is processed to make 35kg-150kg of cheese. https://www.malagosfarmhouse.com/who-we-are-1
Region 12		
Amoil Incorporated Dairy Farm	Producer / Processor	• Selling of processed and frozen dairy products

Source: Foodlink database of key informants.

Table A7.6. Brand Shares in Chained Cafés/Bars: % Foodservice Value: 2017-2020

Retailer	Global Brand Owner	2017	2018	2019	2020
Starbucks	Starbucks Corp	51.6	51.5	51.2	53.0
Dunkin' Donuts	Dunkin' Brands Group Inc	9.0	8.8	8.8	9.5
The Coffee Bean & Tea Leaf	Jollibee Foods Corp	-	-	5.6	5.5
McCafé	McDonald's Corp	4.5	4.6	4.2	4.8
Bo's Coffee	WS & Landin Inc	4.7	4.7	4.7	4.6
Mary Grace Cafe	Mary Grace Foods Inc	4.4	4.8	5.3	4.5
Figaro Coffee	Figaro Coffee Co	3.3	2.9	2.9	2.7
Coffee Project	MBV Group of Cos	1.7	2.1	2.5	2.5
Seattle's Best Coffee	Starbucks Corp	1.5	1.6	1.7	1.6
Barcino Wine Resto Bar	Tarraco Group Inc	1.2	1.6	1.6	1.0
Café France	Euro-Med Laboratories Phils Inc	1.4	1.2	1.2	1.0
Padi's Point	Padi's Philippines Corp	1.5	1.3	1.2	0.8
Gloria Jean's Coffees	Retail Food Group Ltd	0.8	0.8	0.8	0.8
Cowboy Grill	Golden Pizza Inc	0.8	0.7	0.7	0.3
Café Adriatico	LJC Restaurant Group	0.1	0.1	0.1	0.1
The Coffee Bean & Tea Leaf	International Coffee & Tea LLC	5.0	5.4	-	-
Dôme	Dôme Coffees Australia Pty Ltd	0.1	0.0	-	-
The Coffee Beanery	Coffee Beanery Ltd	-	-	-	-
Gloria Jean's Coffees	Jireh International Pty Ltd	-	-	-	-
Others	Others	8.4	7.8	7.5	7.2
Total	Total	100.0	100.0	100.0	100.0

Source: Cafés/Bars in the Philippines, Euromonitor International 2021

Table A7.7. Tariffs for importation into the Philippines of fresh milk (pasteurised, ESL, UHT) during 2012, 2016, 2020 and 2024 (Philippine Tariff Commission, 2021).

	Whole				Skim			
	2012	2016	2020	2024	2012	2016	2020	2024
MFN	3	3	3	NA	3	3	3	NA
AANZFTA	3	2	0	0	3	2	0	0
ACFTA	0	0	0	0	0	0	0	0
AIFTA	3	2	0	0	NA	NA	NA	NA
AJCEPA	2	1	0	0	2	1	0	0
ATIGA	0	0	0	0	0	0	0	0
PJEPA	2	1	0	0	2	1	0	0
PH-EFTA FTA (NOR	NA	NA	NA	NA	NA	NA	NA	NA
PH-EFTA FTA (CHE/LIE)	NA	NA	1	0	NA	NA	1	0
PH-EFTA FTA (ISL)	NA	NA	NA	NA	NA	NA	NA	NA
AHKFTA	NA	NA	3	0	NA	NA	3	0

	<2 kg				>20 kg			
	2012	2016	2020	2024	2012	2016	2020	2024
MFN	1	1	0	NA	1	1	1	NA
AANZFTA	0	0	0	0	0	0	0	0
ACFTA	0	0	0	0	0	0	0	0
AIFTA	NA	NA	0	NA	1	1	0	0
AJCEPA	1	0	0	0	1	0	0	0
ATIGA	0	0	0	0	0	0	0	0
PJEPA	2	1	0	0	2	1	0	0
PH-EFTA FTA (NOR	NA	NA	0	0	NA	NA	NA	NA
PH-EFTA FTA (CHE/LIE)	NA	NA	0	0	NA	NA	0	0
PH-EFTA FTA (ISL)	NA	NA	0	0	NA	NA	0	0
AHKFTA	NA	NA	1	0	NA	NA	1	0

	Yogurt				Ice Cream			
	2012	2016	2020	2024	2012	2016	2020	2024
MFN	7	7	7	NA	10	10	10	NA
AANZFTA	5	5	3	3	0	0	0	0
ACFTA	0	0	0	0	0	0	0	0
AIFTA	7	6	5	5	8	6	0	0
AJCEPA	4	1	0	0	6	2	0	0
ATIGA	0	0	0	0	0	0	0	0
PJEPA	4	1	0	0	4	1	0	0
PH-EFTA FTA (NOR	NA	NA	4	0	NA	NA	0	0
PH-EFTA FTA (CHE/LIE)	NA	NA	4	0	NA	NA	0	0
PH-EFTA FTA (ISL)	NA	NA	NA	NA	NA	NA	NA	NA
AHKFTA	NA	NA	2	0	NA	NA	8	4

Table A7.8. Safety and Quality Standards for Raw milk and Dairy Animals

Test	Standard
Dairy Safety	
1. Standard Plate Count	0-300,000 cfu/mL (bulk milk) 0-150,000 cfu/mL (individual farm)
2. Antibiotic Residue Test	Negative
3. Temperature	2-4°C
4. Somatic Cell Count	<400,000 cells/mL
5. Titratable Acidity	0.14-0.18% lactic acid
6. Hydrogen Ion Concentration (pH)	6.6-6.7
7. Aflatoxin M1	Max 0.5 µg/kg
8. Organoleptic/Sensory	a. Smell – pleasant b. Appearance – no visible dirt/or extraneous matter
9. Contaminants like heavy metals, veterinary drug residues and pesticide residues	Must comply with the Maximum Residue Limits (MRLs) established by Codex Alimentarius Commission
Dairy Safety (Dairy Animals)	
1. *Brucella/Leptospira*	Negative
2. Tuberculin Test	Negative
Dairy Quality	
1. Milkfat Content	Cow's milk: ≥ 3.0% Carabao's milk: ≥ 6.0% Goat's milk: ≥ 4.0%
2. Specific Gravity	Reading at ambient temperature Cow's milk: ≥ 1.025 Carabao's milk: ≥ 1.028 Goat's milk: ≥ 1.028
3. Organoleptic/Sensory	a. Smell – pleasant b. Appearance – no visible dirt/or extraneous matter
4. Sediment	No visible dirt extraneous matter in the filter

Source: NDA, 2016

Table A7.9. Safety and Quality Standards for Pasteurized Milk

Test	Standard
Dairy Safety	
1. Organoleptic/Sensory	a. Smell – pleasant b. Appearance – no visible dirt/or extraneous matter c. Taste – pleasant, good
2. Temperature	2-4°C
3. Standard Plate Count	≤ 50,000 cfu/mL
4. Coliform Count	≤ 100 cfu/mL
5. *E. coli* Count	Negative
6. *Salmonella* / 25 mL	0
7. *Listeria monocytogenes* / 25 mL	0
8. Psychotropic Bacteria	≤ 10 cfu/mL
9. Contaminants like heavy metals, veterinary drug residue and pesticide residues	Must comply with the MRLs established by Codex Alimentarius Commission
7. Aflatoxin M1	Max 0.5 µg/kg
Dairy Quality	
1. Milkfat Content	Cow's milk: ≥ 3.0% Carabao's milk: ≥ 6.0% Goat's milk: ≥ 4.0%
2. Milk solids non-fat	Cow's milk: ≥ 8.25% Carabao's milk: ≥ 8.5% Goat's milk: ≥ 8.5%
3. Organoleptic/Sensory	a. Smell – pleasant b. Appearance – no visible dirt/or extraneous matter c. Taste – pleasant, good
4. Temperature	2-4°C

Source: NDA, 2016

Table A7.10. Certificate of Compliance (COC) fees (PHP/head)

Classification	No. of Dams and Heifers	COC Fee
Small	Below 25 heads	50
Medium	25 – 100 heads	2,400
Large	Over 100 heads	3,600

Source: NDA, 2016

Classification	Capacity of the Centre/Facility	LTO Fee
Small	Up to 1,000 litres	1,000
Medium	Up to 3,000 litres	3,000
Large	Over 3,000 litres	5,000

Source: NDA, 2016

Classification	Rated Capacity of the Centre/Facility per hour	LTO Fee
Small	Up to 1,000 litres	2,500
Medium	Up to 3,000 litres	5,000
Large	Over 3,000 litres	7,500

Source: NDA, 2016

Table A7.11. Summary of available government and not for profit loans to smallholder dairy farmers.

Organisation/Product	Loanable amount	Interest rate
Land Bank		
Agricultural and Fishers Financing Program 14 provinces available	• Minimum Loan: 20,000 PHP per project • Maximum Loan: 300,000 PHP per borrower for total projects which can finance up to three various projects, simultaneously.	• 15% p.a.
Agricultural Competitiveness Enhancement Fund (ACEF)	• 1 million PHP per individual farmer; and • 5 million PHP per project loan per farmer cooperative, and MSE	• 2% p.a.
Young Entrepreneurs from School to Agriculture Program 18 to 35 years old	• Not more than 90% of the total project cost • Minimum of P50,000 per borrower	• Prevailing interest rate
Development Bank of the Philippines (DBP, 2021)		
Sustainable Agribusiness Financing Program for the Dairy Industry	• Up to maximum of 80% of the total project cost. • For Domestic Packing Credit, up to 80% value of Purchase Order	• Prevailing interest rate
Agricultural Credit Policy Council (ACPC) 2021 [a,b,c]		
Kapital Access for Young Agripreneurs 18 to 30 years old	• Maximum Loan: 500,000 PHP	• 0% up to 5 years
Agri-Negosyo Loan Program (ANYO) Micro and small enterprises	• Micro business: maximum loan 300,000 PHP • Small business: 300,000 to 15 million PHP	• 0% up to 5 years
Agrarian Production Credit Program (APCP) For cooperatives	• Not specified	• For Short-Term Loan: 8.5% per annum • For Term Loan: 9.5% per annum
Sorosoro Ibaba Development Cooperative (SIDC)		
KooPinoy 12 loan products	• Between P30,000 and P15million	• 11 to 15% p.a.

Landbank, 2021 a, b, c;

Table A8.1. Per capital consumption of fresh/pasteurised milk by socio-economic class, 2012

Region	All Classes	AB	C	D	E
Philippines	0.19	0.29	0.36	0.15	0.05
NCR	0.01	a*	0.02	a*	a*
CAR	0.07	a*	0.15	0.02	0.01
Ilocos Region	0.26	0.17	0.09	0.46	a*
Cagayan Valley	0.03	a*	0.10	0.01	0.00
Central Luzon	0.94	1.27	1.79	0.47	0.25
CALABARZON	0.16	0.23	0.27	0.12	0.10
MIMAROPA	0.06	a*	0.10	0.07	0.03
Bicol Region	0.03	0.05	0.07	0.02	0.01
Western Visayas	0.33	0.11	0.18	0.58	0.08
Central Visayas	0.02	a*	0.03	0.02	0.01
Eastern Visayas	0.07	a*	0.18	0.07	0.01
Zamboanga Peninsula	0.15	a*	0.13	0.22	a*
Northern Mindanao	0.12	a*	0.10	0.19	0.00
Davao Region	0.07	a*	0.13	0.07	0.01
SOCCSKSARGEN	0.04	0.68	0.02	0.05	0.02
CARAGA	0.03	0.42	0.04	0.01	a*
ARMM	0.07	0.29	0.27	0.04	a*

Source: DA-BAS (2013) a Less than 0.001 litre*

Table A8.2. Per litre equivalent pricing for milk variants and pack sizes from online shopping survey October 2020.

Category	Processing	Pack size	Retail price per litre		Source
			USD	**PHP**	
Full Cream	UHT	2 L	$1.74	₱84	Europe, Australia
		1 L	$1.88	₱91	Europe, NZ, Australia
		90 to 250 mL	$3.43	₱166	Europe, NZ
	UHT Reconstituted	1 L	$1.58	₱77	Philippines
		200 mL	$2.47	₱120	Philippines
Avg Full Cream			**$2.22**	**₱108**	
Low Fat	UHT	1 L	$1.71	₱83	Europe, Australia
		90 to 250 mL	$3.71	₱180	New Zealand
	UHT Reconstituted	1 L	$1.75	₱85	Philippines
Non-fat	UHT	1 L	$1.73	₱84	New Zealand
		250 mL	$3.08	₱150	New Zealand
	UHT Reconstituted	1 L	$1.83	₱89	Philippines
Avg Modified			**$2.30**	**₱112**	

Table A8.3. Provincial fresh and flavoured milk pricing across provinces.

	Fresh Milk				Flavoured milk			
	Avg	**Max**	**Min**	**Obs**	**Avg**	**Max**	**Min**	**Obs**
Luzon	**₱103**	**₱240**	**₱75**	**40**	**₱109**	**₱250**	**₱77**	**39**
Albay	₱75	₱75	₱75	1	₱90	₱90	₱90	1
Batangas	₱95	₱240	₱80	13	₱104	₱250	₱85	14
Benguet	.	.	.	0	₱77	₱77	₱77	1
Bulacan	₱100	₱110	₱85	3	₱122	₱180	₱90	4
Cagayan	₱100	₱100	₱100	1	.	.	.	0
Camarines Sur	₱110	₱110	₱110	6	₱110	₱110	₱110	6
Cavite	₱100	₱100	₱100	1	₱100	₱100	₱100	1
Isabela	₱80	₱80	₱80	1	₱90	₱90	₱90	1
Laguna	₱101	₱145	₱88	5	₱101	₱150	₱85	4
Nueva Ecija	₱174	₱174	₱174	1	₱154	₱154	₱154	1
Quezon	₱83	₱90	₱80	3	₱95	₱110	₱85	4
Rizal	₱180	₱180	₱100	4	₱190	₱190	₱100	5
Zambales	₱80	₱80	₱80	1	₱100	₱100	₱100	1
Visayas	**₱82**	**₱90**	**₱75**	**32**	**₱89**	**₱95**	**₱85**	**32**
Antique	₱90	₱90	₱90	1	₱90	₱90	₱90	1
Bohol	₱80	₱80	₱80	10	₱85	₱85	₱85	11
Cebu	₱90	₱90	₱90	10	₱95	₱95	₱95	11
Misamis Oriental (CDO)	₱90	₱90	₱90	1	₱94	₱94	₱94	1
Negros Oriental	₱75	₱75	₱75	10	₱85	₱85	₱85	11
Davao	**₱76**	**₱105**	**₱67**	**45**	**₱85**	**₱89**	**₱80**	**2**
Davao del Norte	₱70	₱70	₱67	8	.	.	.	0
Davao del Sur	₱78	₱100	₱75	17	.	.	.	0
North Cotabato	₱80	₱80	₱80	3	.	.	.	0
Sarangani	₱72	₱72	₱72	9	.	.	.	0
South Cotabato	₱75	₱85	₱72	5	.	.	.	0
Sultan Kudarat	₱105	₱105	₱105	1	.	.	.	0
Bukidnon	₱78	₱78	₱78	1	₱89	₱89	₱89	1
Zamboanga del Sur (Pagadian City)	₱80	₱80	₱80	1	₱80	₱80	₱80	1

Source: NDA

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Department of Agriculture
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CERTIFICATION

This is to certify that in the determination of the price of PHP 18.00 per 200 ml for the current milk feeding program with the Department of Education (DepEd), the National Dairy Authority (NDA) exerted all efforts to secure the most advantageous price to the government based on the existing Price Data of the agency attached hereto as Annex A. This Price Data, which is national in scope, was based on a scanning of NDA-assisted dairy farms and processing plants nationwide as of May 2020.

The following findings are derived from the Price Data:

Milk	Sample Size (complete roster)	Mean Commercial Price per Liter	Buying Price per Liter	Mean Commercial price per 200ml	NDA Buying price per 200ml
Pasteurized Fresh Milk	50	**97.45**	90	**19.49**	18
Pasteurized Flavored/ Choco Milk	36	**109.13**	90	**21.83**	18

Based on the Price Data of local pasteurized fresh and flavored milk above, the buying price is an advantageous price to the government as it is below the average prevailing market prices of the said commodity.

In addition, the DepEd, the local dairy processors, and representatives of the NDA and the Philippine Carabao Center (PCC), in a series of consultations held among them in preparation for the implementation of the milk feeding program, agreed at the price of PHP 18.00 per 200 ml, which was the amount the DepEd's budget can allow. Thus, the PHP 18.00 pesos price point per 200ml (or Php 90 per liter) was acceptable to local dairy processors and cooperatives.

Issued this 6 November 2020 at Quezon City.

MARILYN B. MABALE
Administrator

A food-secure Philippines
with prosperous farmers and fisherfolk

Masaganang ANI Mataas na KITA

Table A8.4. Online pricing for soft cheeses in Australasia

	US Currency	
100 g	**Ricotta**	**Cottage (Cream)**
Australia	$0.84	$0.87
India	$1.83	$0.55
Indonesia	$1.62	$1.83
New Zealand	$1.57	$0.96
Thailand	$1.51	$2.34
Average	**$1.47**	**$1.31**

Table A8.5 Per 100 mL or grams equivalent pricing for drinking and set yoghurt from online shopping survey October 2020 and June 2021

Category	Pack size		Retail price per 100 mL or grams		Source
		Unit	USD	PHP	
Drinking (Oct 2020)	90	ML	$0.28	₱14	Thailand
	100	ML	$0.17	₱8	Unknown Phil company
	110	ML	$0.22	₱11	Philippines
	180	ML	$0.22	₱11	Philippines and Thailand
	200	ML	$0.38	₱19	Australia
	Avg		**$0.26**	**₱11**	
Greek (June 2021)	100	G	$0.88	₱42	Spain
	125	G	$0.90	₱43	Philippines
	250	G	$1.47	₱70	Philippines
	500	G	$0.80	₱38	Philippines
	Avg		**$1.00**	**₱48**	
Set (Oct 2020)	100	G	$0.65	₱32	Germany and Spain
	125	G	$0.63	₱31	Philippines
	150	G	$0.65	₱31	Germany
	500	G	$0.54	₱26	Philippines
	Avg		**$0.62**	**₱30**	

Table A8.6. Some online prices of yogurt direct to customer.

Category	Pack size	Retail price per 100 g		Brand/Processor
		USD	PHP	
Greek				
	350 g	$1.05	₱50	Rizal Dairy Farms
	2000 g	$0.82	₱39	Rizal Dairy Farms
	200 g	$1.36	₱65	Pinkies
	480 g	$1.09	₱52	Pinkies
	90 g	$1.26	₱60	Hacienda Macalauan
Avg Greek		**$1.11**	**₱53**	
Set				
	350 g	$0.81	₱39	Rizal Dairy Farms
	2000 g	$0.54	₱26	Rizal Dairy Farms
Avg Set		**$0.68**	**₱33**	
Cream				
	200 g	$0.89	₱43	Pinkies
	1000 g	$0.52	₱25	Pinkies
	210 g	$0.64	₱31	Hollys
	1050 g	$0.45	₱22	Hollys
Avg Cream		**$0.63**	**₱30**	

Table A8.7 Milk self-sufficiency (provisional basis) based on estimated population (2021) and milk supply (NDA 2018b)

Province	Population (Estimated 2021)	Provincial milk supply deficit ('000 litres pa)[a]	Admin Region	Region
Metro Manila	12,877,253	- 193,159	-	Luzon
Cebu	4,632,359	-68,799	7	Visayas
Cavite	3,678,301	-55,056	4A	Luzon
Bulacan	3,292,071	-47,875	3	Luzon
Negros Occidental	3,059,136	-45,448	6	Visayas
Pangasinan	2,956,726	-44,118	1	Luzon
Laguna	3,035,081	-44,075	4A	Luzon
Rizal	2,884,227	-42,962	4A	Luzon
Pampanga	2,609,744	-39,146	3	Luzon
Batangas	2,694,335	-36,930	4A	Luzon
Iloilo	2,384,415	-35,357	6	Visayas
Davao del Sur	2,265,579	-33,667	11	Mindanao
Nueva Ecija	2,151,461	-31,896	3	Luzon
Quezon	2,122,830	-31,094	4A	Luzon
Leyte	1,966,768	-29,313	8	Visayas
Camarines Sur	1,952,544	-29,183	5	Luzon
Zamboanga del Sur	1,872,473	-28,087	9	Mindanao
Isabela	1,593,566	-23,806	2	Luzon
Misamis Oriental	1,564,459	-23,015	10	Mindanao
South Cotabato	1,509,735	-22,487	12	Mindanao
Maguindanao	1,473,933	-22,109	ARMM	Mindanao
Cotabato	1,379,747	-20,696	12	Mindanao
Tarlac	1,366,027	-20,397	3	Luzon
Negros Oriental	1,354,995	-20,081	7	Visayas
Albay	1,314,826	-19,722	5	Luzon
Bohol	1,313,560	-19,544	7	Visayas
Bukidnon	1,415,226	-18,530	10	Mindanao
Cagayan	1,199,320	-17,808	2	Luzon
Palawan	1,104,585	-16,550	4B	Visayas
Lanao del Sur	1,045,429	-15,681	ARMM	Mindanao

Source: NDA [a]*This has been estimated by calculating provincial dairy demand (population x 15 kg per capita dairy cow milk equivalent consumption) minus provincial dairy cow milk supply (from Table 1).*

Table A8.8. Volume (MT, in LME) and Value (FOB '000 US$) of Philippine Dairy Exports

Products	2016		2017		2018		2019		2020	
	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value
Milk and Cream										
Liquid (RTD) Milk	14.8	31.4	0.4	1.2	25.6	28.0	38.4	56.2	24.9	40.0
Skim Milk Powder	-	-	4,840.3	1,303.5	2,735.8	1,154.3	1,839.4	484.8	116.9	103.3
Whole Milk Powder	205,544.2	83,761.3	4,207.9	1,654.3	142.2	36.9	521.0	80.9	226.0	91.6
Evaporated Milk	56.0	37.0	29.5	17.5	23,268.7	5,518.7	4,551.6	2,969.2	18.9	38.8
Cream	787.8	552.1	4,136.0	2,252.1	15,028.9	3,596.2	35,317.3	8,164.0	12,924.2	3,938.5
Condensed Milk	4.2	1.9	13,994.1	3,392.2	5,335.4	1,179.2	3,432.5	1,220.5	1,881.8	917.2
Ice cream/mixes	3,569.5	6,298.2	17,740.6	9,945.3	2,682.8	4,837.3	2,831.8	4,741.7	2,159.7	2,911.0
Ice drops/ice milk	-	-	2,689.8	2,274.1	6,663.8	5,255.5	11,931.6	9,264.9	10,128.5	7,847.6
Whey Powder	-	-	26.1	4.3	998.7	138.6	267.2	119.2	344.6	156.4
Others	429.7	931.7	3,718.8	3,768.5	2,272.7	4,680.9	1,442.6	3,906.1	2,523.8	6,870.5
Butter/Butterfat	663.3	210.0	340.7	202.7	1,123.9	631.5	2,512.3	1,550.1	2,037.7	1,285.0
Cheese	512.2	158.6	618.0	347.5	988.7	245.2	1,159.6	617.5	3,422.3	1,132.8
Total	211,581.6	91,982.1	52,342.0	25,163.2	61,267.2	27,302.1	65,845.3	33,175.0	35,809.2	25,332.8

Source: NDA, 2021d

Table A8.9. Volume (MT, in LME) and Value (FOB '000 US$) of Philippine Dairy Exports (by country)

Country of Destination	2016		2017		2018		2019		2020	
	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value
Malaysia	115,645.1	43,587.9	13,754.1	4,541.7	11,453.5	5,153.8	11,305.4	3,885.9	-	-
Vietnam	8,050.2	3,680.6	7,594.2	2,872.0	10,850.3	3,461.8	8,818.4	3,696.9	3,909.3	4,651.6
Singapore	-	-	8,468.1	3,490.5	10,484.1	4,453.1	11,837.9	6,898.0	8,082.9	5,267.6
United Arab Emirates	-	-	3,930.7	3,068.1	5,384.7	2,938.6	6,493.4	4,711.7	3,871.5	2,718.4
United States of America	-	-	-	-	2,659.5	2,380.7	4,533.3	2,783.0	5,026.9	3,587.4
Others	87,886.4	44,713.3	18,595.1	11,164.0	20,435.1	8,914.1	22,856.9	11,199.6	14,918.7	9,107.8
Total	211,581.7	91,981.8	52,342.2	25,136.2	61,267.2	27,302.1	65,845.3	33,175.0	35,809.2	25,332.8

Source: NDA, 2021e

Table A8.10. Volume ('000 MT, in LME) and Value (CIF mil US$) of Philippine Dairy Imports

Products	2016		2017		2018		2019		2020	
	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value
Milk and Cream										
Skim Milk Powder	1,435.85	349.71	1,121.44	337.67	1,276.15	296.80	1,336.99	378.43	1,439.55	450.42
Whole milk Powder	166.17	48.28	150.51	49.54	168.52	58.83	228.52	88.36	197.63	71.86
Evaporated Milk	0.60	0.18	6.73	3.25	1.35	0.38	0.02	0.03	-	-
Buttermilk/ Buttermilk powder	237.18	50.48	241.44	68.43	291.04	74.59	287.32	103.06	312.67	104.62
Whey Powder	403.93	51.08	422.34	57.84	441.14	60.70	432.41	64.97	367.14	55.44
Liquid (RTD) Milk	65.60	55.76	61.49	49.54	79.39	63.24	87.20	72.70	97.81	73.86
Cream	28.84	15.86	3.78	2.58	195.68	66.16	135.10	51.61	54.12	17.99
Condensed Milk	16.70	5.54	19.63	6.10	23.01	7.56	5.40	2.50	2.66	1.08
Others	54.62	26.39	59.00	42.18	27.16	35.65	33.23	48.62	42.84	47.02
Butter/Butterfat	232.21	106.90	247.65	169.08	259.80	189.39	262.24	189.79	250.45	139.81
Cheese	127.32	94.26	108.20	80.41	125.40	90.46	121.29	91.64	125.44	82.93
Curd	3.55	3.28	44.08	36.48	50.96	44.12	40.11	37.61	45.83	37.12
Total	2,772.57	807.72	2,486.29	903.10	2,939.60	987.88	2,969.83	1,129.32	2,936.14	1,082.15

Source: NDA, 2021f

Table A8.11. Volume ('000 MT, in LME) and Value (CIF mil US$) of Philippine Dairy Imports (by country)

Country of Origin	2016		2017		2018		2019		2020	
	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value
New Zealand	849.33	318.30	707.23	360.10	726.73	373.97	750.09	413.32	682.05	324.74
USA	841.34	194.54	741.93	201.27	915.55	209.01	795.58	226.89	1,123.51	336.24
Australia	145.82	50.56	104.39	40.83	143.71	61.06	140.94	61.22	113.78	55.78
Netherlands	-	-	184.73	45.20	180.27	43.00	230.61	61.70	155.21	55.49
Germany	137.50	40.71	126.86	46.46	-	-	137.50	49.89	85.34	37.74
Others	798.58	203.61	621.16	209.24	973.34	300.84	915.11	316.30	776.25	272.16
Total	2,772.57	807.72	2,486.30	903.10	2,939.60	987.88	2,969.83	1,129.32	2,936.14	1,082.15

Source: NDA, 2021g

Table A12.1. Commercial input suppliers servicing the dairy industry.

Name	Inputs and services	Regions
Concentrate ingredients		
Alltech Biotechnology Corp	Acidifiers, yeasts & natural products	NCR
Arctus Enterprises, Inc.	Zeolites	NCR
Ariela Marketing Co., Inc.	Acidifiers, yeasts & natural products	3
Asia Brewery	Concentrate ingredients & additives	NCR
Atlas Fertilizer Corp.	Phosphorus additives & mineral blocks.	NCR
Bayer Philippines, Inc.	Premixes, protein meals. Also crop protection, vet products	NCR
Bentoli Agrinutrition Philippines, Inc.	Minerals	NCR
Cagayan De Oro Oil Co., Inc.	Copra meal	NCR
Cenapro, Inc.	Corn germ meal & corn gluten meal	7
Cherson International Aa Inc.	Phosphorus additives & mycotoxin binders	1 NCR
Chester Industries, Inc.	Zeolite & mycotoxin binders	NCR
Cordline Vet Products, Inc.	Concentrate ingredients	NCR
Dating Bayan Agro Industrial Corp.	Concentrate ingredients	7
East Asia Vet Products, Inc.	Concentrate ingredients	NCR
Easy Bio Philippines Inc.	Protein supplements	NCR
Evonik (Philippines), Inc.	Amino acids & fatty acids	NCR
Four E Agricultural Supply (Dealer)	Concentrate ingredients	3
Grain Handlers Phils. Inc.	Extruded corn & cracked corn	NCR
Infinipeak Agrivet Trading (Dealer)	Concentrate ingredients	3
INPHILCO, Inc.	Milk replacers & powders	NCR
Inter-Island Feeds	Bone meal	NCR
Julu Cornstarch Corp.	Corn gluten	11
Kasaka Farm Industries	Oyster shell, limestone	3
La Suerte Merchandising	Bone meal	NCR
Lamsan Trading	Corn gluten	12
Lu Do and Luym Corporation	Copra meal & corn gluten	NCR
Morning Star Milling Corp.	Wheat pollard	NCR
MSO Agri-Express Trading	Minerals & toxin binders	4A
Nurich Vitameal Corp.	Dicalcium phosphate & tricalcium phosphate	1
Pheschem Industrial Corporation	Dicalcium phosphate & mono-dicalcium phosphate	NCR
Philchema Inc.	Binders	NCR
Philippine Trade Center, Inc.	Protein meals & corn germ	BARMM
Philnutri Corporation	Antioxidants	NCR
Progressive Laboratories	Wheat germ	NCR
Realvet Incorporated	Flavouring	4A
Royal Feeds & Mercantile Corp.	Corn grits, extruded corn, copra cake & full fat soya meal	NCR
Rpm Feedmill	Corn grits & cracked corn	3
Saile Industries	Zeolite	NCR
SKEM Corporation	Corn grits	5
SKP Feeds Milling Co., Inc.	Cracked corn & corn grits	NCR
Supra Feeds Enterprises, Inc.	Cracked corn & corn grits	5
Tiger Construction and Devel. Corp.	Tricalcium phosphate & tiger oyster shell	5
Union Hikari Fertilizer Industries, Inc.	Concentrate additives	NCR

Yuyek Manufacturing Corp.	Copra meal	NCR
Concentrates		
Agrichexers Feed Corp*	Concentrates & animal health products	3
Agro Master Inc.	Beef & dairy	3
Cargill Philippines, Inc.	Ruminant & monogastric	NCR
Cavite Farmers Coop (CAFFMACO)	Pig, bird, poultry, cattle, goat, dog	4A
Cdr Agro-Industrial Enterprises	Dairy	4A
Champion Feed Mills Incorporated	Beef & dairy	NCR
Cj Philippines, Inc.	Concentrates & agricultural products	3
Dc Gem Enterprise	Dairy	4A
Jet Best Multilines Corp.	Ruminants	4A
Nutrimix Feeds Corporation	Dairy	3
Palm Vieco Trade	Concentrates	NCR
Primera Agro Development Corporation	Ruminants, poultry, aquaculture	4A
San Miguel Corporation	Concentrates	NCR
Selecta Feeds, Incorporated	Dairy	NCR
Soro-Soro Ibaba Dev't. Coop. (SIDC)*	Dairy	4A
Vieonovo	Concentrates	NCR
Vision 2000 Feedmill Corporation	Cattle, swine, poultry	4A
Vitarich Corporation	Dairy & monogastrics	3
Veterinary supplies		
Adisseo Philippines, Inc.	Electrolytes	NCR
Agrispecialist, Inc.	Veterinary products	4A NCR
BASF Philippines, Inc.	Veterinary products	NCR
Broadchem Philippines Biopharma Corp	Performance enhancers	NCR
Chemvet Products, Inc.	Veterinary products	NCR
Equalivet Incorporated	Antimold & antibacterial products	NCR
JCS Chemical Industries, Inc.	Antimold & antibacterial products	NCR
Maxion Bioscience, Inc.	Veterinary products	NCR
Nutrivet Chemical Industries	Antibiotics	4A
Progressive Poultry Supply, Corp.	Veterinary products & calf concentrates	NCR
RNT Enterprises, Inc.	Antioxidants	4A
Ro-Ann Veterinary Manufacturing, Inc.	Electrolytes	1
San Miguel Foods, Inc.	Veterinary products	NCR
Sybex Animal Health and Nutrition Inc.	Binders	3
Transcend Philippines, Inc.	Growth/performance enhancers	NCR
Univet Nutrition & Animal Healthcare	Disinfectants	NCR
Universal Robina Corp.	Antibiotics	NCR
Seeds and Fertiliser		
Aljay Agro-Industrial Solutions, Inc.	Seeds (corn & rice) & fertilisers	2
Universal Harvester Incorporated	Fertilizers & acids	NCR
Herd reproduction		
ANSA Genetics Inc.*	Semen and embryos	4A
Hacienda Macalauan Inc.*	Semen & live animals	4A
Rumen Nutrition and Genetic Solutions*	Livestock genetics (and herd nutrition)	4A
Silage and TMR		
Benacorn	Corn silage, TMR, general agricultural services	3 4A

Table A17.1. Additional information of key organisations in the Philippines dairy industry and their possible involvement in a large project.

Organisation	**Department of Science and Technology (DOST) - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)**	**National Dairy Authority**	**Institute of Animal Science (IAS), College of Agriculture and Food Science (CAFS), University of the Philippines Los Banos,**
Established	1972	1995	1909
Head Office address	Paseo de Valmayor, Timugan, Economic Garden Los Baños, Laguna	Quezon City, NDA Building, BAI Compound, Visayas Avenue, Diliman, Metropolitan Manila	College of Agriculture and Food Science University of the Philippines Los Baños, College, Laguna, Philippines 4031
Key contacts	Reynaldo (Ray) V. Ebora Executive Director rvebora@gmail.com Direct Line: (049) 536-4990 Dr. Synan S. Baguio Chief Science Research Specialist Director Livestock Research Division (LRD) s.baguio@pcaarrd.dost.gov.ph	Farrell Benjelix Clores Magtoto Deputy Administrator II NDA-Central Office Office of the Deputy Administrator Email:fmagtotonda@gmail.com Phone:89260733-35 Local # 220	Dr. Rommel C. Sulabo Director
Annual Budget (million PHP)	1230 (2020)	266 (2020)	Unknown
Resourcing (indicative budget, staffing, FTE)	LRD has 12 staff.	Unknown	Unknown

Organisation	**Department of Agriculture (DA)**	**Bureau of Animal Industry (BAI)**	**Dairy Confederation of the Philippines**
Established	1898	1930	1993
Head Office address	Phone +63 (2) 8928-8741 and +63 (2) 8273-2474 Address Elliptical Road, Diliman, Quezon City, 1100 Email info@da.gov.ph	5 Visayas Ave, Diliman, Quezon City, 1128 Metro Manila, Philippines	National Dairy Authority Building, BAI Compound, Visayas Avenue, Quezon City Tel. No. (02) 697.6049 Telefax (02) 926.3840 Email: dairyconphil@yahoo.com
Key contacts	Dr. William D. Dar Secretary 8928.8756 to 8920.3986 osec@da.gov.ph	Reildrin G. Morales, DVM, MVPH MgT Officer-in-Charge, Director Email Address: bai.director@da.gov.ph Contact Number: (02) 8528 2240 local 1101-1103	
Annual Budget (million PHP)	85.5	0.7 (a component of DA budget)	NA
Resourcing (indicative budget, staffing, FTE)	Unknown	Unknown. Interviews indicate that veterinary officers are commonplace in regional centres.	Three staff – limited budget

Organisation	**Nestle**	**DVF Dairy Farm Inc**	**Batangas Dairy Multi-Purpose Co-operative (BADACO)**
Established	1911	1991	1990
Head Office address	31 Plaza Dr, Rockwell Centre, Makati, Metro Manila, Philippines	DVF Dairy Farm Plant Tel. (044) 411 1393 Maharlika Road, Barangay Talavera, Nueva Ecija	Barangay Inosloban, Lipa City, Batangas, Philippines
Key contacts	Arthur Baria, Agri-Business Head of Nestlé Philippines Inc.	Danilo Fausto. Son (Noel) is taking over as COO.	Edwin Sanchez, Consultant to BADACO. (Previous Manager)
Annual Budget ('million PHP)	117,000	NA	>24
Resourcing (indicative budget, staffing, FTE)	3,700 staff	NA	35
Impact/outcomes delivered	Has strong brand presence in Philippines in ambient temperature products	Has strong focus on jobs and engaging communities in supply chain	Successful integrated supply chain with SHD ownership.