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Is Agriculture and Fisheries Ascending the Value-Added Ladder? The State of Agricultural Value Chains in the Philippines

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Abstract

The Agriculture and Fisheries Modernization Act (AFMA) was passed and implemented a quarter of a century ago. AFMA comprised a suite of policy, institutional, and investment measures that envisaged the transformation of the agriculture and fisheries sectors, from a resource-based to a technology-based industry. One aspect of the modernization process that the AFMA is aiming at and which is the focus of this study is the development of agro-based value chains that move up the value-added ladder ascendancy. This is done by examining AFMA and the agri-food value chain development and ascendancy in the value-added ladder from the lens of the agri-food systems approach and theory of change. In addition to this, value chain case studies of selected agricultural commodities were conducted.

Unfortunately, the impact of AFMA on the modernization of the agri-food value chain systems more than twenty years after its enactment is mute. There are several factors why AFMA's role to the ascendancy in the value-added ladder of the agri-food is limited: its narrow view of value-added ladder ascendancy, its focus was mainly on just one segment of agro-based value chains, its rice self-sufficiency position impeded the growth of other agro-based value chains, and its beneficiaries were mainly for small-scale farmers and fisherfolk.

There are five worthwhile areas of AFMA intervention that need expanding for enhanced value-added ladder ascendancy. These are the market-determined credit facilities and the food safety and quality standards. The first expands the credit outreach to the often-disadvantaged rural producers while serving as a vehicle or catalyst for strengthening the links between primary agriculture production, and the backward and forward links to the final consumer markets. The second deals with developing competitive agri-based commodities and products that are consumer safe and are of an internationally acceptable quality which can facilitate the modernization of traditional retail markets. The third is the promotion of clustering of small farmers into formal groups which can facilitate the efficient coordination, transfer, and adoption of government interventions or programs. The fourth is the inclusion of ICT market-related advancements given the new normal. Finally, the fifth entails the transition of AFMA from a supply- or commodity-driven approach to the adoption of a holistic food system framework.

Finally, there is equally a need for policy measures that go beyond the present AFMA jurisdiction. Germane reforms are on the: Comprehensive Agrarian Reform and the need to phase it out and ensure a freer land market, more novel public-private partnerships that bring in the largely numerous micro and small and medium enterprises that dominate the midstream and downstream segments of the value chains, the need to overhaul the DA's "banner programs" away from rice to diversified farming systems and value chains, and the need to move DA's budget away from the provision of private goods to public goods.

Keywords: agri-food value chains, AFMA, upstream and downstream segments, food systems, theory of change, forward and backward linkages

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Is Agriculture and Fisheries Ascending the Value-Added Ladder? The State of Agricultural Value Chains in the Philippines[*]

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1. Introduction

On July 1997, Republic Act No. 8435 known as the Agriculture and Fisheries Modernization Act (AFMA) was passed by the Philippine Congress and its Implementing Rules and Regulations (Department of Agriculture Administrative Order No. 6 Series of 1998) were subsequently issued a year later by the Department of Agriculture[1] (DA). A milestone legislation, it encompassed a suite of policy, institutional, and investment measures for modernizing the agriculture and fisheries sectors, which was defined in the Act as a process of transforming these sectors from a "resource-based" to a "technology-based industry" (AFMA Section 3a). The strategic aspects of the modernization process leading to this pathway of which AFMA is envisaged to contribute directly are schematically outlined in the subsequent objectives of the Act (AFMA Section 3). One aspect of the modernization process is the promotion and development of value chains:

> g. *To induce the agriculture and fisheries sectors to ascend continuously the value-added ladder by subjecting their traditional or new products to further processing in processing to minimize the marketing of raw, unfinished or unprocessed products…* (AFMA Section3).

This paper focuses on the attainment of this aforementioned objective. Unlike previous assessments of AFMA which evaluated the Act in terms of the key measures that it espoused (i.e., production and marketing services, human resource development, research and development (R&D) and extension, rural non-farm employment, trade and fiscal measures, and other provisions, this paper examines the legislation from the perspective of a particular attribute to the modernization process. More specifically, it investigates the impact of AFMA on the value chains that developed and the nature, scope, and depth of their progress and resilience especially in the context of the emergence of major drivers of change in the past twenty years. The most important of these drivers of change were rising population, changing incomes and consumer food preferences in the local front, and in the global arena, intensified climate change variability, the uncontrolled COVID-19 which continues to adversely affect the socio-economic-political landscape of the country and worldwide, including the global value chains, and inter-and intra-trade relations.

The specific questions that the paper will dwell on are the following:

(i) Has the agriculture and fisheries sectors moved up the value-added ladder; what is the pace and extent of the value-added ladder ascendancy, and who are the major actors and stakeholders?;

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[1] Dr. William Dar, Secretary of the Department of Agriculture then, signed the Implementing Rules and Regulations was. Two decades later, Dr. Dar was reappointed as the Secretary of this Department, and it is during his last year term that the impact assessment of this measure is being undertaken.

(ii) Is modernization through value chain development on track, ahead of expectation, or lagging behind?;
(iii) Given real-world developments in the past twenty five years, what are the elements of the AFMA framework or objectives that remain relevant, and which need to be updated?;
(iv) What are the future prospects for accelerating the agriculture and fisheries modernization process through the value added ladder ascendancy?; and
(v) What will be the policy measures that will be needed to ensure that agro-food value chain development contributes to the modernization pathway of the agriculture and fisheries sectors?

This paper will contribute in the overall evaluation of the AFMA with emphasis on the agri-food value chains and their ascendancy to the value-added ladder. The specific objectives are to:

(i) Review the available literature and data that are relevant in assessing the attainment of AFMA's objective pertaining to the progress of inducing "the agriculture and fisheries sectors to ascend continuously the value-added ladder…" (Section 3.g);
(ii) Evaluate the constraints, concerns and missed opportunities that have determined the past pace of progress as well as the prospects for future agro-food value added ladder ascendancy; and
(iii) Propose the policies for going forward in attaining the AFMA objective of agro-food value-added ladder development.

To achieve these objectives and address the abovementioned research questions, the paper is divided as follows. The first section reviews the literature on the developmental thinking of the agro-food value chain processes and stages, which has led to the more dynamic agro-food systems perspective that embed the theory of change. It also discusses the approach in examining agro-food value chains. The review provides the groundwork for the conceptual and operational framework of the research study. Subsequently, it elaborates on the case study approach, which served as the methodology of the study. The next section discusses four strategic agro-food value chains, specifically the rice value chain, fruits and vegetables (often referred as the high value commodities) value chains, yellow corn – animal feed – livestock and poultry value chains, and the fisheries value chains. The last section summarizes the major findings in terms of the modernization contribution of and constraints to agro-food value chain development, which serve as the bases for the policy measures that will accelerate the modernization of the value-added ladder ascendancy in particular and the overall modernization of the agriculture and fisheries sectors.

2. Review of Literature

One of the major objectives of AFMA is to promote "value-added ladder ascendancy," which is briefly described in Section 3.g of the law as "… subjecting their traditional or new products to further processing in order to minimize the marketing of raw, unfinished or unprocessed products." This would imply that the scope of agriculture and fisheries sector activities as envisaged by the law does not only intend to modernize crop, livestock or fishery production, but that the modernization of agro-based commodities would entail their efficient and effective links with the harvesting, processing of these commodities into agri-food products, and the marketing of these products to the end-consumers, both local and foreign-based.

2.1. Evolution of the value chain concept

In the literature, the full range of activities linking crop, livestock and fishery production with the non-agriculture sector activities, mainly the food-based manufacturing (processing) and the service sectors (logistics, trading services (wholesale and retail), food services, and finance) in the delivery of agri-food products to the consumers constitutes the agri-food value chains (adapted from Kaplinsky and Morris 2000).[2] The four main segments of the value chain are the upstream (input provision), agriculture production, midstream (aggregation of agriculture produce to processing), and downstream (logistics, trading (wholesale and retail) and distribution (or consumer markets spanning from the conventional mom and pop stores to modern large supermarkets or hypermarts, and specialized buyers like food services, restaurants, hotels, and institutional buyers) segments with food consumers (local and foreign) as the final destination (**Figure 1**). This inter-linked stream of activities involves many players such as:

(i) input producers, traders, and logistics providers at the upstream stage;
(ii) farmers and fisherfolk at the farm production stage;
(iii) processors, various logistic providers, traders, and aggregators at the midstream levels; and
(iv) wholesale and retail traders, a variety of logistics providers, and a mix of agri-food sellers and buyers.

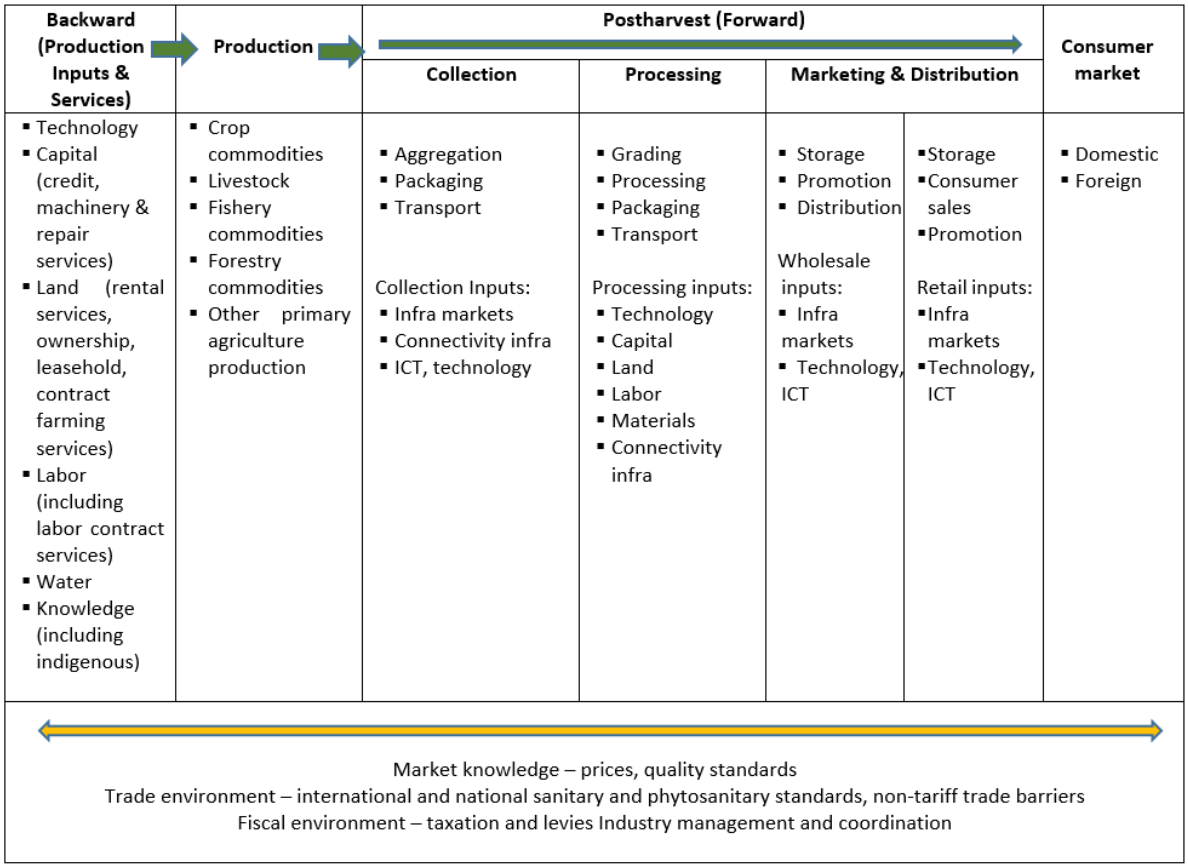
For some food essentials like staples, government players are also involved. The actors in the agri-food value chains vary in the following ways:

(i) in size (small-sized farm owners to large plantation owners, micro and small and medium entrepreneurs and multinational food companies);
(ii) whether they are formal (economic entities) or informal (micro to small traders);
(iii) their degree of links with various chain players (coordinated (meaning players are linked through different forms of procurement arrangements) or integrated (chains are owned by single enterprise)); and
(iv) whether the modality of link to the chain is vertical (players involved in production to processing and marketing and distribution) or horizontal (players doing similar activities in the chain).

Furthermore, the players are spread out spatially in both rural and urban areas, with the chain being either complex and long (many intermediators involved) or short and localized. The chain link is described as "weak" or "strong" depending on the degree and scope of coordination between and among the various players. Often and even in developed economies, primary producers are portrayed as the weakest link in the agri-food value chains (Finnerty 2016). In short, the agri-food value chain embeds not just the technical aspects of the product and its processes but more importantly, it also engenders a web of various relationships among the players.

[2] Technically, another segment of the agri-food value chain is the upstream segment (or backward linkage) where the focus is on resources and inputs used in agriculture production.

Figure 1. Generic agriculture-based (agro-based) value chain components



Source: Adapted from ADB TA[4]

Precursors of the agri-food value chain concept include the French *filière* approach of the 1950's and in the 1980's several value chain concepts emerged that expanded the *filièr concept,* including the food-based sub- sector approach, supply chain concept, Porter's value chain, and the global commodity chain (Food and Agriculture Organization [FAO] 2014, Annex). The *filière* or the commodity approach is a supplier-driven approach that focuses on mapping and analyzing the technical quantification of the physical product flows from one actor to the next until the agri-food product reaches its final consumer. The emphasis is on minimizing the transport, storage, and logistics costs to increase value addition at the midstream and downstream aspects of the supply side. The food-based subsector approach is a meso-level analytical concept that starts from a particular agricultural raw material and traces the various competing channels through which this material is transformed into intermediate and final food products in response to different needs of multifarious consumer markets. This concept looks at rural and urban interphase as well as the supply of and demand for agri-food products.

On the other hand, the supply chain approach focuses on logistics and supply management as main conduits for value addition in the product and service flows. It also introduced the concepts of vertical and horizontal linkages in maximizing value addition of midstream and downstream segments. Significant innovations in logistics (particularly in the transport, warehousing, and storages), which started in the early 20th century in developed economies,

[4] https://www.adb.org/sites/default/files/linked-documents/37292-04-nep-oth-01.pdf

ensured more efficient, just-in-time delivery of both bulky and fragile food items, and very competitive pricing (GlobalTranz Resources 2015).[5]

Employing the supply chain concept, Porter's value chain approach is designed essentially to be a business supply chain strategy tool at a micro or firm level's viewpoint (Porte 1998). Porter's contribution to the value chain concept is that he broadened the activities where value-creating opportunities and hence competitive advantage may be harnessed at the midstream and downstream segments. These included the five primary activities (inbound logistics, outbound logistics, operations, marketing, and customer service) and the four support activities (firm infrastructure, human resources management, technology development, and procurement).

Lastly, the global commodity chain concept was a milestone in value chain thinking as it puts emphasis on the buyer-driven approach, putting into center stage the final consumer markets at domestic and international levels – the key drivers for the agri-food value chains. This approach brings to the fore the issues relating to chain governance resulting from the complex management of the agricultural connections of local and global markets and the effective coordination of food supply chains and networks between and among the value chain players (Gereffi and Korzeniewicz 1994 cited in Brouwer et al. 2020).

2.2. Value addition and pathways

At the heart of the value chain concept is the creation of value addition for the stakeholders engaged in each phase of the value chain - from farm production to aggregation of farm produce including storage activities, processing, logistics, and delivery modalities (wholesale, retail, food services) until the agri-food products reach the final consumers. Operationally, value added is defined as the "difference between the non-labor costs incurred to produce and deliver a food product and the maximum price that the consumer is willing to pay for it" (FAO 2014, p.6). The added value of agri-food value chains comprises of:

(i) salaries and incomes of employees;
(ii) return on assets in terms of profit for entrepreneurs and for asset owners;
(iii) tax revenues to government;
(iv) better food supply to consumers (or consumer surplus, which is the difference between what the consumer is willing to pay for the product and the actual market price paid for it); and
(v) net impact on the environment (externalities), which may be positive or negative.

FAO (2014, Figure 3:15) disaggregates the pathways of the value-added contributions of the agri-food value chains to local and national economic growth as follows:

(i) the investment loop whereby continued positive returns to assets to the value chain players create wealth that are reinvested by the burgeoning commercial agribusiness-minded entrepreneurs engaged in the value chain segments to improve efficiency in food supply, as well as upgrade and modernize the value chain activities;

[5] See also BlumeGlobal. n.d. *The History and Evolution of the Global Supply Chain*. https://www.blumeglobal.com/learning/history-of-supply-chain/

(ii) the multiplier loop arising partly from increased incomes of workers in the value chains and mainly on the consumer surplus generated due to better food supply that benefits farmers (who are net buyers of food) and food consumers alike; and
(iii) the progress loop through the agri-food value chains' tax receipts to government, a part of which can fund social protection measures for the low-income members of society.

2.3. The quiet revolution in developing economies and value-added ladder ascendancy

2.3.1. Restructuring at the midstream and downstream segments of the agri-food value chains

In the past 50 years, developing economies of Latin America, Asia, and Africa witnessed rapid transformation of their agri-food value chains, particularly at the post-farmgate segments, or the midstream and downstream levels of the chain (Reardon et al. 2012; Reardon and Timmer 2007). Reardon et al. (2012) aptly described the agri-food value chain transformation as a "quiet revolution" as most of the policy discourse on agriculture and rural development focused on the farm production or supply level. Less attention was accorded on the midstream and downstream segments, which Reardon described as the "hidden middle" because though they constitute about 40 percent of the average food supply chain share in revenue, they are usually "missing" from public policy debate. The agri-food value chain encompasses the post-farmgate activities ranging from agglomeration of agriculture commodities (crops, livestock, poultry, fishery, forest, etc), milling, food processing, storage, transport and logistics, wholesale and procurement, retail distribution, food services, and other associated activities, and final food consumers (both local and foreign).

Reardon et al. (2018) observed three but overlapping phases of these transformations: (1) changes in wholesaling (from 1960 to early 1990s), (2) followed by the restructuring at the processing segments (circa 1970s-1990s), and then by (3) changes in retailing (1990s-2000s). During the recent pandemic years, e-commerce at the midstream and downstream segments is quickly changing the landscape of the logistics and procurement systems that may determine the next phase of the agri-food value chain transformation (Reardon and Vos 2021). The nature and pace of these transformation processes were driven by a confluence of interlinked factors, namely:

(i) the pull factor from the demand side that was spurred essentially by population and income growth, urbanization, and diet change;
(ii) policy reforms, particularly on trade liberalization, retail and foreign direct investment, and public infrastructure investments;
(iii) technological innovations to meet changing food preferences (processed and more convenient food products, and recently, the rise of organic and fresh produce), and the growing need for reliable food supply and just-in-time delivery of safe and quality food; and
(iv) exogenous factors, primarily climate change and COVID-19.

These factors are discussed briefly below:

- *Growth in consumer demand and changes in consumer preferences*

Growth in population and incomes in the developing economies of Latin America, Asia, and Africa occurred from the 1980s onwards. This was accompanied by an expansion of the urban population with the urban food market becoming the major food destination. This served as the impetus for the growth of rural-urban supply chains. Reardon et al. (2018) observed that in Bangladesh, Nepal, Indonesia, and Vietnam whose urban share of the population was averaging at just 38 percent in 2020, urban food consumption was at 53 percent. On the other hand, the poorest regions in Eastern and Southern Africa where 26 percent of the population were urban residents, the cities' food consumption was at 48 percent (Dolislager cited in Reardon et al. 2018). Other notable food demand changes included the following:

(i) declines in staple food consumption and the rise of protein-related food (meat and fish) and in more developed economies an increase in horticulture commodities;
(ii) the "Westernization" of food diets (Pingali 2006) with the increase in the consumption of processed and convenient food products from both urban and rural residents; and
(iii) shift to higher quality grains (rice), increased preference for wheat products, a change in terms of crop use (from white corn as a food staple to yellow corn as an input to livestock, poultry, and aquaculture), and in response to derived demand for processed products (e.g., rice and wheat for the production of pasta and different bread products) (Reardon et al. 2018).

These changes influenced technological innovations in processing and market logistics, variations in procurement systems (from spot markets to a variety of transactions contracts), and rural-urban links. In turn, these pushed for the restructuring of the agri-food players in the midstream and downstream segments of the agri-food value chains.

- *Policy Reforms, Infrastructure Investments, and Public-Private Roles*

Policy reforms on market orientation and private sector participation served as game changers on the structure and conduct at the midstream and downstream segments of the agri-food value chains. Protective trade and domestic policies with strong government presence dominated the political landscape in the 1950s to early 1980s of less developed economies. These were characterized by huge public investments on productive (irrigation and subsidies on inputs) and market infrastructure (wholesale markets, transport, and roads) as well as the establishment of government-run agencies that managed the procurement of farm produce, regulated food consumer prices, and controlled the international and domestic trading aspects. The premise of these interventions was that actors in the midstream and downstream levels (mainly wholesalers, agri-food processors, and traders) were generating super profits to the detriment of the large number of small-scale and low-income farmers. These public investments were supposed to reduce the transactions costs incurred by farmers, thus enabling them to obtain a higher share on the retail price of their produce.

The protectionist policy and state control stance were replaced from the 1980s to the 2000 decade by trade liberalization, openness to foreign direct investments. and more market-oriented retail sector and structural adjustment that reduced or eliminate public support systems. Liberalization of food processing and participation of foreign and domestic companies

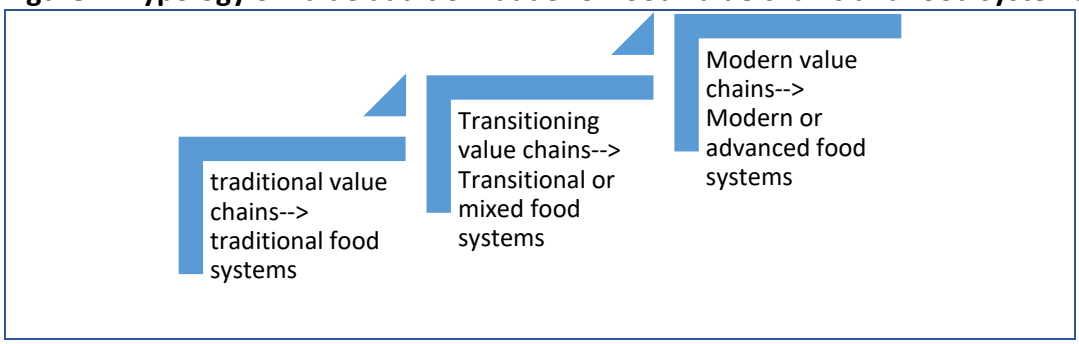
in the retail sector significantly restructured the midstream and downstream segments of the agroindustry resulting to upgraded processing facilities, production of diverse processed food products, efficient agglomeration, and logistics systems for long rural-urban links.

A case in point is the quiet revolution at the downstream retail sector. The first phase was the "supermarket revolution" which changed the wholesale and retail food system landscape in Latin America and Asia from state-owned or -managed marketing systems to large market-based wholesale or retail enterprises (Rozelle and Swinnen 2004). Almost simultaneously to this wholesale or retail trend was the "food service revolution" as evidenced by the meteoric surge of fast-food chains in response to the rapidly growing consumer demand for food away from home for China (Lui et al. 2015), and for Asia (Pingali 2007). Studies too on staple food chains like rice and potatoes illustrate how technological innovations along the mid-stream intermediaries (e.g., cold storage providers, modern millers, transport service providers, etc. [Reardon et al. 2012]) have resulted in the steady supply of affordable quality rice and year-round supply of potatoes among the rising number of urban-based middle-income class. The third wave of agri-food value chain revolution which also supported and reinforced the previous transformations occurred when more market-based policies were implemented, including the attraction of more foreign direct investments, enforcement of food safety standards, and adoption of more open trade policies (country cases were China and Vietnam). These facilitated the development of global value chains and large domestic value chains. The fourth revolution is quickly emerging in response to the COVID-19 pandemic. As supply chains were disrupted by government-imposed lockdowns and restrictions, agri-food value chains especially the modern and more integrated agri-food value chains quickly adapted and innovated through the application of e-commerce, e-procurement, and e-payment mechanisms (Reardon and Vos 2021).

2.3.2. Agri-food value added ladder

Reardon et al. (2018) provided a typology of the "value-added ladder" as a step-up process of specific food value chains (e.g., rice value chains) from traditional to transitioning and subsequently to modernized food value chains (**Figure 2**). These can be expanded to illustrate the traditional, transitional or mixed, and advanced or modern food systems at meso (or group of value chains sourcing agriculture commodities (e.g., rice, livestock, fishery commodities) and providing agri-food or agri-based nonfood products (Arslan et al. 2018; discussed in more detail below). In reality, the value-added steps are not discrete and mutually exclusive. Within related agri-food value chain groups, a variety of traditional, transitioning, and modern value chains can co-exist. For each step of the ladder, there can also be several modalities. From a general food system perspective, hybrids of value-added food value chain networks are present and co-exist depending on the influence and interaction of the "drivers of chain" on the system transformations. In the Asian case for example, the past twenty-five years saw the rapid transformation of the food value chains and food systems, shifting from traditional systems to a mix of transitioning and modern systems. As noted above, the confluence of the five interlinked transformations (Reardon and Timmer 2014) influence the relations and interactions of each segment of the value chain and define the structure, conduct, and performance of the value chain networks in general and the subcomponents and their value chain players in particular.

Figure 2. Typology of value addition ladder of food value chains and food systems



Source: Reardon et al. (2018)

The key features of each food value addition ladder are shown in **Table 1**. It describes the dominant players, the main procurement method and sources of agricultural produce, the length of the intermediation process, the nature of the coordination and degree of concentration, and the food safety standards.

Table 1. Food chain's value addition ladder and features

Value chain ladder	Key characteristics or features
Traditional food *value* chain/Traditional food systems	• Prevalence of small-scale farmers or fisherfolks engaged in predominantly local staple production and distribution through informal market outlets; • Farmers and fisherfolk produce marketable surplus with producers and operators being mostly family owned using less hired labor and little capital; • Price takers on inputs and vulnerable to supply disruptions; • Traders and processors are micro, small, and some medium enterprises (MSMEs); • Chains are fragmented, localized, and spatially short linking consumers to local wet or public markets; • Spot market links in all segments; and • No food safety standards.
Transitioning food value chain/Transitional or mixed food systems	• Emergence of commercial small-medium agriculture producers; • Co-existence of traditional transitioning food chains; • Presence of crop diversification and processed or convenience agri-food products; • Wholesale, processing, retail restructuring as well as upstream changes (farming or farm input); • Integration through consolidation; • De-intermediation; • Rural-urban supply changes; • Supply chains are long and operations depend on hired labor; • Multiple stages between farm and retail are poorly integrated and fragmented; • Dominance of small-scale farmers or fisherfolks with simple food processing and sales through wet market, street food and corner shops; and

Value chain ladder	Key characteristics or features
	• Traders and middlemen take large shares of value-added returns.
Modern food value chains/Advanced or modern food systems	• Closely interlinked from farming to midstream up to consumer markets; • Possess greater capacity to adjust and innovate; • Fair degree of control over input supplies and marketing channels; • Greater flexibility to switch between suppliers within their networks and between destination markets; • Sufficient resources to innovate and "pivot" business operations; and • Dual small and large or commercial farming more processed and packaged (partly imported) food that is distributed through supermarkets and restaurants.

Source: Reardon and Vos 2021

2.4. From agri-food value chains to agri-food systems: Applying the Theory of Change

The combined benefits of these agri-food value chains pathways can directly contribute in reducing food poverty. Sustainable agri-food value chains are developed as the economy progresses and the government institutes policies that enhance food safety, food security, and reduce environmental footprint of the agri-food value chains. Underpinning the development of sustainable agri-food value chains are the three elements of sustainability. These are:

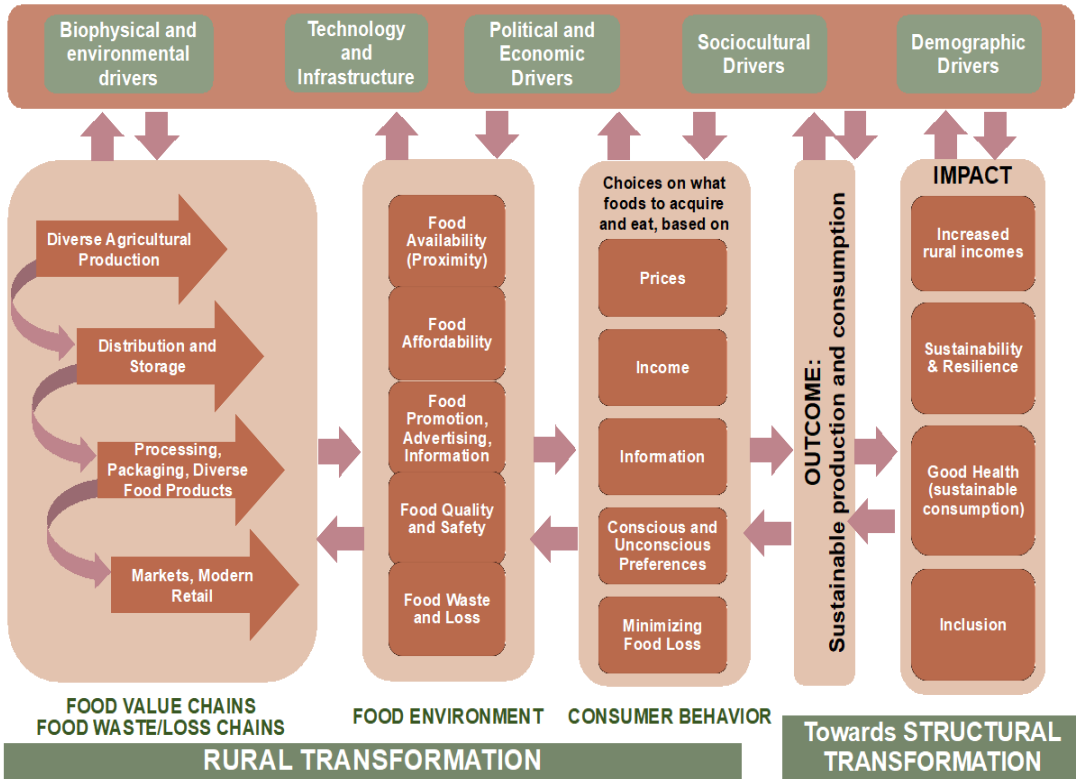
(i) economically sustainable agri-food value chains, meaning that these value chains are profitable economic ventures and are end-market-driven;
(ii) socially sustainable or the value chains in the aggregate and the environment that these operate promote inclusive growth meaning that the disadvantaged poor food consumers can readily access food; and
(iii) environmentally sustainable implying that green measures are enforced in all the value chain segments.

Understanding the development (or underdevelopment) of sustainable agri-food value chains requires a more holistic approach especially for developing middle-income economies whose agri-food value chains are changing rapidly. Although the dominance of the agriculture sectors in these economies was on the demise, there is an underlying premise that modernization of agri-food value chains can serve as pillars for industrialization. However, their interactions and interlinkages with multifarious drivers for change that are both external and internal, would need to be better analyzed and understood to identify trade-offs and synergies in contributing to the developmental objectives such as food and nutrition security, poverty reduction, inclusiveness, and environmental sustainability. A more integral agri-food systems framework that clearly distinguishes between causes (drivers) and outcomes (effects) in the transformation of the agri-food value chains is essential to better assess policy reforms. This in turn can assist in the determination of the strategic leverage points on policy, investment, and institutional reforms that can better align the transformations of agri-food value chains in both ensuring their economic viability while contributing to the national development outcomes and in the process, facilitating the industrialization process.

Agri-food or simply food systems is defined by the High-Level Panel of Experts (2017, p.11), the science body interface of the United Nations (UN) Committee on World Food Security, as constituting: "all elements and activities related to production, processing, distribution, preparation and consumption of food, the market and institutional networks for their governance, and the socio-economic and environmental outcomes of these activities." The food systems framework (**Figure 3**) elucidates the linkages and feedbacks between three key aspects of the food system. More specifically, these are:

(i) the exogenous and domestic food systems drivers such as climate change (integral to the biophysical and environmental drivers), economic growth, technology innovations and infrastructure buildup, political, sociocultural-economic drivers, and demographic drivers (rising incomes, population growth, urbanization);
(ii) food system components comprising the (a) agri-food value chains or "the dendritic cluster of value chains" (Reardon et al. 2018) including agriculture production, aggregation and storage, processing, distribution (wholesale and retail including supermarkets, institutional buyers, food services), and (b) waste/loss chains. These are mediated by the public and private food environment, before these reach the final market or the food consumers (whose demand is influenced by their incomes, tastes and preferences or consumer behavior in general); and
(iii) the food system outcomes (sustainable production and consumption) and development impact (food and nutrition security, sustainability and resilience, and inclusiveness).

Figure 3. Food systems framework



Source: adapted from Brouwer et al. 2020

The agri-food value chains component comprises the upstream (resources and inputs) segment, which is linked to agriculture production (of crops, livestock, fishery, and forestry commodities), and in turn is linked to the midstream (consolidation/distribution, storage, processing and packaging) and downstream segments of the value chain (markets and retails).

On the other hand, the component on food environment refers to (a) the availability and affordability of the commodities and food products, (b) the requisites of information, promotion, advertising, communication, and (c) attributes on food safety and quality. Public policy and private technological innovations can influence the food system's transformations through "push" and "pull" types of incentives (Arslan et al. 2018). In particular, push incentives reform the supply condition and the cost structure of the food systems through laws and regulations, taxation and external and internal infrastructure, while pull incentives focus on changing the demand side of food systems through information like labelling, social norms, or pricing. These first two components of the food systems (agri-food value chains and the food environment) constitute the supply side components of the food systems.

The third component of the food system describes the demand side, which is typified by consumer behavior (consumers' choices on what food to buy and eat are based on income, prices, preferences, and information). The three components' interactions are dynamic, i.e., (a) two-way horizontal linkage and feedback mechanisms that are influenced by the dominant players or actors affecting the supply and demand sides, and (b) the drivers of changes that include biophysical and environmental (e.g., climate change), technology and infrastructure (for example the intervention measures of AFMA), political and economic (e.g., political vested interest groups, market-oriented policies, trade), demographic (e.g. extent of urbanization), and socio-cultural factors.

The interactions and linkages of the food system components with the drivers of change contribute to the development outcomes (e.g., improved productivity), and impacts such as food and nutrition security, sustainability, resilience, and inclusiveness. As noted above, the relationship is not linear as feedbacks on the achievement of the impact (e.g., trade-offs in impact and resulting disparate attainment of the desired outcomes), as well as on the consumer behavior and changes in preferences relating to food (e.g., income growth and increased demand for organic and unprocessed food) will be relayed to the food environment and the various agri-food value chains. The interaction of the food system with multifarious external and endogenous factors also input on the food system components, thus resulting to a dynamic agri-food system landscape. The nature and degree of interactions and interrelations of the supply and demand components of the food system influence the rural economy and its relations and links with the urban sector. Subsequently, these influence the nature and pace of rural transformation (e.g., development of its nonrural farm economy though diversified rural income sources) which in turn, translate into its contribution to the structural transformation of the economy or of industrialization (e.g., food inflation and transfer of the "surplus labor" in the rural areas).

It needs to be stressed that while there is general consensus on the food system's components as well as on the nature and scope of influence of consumer behavior, the dynamics in the relationships and interactions of the food system's subcomponents, as these respond to the different drivers of change, are complex and vary spatially and intertemporally. These require the use of the theory of change in examining their contribution to achieving development goals such as food and nutrition security, expanded incomes of rural producers in and improved resilience toward ensuring inclusive growth, and ascertaining a sustainable growth pathway.

Addressing these triple goals is a major challenge as the relationships and interactions that ensue between the food system subcomponents as these respond to the array of drivers vary spatially and intertemporally. There are also trade-offs considering the conflicts in achieving these goals. For example, improving food productivity can ensure food security but it may be at the expense of achieving the sustainability outcome as more chemical fertilizers are used (Maynard et al. 2007; Hall and Dijkman 2019).

The key point of applying a food systems approach is to go beyond commodity production by including the value chain segments of the commodity and examining the commodity-based value chain from the socio-political perspectives and their interactions with the demand side. a practical 'do no harm' research and policy framework. Underlying this system's approach is the employment of the theory of change to capture the dynamics arising from the interplay of various drivers of change.

2.5. Impact assessments linking agri-food value systems to development outcomes and impact

Conceptually, seamlessly linked agri-food value chains from inputs to farm production to agri-food intermediaries and finally to consumers (or the farm to fork link) would result in more efficient food supply and demand. All things equal, access to affordable food can ensure food security and reduce food poverty while the efficient food supply and demand can expand job opportunities and inclusion of small players in the value chains. With rising incomes and diversifying consumer preferences for varied and quality food, efficient supply of and demand for food can improve the quality of life of (a) urban and rural food consumers, (b) SME actors involved as food intermediaries, and (c) farmers and fisherfolks. These were the underlying premises of government and international financial support[6] for agri-food value chain development beginning in the 1990s and continuing to date. However, several emerging studies on the impacts of these rapid and recent agrifood value chain transformations to these development goals indicate mixed results. These are summarized in Reardon et al. (2019) and are summarized below:

First, on impacts of inclusion or exclusion of small farmers or fisherfolks, the evidences show mixed results. Some studies found the effective linkage of small-scale farmers to urban consuming centers and that diversification to high value crops offers additional incomes to farmers and access to complementary services like credit, inputs, and market information. However, other studies observed that the gains of exportable high value crops accrue mainly among the upper tier and more well-off farmers in rural areas because of the stringent quality and safety standard requirements of importing countries. Farmers in remote locations are often excluded from the value chain links.

Second, the poor and low-income rural producers are off the grid of the agri-food value chain networks. A comprehensive review of this issue, while outdated, found out the poorest often do not benefit from value chain interventions (Humphrey and Navas-Aleman 2000). More recent studies of internationally funded projects confirmed this finding especially for the ultra-poor segments of the rural economy. However, it noted that successful participation in value chains of low-income rural producers depends on a minimum level of resources that are

[6] See for example in ADB 2019. Strategy 2030 Operational Plan for Priority 5: Promoting Rural Development and Food Security, 2019-2024. September. Manila: ADB. https://www.adb.org/sites/default/files/institutional-document/495971/strategy-2030-op5-rural-development-food-security.pdf; IFAD.

available to them such as proximity to markets due to good rural road networks, access to advisory services and credit, etc. (Kaplan et al. 2016; Devaux et al. 2018). Other studies on specific value chain integrations (VCIs) showed incremental increases on producer incomes, but no significant impact on food security among the poor (Herrmann et al. 2018; Ebata and Huettel 2019). The limited impact especially on the low-income rural producers has been attributed, among others, on structural issues beyond the influence of VCIs, such as insecure land tenure rights (Donovan and Poole 2014).

Third, impacts on off-farm employment indicate that during transitional phases when small and micro enterprises (SMEs) dominate the midstream and downstream, off-farm employment has expanded in both rural and peri-urban areas especially at the low entry industry- or service-sector related jobs such as transport, loading, commerce, food preparation, and small processing. However, as the food system modernizes, cheaper priced processed and non-nutritional urban produced foods penetrate rural areas resulting in rising incidence of obesity. Modernization with the rise of large vertical integrated agro-food value chain intermediaries also displaces small scale traders, transport providers, and processors.

Fourth, longer supply chains that are prevalent among SME-dominated agri-food value chains tend to be more vulnerable to external shocks. During the COVID-19 pandemic, the demise of many of these entities was prevalent. Only the large and modern agri-food value chain intermediaries have the resources to be flexible and pivot their business operations that can adapt to the challenging economic situations. There is a tendency however, for these large modern agro-food value chain actors to reinforce their hold on the value chain networks through consolidation and concentration of their vertical integration of key midstream and downstream activities.

Fifth, there is an overall mistrust sentiment between agriculture producers and service providers and buyers of producers that are prevalent in both informal and formal purchase arrangements. In such an environment, agriculture producers have the tendency to pole vault. Similarly, buyers and service providers can also renege on the arrangements.

Lastly, what these findings highlight are that transformations and upward movements of agri-food value chains in the value-added ladder can in the short-term, be economically beneficial to small-scale farmers and SMEs who belong to the low-income rung. However, these gains do not necessarily translate in the medium-term toward the attainment of developmental impacts like growth, food security, inclusion, and nutrition security. There is a role for the public sector in ensuring that the short-term gains from agri-food value chain changes become aligned with the country's development outcomes and impacts. Performance measures that indicate the efficacy, efficiency, and relevance of the public sector's interventions in enabling the upgrade and upscaling of agri-food value chain intermediaries, and in minimizing the trade-offs between their potential positive and negative contributions to the developmental outcomes and impacts will have to be put in place.

As AFMA's implementation period occurred at the same time that significant transformational changes transpired in the agri-food value chains in developing economies including the Philippines, part of the review of the AFMA was done in the context of its understanding of the agri-food value chains. More specifically, on how these adapt to measures on agri-related investments, policies, and institutional arrangement, their impact on the agri-food value chains on the operations of the value chain intermediaries particularly on the nature and pace of their value-added ladder movement, and the implications of these changes in the agri-food value

chains on the attainment of the development outcomes and impacts espoused by AFMA. Some evidences in the literature on the public sector's roles and measures that effectively faciliated agri-food value chain development and their positive impact on developmental outcomes and impacts were:

(i) Policies that incentivized agri-food value chain intermediaries to undertake technological and institutional innovations in response to changing food demand and external shocks like the global rice crisis in 2008 and climate change;
(ii) Contract enforcements and reduced business and transactions costs for start ups and operations of agri-food related SMEs;
(iii) Basic infrastructure (roads, storage facilities) for linking rural production clusters with urban markets, development of peri-urban centers, and afforable mobile and information, communication, and technology (ICT) access for data and market information;
(iv) Tariff and non-tariff measures that regulate export and import of agri-food commodities;
(v) Transitions from protectionist-oriented to export-driven market; and
(vi) Coordinated actions of inter-agencies and accountability measures.

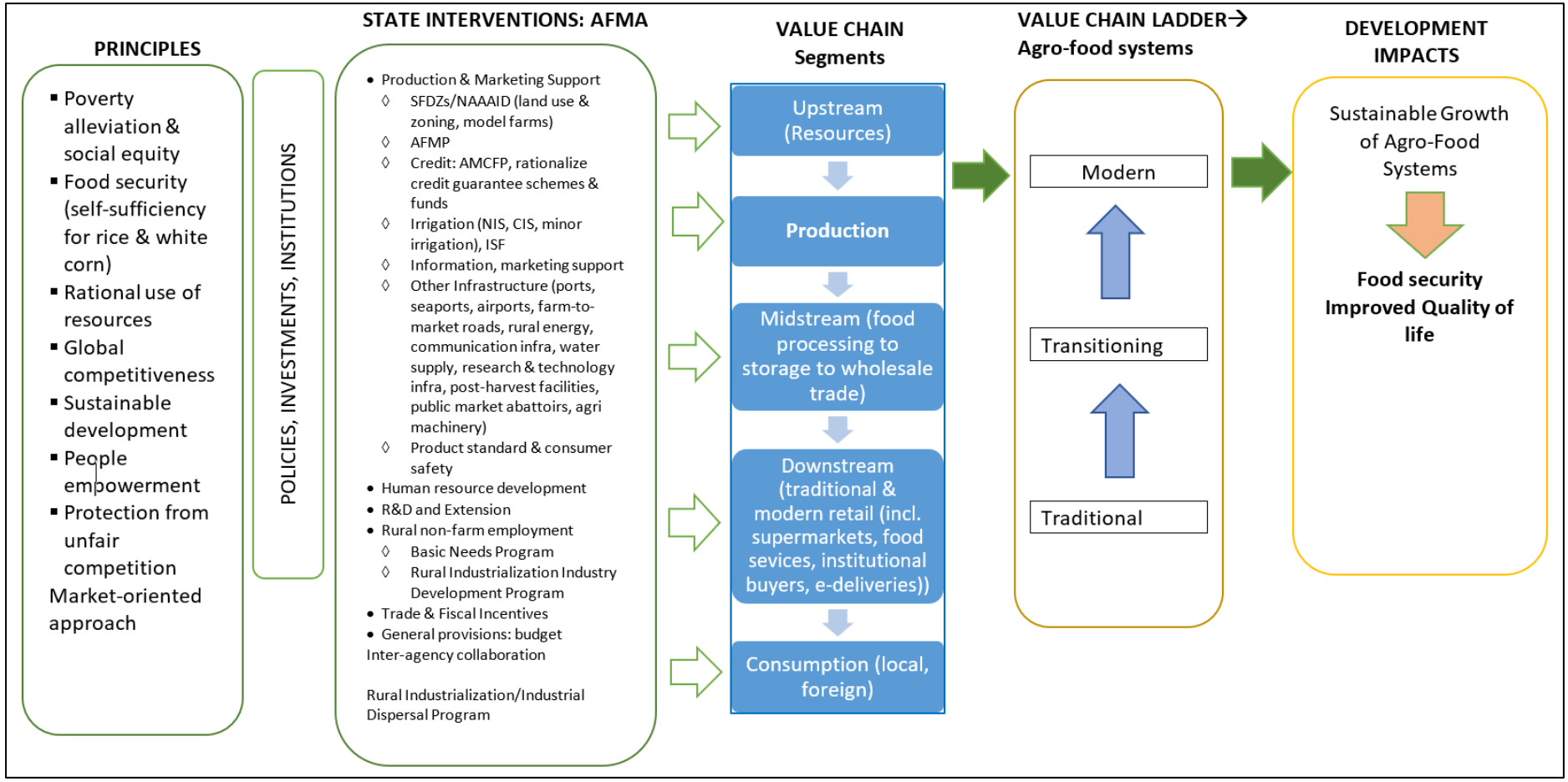
These aspects of government interventions applying the AFMA lens and their implications on value added ladder ascendancy as an essnetial ingredient for modernization of the agriculture and fisheries setors are assessed in the paper. Given this, the next section elaborates on the framework and methodoly used by the research.

3. Framework and Methodology

3.1. The conceptual framework

This paper examines AFMA and the agri-food value chain development and ascendancy in the value-added ladder from the lens of the agri-food systems approach (see **Figure 3**). **Figure 4** provides a schematic illustration of the agri-food value chain system in the Philippine and AFMA's principles, intervention measures for modernization, and its envisaged goals of improved rural incomes, inclusive growth, and stainability. The agri-food value system approach is holistic. Specifically, the state of the supply side comprising the gamut of agri-food value chain components of the various agriculture and fisheries commodities (i.e., the inputs and the upstream or farm and fishery production, midstream, and downstream segments) is put in the context of the drivers of change or the external and internal factors that influence its present condition (AFMA is one of the influencers for change), and the varying response/s to the agri-food consumer market (or the demand side). The state of the consumer market (both domestic and foreign) is also not homolytic as it is influenced by differences in the demographic as well as economic-socio-cultural-political factors, and also by individual consumer preferences. Second, it is comprehensive in that it essentially puts the interplay of the supply and demand side of agri-food products as the core of the whole food environment, which encompasses the availability, accessibility, resilience, and sustainability of the agri-food value chains at meso, national, and global levels (these are the key ingredients of food security, FAO 2008). Third, because of the complex interphase and inter-relations of the various players in the agri-food value chain system, the analytics goes beyond the economistic- and technology- oriented approach and instead relies on the theory of change, a multidisciplinary approach in understanding the dynamic and nuanced aspects of the agri-food value system. The agri-food value chain system combined with the theory of change explains more clearly the

Figure 4. AFMA and Philippine agro-food value chain transformation



inextricable link of the agri-food systems' value-added ladder ascendancy to agriculture modernization and more importantly, on rural and structural transformation of the economy. With appropriate public and private support, modernizing agri-food value systems can contribute to the development goals of food and nutrition security, poverty reduction, and sustainable development. **Figure 4** applies the theory of change on AFMA's interventions as these influence the food systems in general and food value chains in particular. De Figueiredo et al. (2014) provide an expanded version of the structure-conduct-performance for value chain assessment of interventions of public policies such as AFMA, and recently, the Rice Tariffication Law, the Sagip Saka Act, and Personal Property Security Act wherein these have implications on agri-food value chains development.

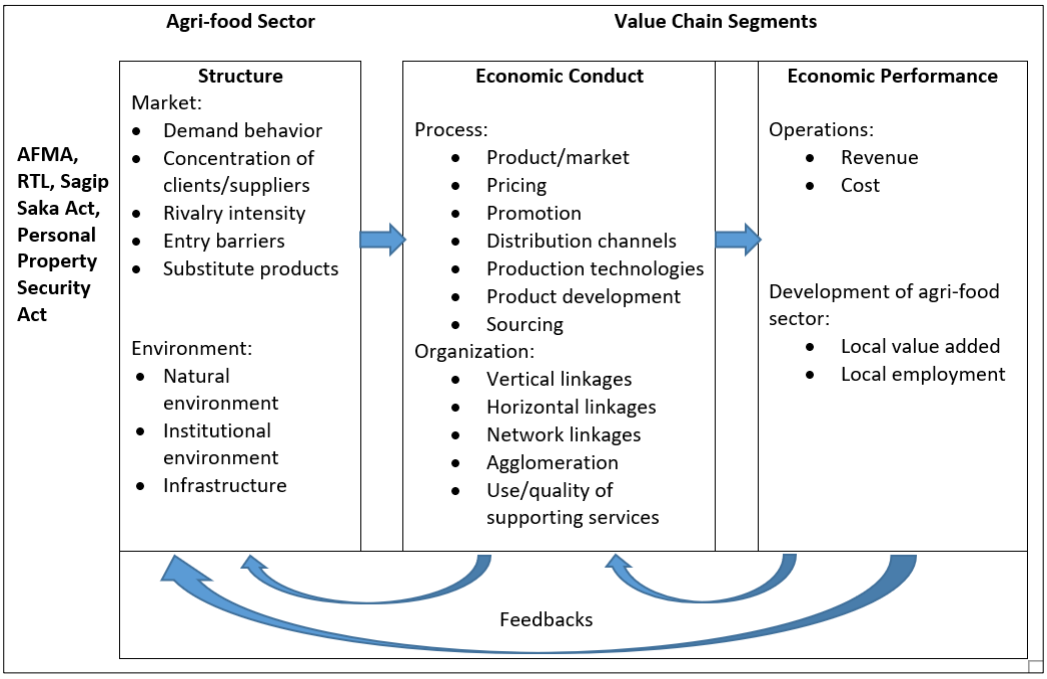
3.1. Methodology and analytical tools

Operationally, the research study employs the meso approach whereby strategic agro-food value chains are examined in the context of the structure-conduct-performance (SCP) mode of analysis (**Figure 5**). The three components of the value analysis are explained as follows:

(i) Structure refers to the characteristics, composition, and distribution (relative size) of players (farmers/fisherfolk, small-medium-large scale actors or entities in upstream, midstream, and downstream segments of the value chain);
(ii) Conduct involves the actions taken by players such as price-taking, product differentiation, tacit collusion, and use of market power; and
(iii) Performance reflects the value addition attributes of the value chain players in terms of productive efficiency, allocative efficiency, and net returns or profitability variables.

It is important to note that these three components are not uni-directional but that there are feedback loops.

Figure 5. Dynamic value chain structure-conduct-performance framework and categories with AFMA and other milestone legislations



Source: Adapted from de Figueiredo et al. 2014

Figure 5[7] also applies the Theory of Change in examining AFMA from the perspective of the dynamic interplay and interrelations of the various actors and stakeholders on the supply and demand aspects of the food value chains and as these respond to various drivers of change. It also puts into context the socio-economic-political contexts in determining the developmental outcomes and impact of the selected agri-food value chains. The desired outcome of AFMA on the food systems and food value chains is the development of food value chains that are efficient and competitive, inclusive, and resilient. For the envisaged outcome to be achieved, the food value chains and the food system that these embody progress up the value-added ladder (from traditional to transitioning (or mixed) to modern or advanced food value chains and food systems). Sustained growth of food value chains (the intermediary impact) is envisaged to contribute to the espoused goals or development impacts of AFMA interventions, specifically, food security and improved quality of life.

The study employs a case study analysis focusing on the rice value chain, the corn-livestock-poultry value chain, and the fisheries value chain. The three agri-based commodities have significant gross value-added contribution to the Agriculture, Fishery, and Forestry (AFF) sector, employ a large proportion of the rural workforce, cover a large share of the total agriculture area, and in the case of rice and fisheries, are major food staples of poor Filipinos in particular. On the other hand, as for livestock and poultry, these are the upcoming food products that respond to rising incomes and changes in consumer preferences for sources of energy and protein. The study also links corn, which by itself embodies a complex value chain with feed as its end-product that in turn, serves as a vital input to the supply of livestock and poultry and its manufactured products. The fishery value chain case study is important partly because of its domestic and foreign consumer market outreach, and because of its sustainability implications.

Because of health protocols and restrictions in mobility, the study authors relied mainly on a desk review of relevant literature, official data sources, and online international data sources, together with other sources available from their professional networks. Where feasible, time series data have been collected and relevant statistical analysis have been utilized and deployed. For the livestock and poultry as well as the fisheries case studies, key informant interviews have been conducted with producers, processors, traders (wholesalers, retailers, etc.), and technical experts from government organizations to understand the challenges, constraints and opportunities of the selected value chain case studies.

The next section provides an overview of the AFMA and its limitations in the context of agro-based value chain promotion and development.

[7] Figure 5 embodies the food systems approach as illustrated in Figure 3 with focus on AFMA as a major public policy intervention that mediates between the food value chain (supply) component with the demand side. The focus of this study will be on agri-food or simply food systems. These comprise crops, livestock and poultry, and fisheries.

4. AFMA and its weak link to agro-based value chain development

4.1. An overview of AFMA

The Agriculture and Fisheries Modernization Act (AFMA, or Republic Act (RA) No. 8435) of the Philippines was approved in December 1997, and its Implementing Rules and Regulations[8] was completed a year after. This legislation laid down the strategic public good and services that purportedly would accelerate the modernization of the agriculture and fisheries sectors while enhancing the profitability of their stakeholders. It also provided the enabling environment to assist the sectors in facing the challenges of globalization with the country's membership in the World Trade Organization (WTO) in 1995. The modernization pathway was to be guided by seven (7) principles[9], namely:

(i) poverty alleviation and social equity;
(ii) food security;
(iii) rational use of resources;
(iv) global competitiveness;
(v) sustainable development;
(vi) people empowerment, and
(vii) protection from unfair competition.

Moreover, the law espoused multi-pronged objectives that essentially outlined what it envisaged are the economic and social traits of the sectors' modernization pathway. These are:

(i) Sector transformation from resource-based to a technology-based industry;
(ii) Profitable and income-generating economic activities especially for the small-scale farmers and fishermen who constitute the major labor force of these sectors. Two subcomponents of this objective are that the measures for modernization would expand the range of economic ventures to include diversified agro-based commodities (high value crops), agro processing, agribusinees-related and agro-indsutrial enterprises, and that economic intensification and expansion will be done through equitable access of assets, resources and services;
(iii) Accessible, available, and stable food supply;
(iv) Horizontal and vertical integration, consolidation, and expansion of agriculture and fisheries activities through the formation and development of collective organizations such as cooperatives, farmers' and fisherfolk associations, corporations, nucleus estates, and consolidated farms to take advantage of economies of scale;
(v) People empowerment;
(vi) Market-driven approach to benefit from comparative advantage;
(vii) Value-added ladder ascendancy defined as the processing of agriculture and fishery commodities to agro-based products, and their subsequent marketing;
(viii) Industry Dispersal or rural industrialization;
(ix) Pro-market and environmentally sustainable growth; and

[8] The DA Administrative Order (AO) No. 6 Series 1998, served as the IRRs of AFMA.
[9] AFMA considers these as "principles" defined as "fundamental doctrines or tenets or distinctive ruling opinions" (https://www.dictionary.com/browse/principle). However, the published AFMA assessment reports considered these principles as espoused goals of the law as well as that have yet to be achieved. The principles are multifarious and wide ranging, cutting across economic, social and political perspectives that if put into operation would undoubtedly result to trade-offs. In many senses, they contributed to the ambiguity of how this legislation can contribute to the modernization of the sectors.

(x) Improved quality of life of the consitutents of these sectors.

To achieve these envisioned modernization attributes, AFMA stipulated five major intervention components comprising sixteen specific measures **(Table 2)** with a budget allocation earmarked for its continued implementation. In 2019, the budget for AFMA-related expenses has already totaled to about PhP 1 trillion (DAP 2021).

Table 2. Public goods and services of AFMA for the modernization of the agriculture and fisheries sector

Major Intervention Components	Specific Measures
Production and marketing services	Strategic Agriculture and Fisheries Development Zones; Agriculture and Fisheries Modernization Plan; Credit; Irrigation; Information and marketing support services; Other infrastructure (fishports, seaports, airports, farm-to-market roads, rural energy, communications infrastructure, water supply system, research and technology infrastructure, post-harvest facilities, public market and abattoirs, agriculture machinery); and Product standardization and consumer subsidy
Human resource development	National Agriculture and Fisheries Education System; Post-secondary education program; and Network of national centers of excellence for territory education
Research and development and extension	Research & development; and Extension services
Rural nonfarm employment	Based Needs Program (renamed as Safety Net Provision); Rural industrialization and Industry Dispersal Program; and Training of workers
Trade and fiscal incentives	Tax exemptions for imported marterials and equipment
General provisions	Appropriations; Congressional oversight; and Implementing rules and regulations

Source: Republic Act No. 8435 or The Agriculture and Fisheries Modernization Act (AFMA)

4.2. AFMA and its limitations in achieving its value-added ladder ascendancy objective

AFMA's narrow view of value-added ladder ascendancy. One of AFMA's objectives in achieving the modernization of the sectors was that its implementation would contribute to the value-added ladder ascendancy of the agriculture and fishery commodities. From the AFMA perspective, value-added ladder ascendancy was defined narrowly as the transformation of the agriculture and fishery commodities into agri-based products, or value addition is augmented after primary production as the agro-based commodities undergo midstream (aggregation, processing, and logistics) and downstream (wholesale and retail, and associated logistic infrastructure and services) processes with each process adding value to the agro-based commodity until it finally reaches the domestic and/or foreign consumers as a manufactured food or agro-based nonfood product. As **Figures 2 and 3** and particularly the Philippine-based food system of **Figure 4** illustrate, this agro-based supply chain and the other chain networks operate in a dynamic environment impacted by external (e.g., biophysical, climate change,

global trade) and internal (socio-economic-political, demographic) drivers of change as well as by public policy interventions (e.g, AFMA) and private innovations that mediate the supply and demand of these agro-based commodities and products. Each supply chain comprises of a diverse range of stakeholders whose relations reflect an asymetry of powers in the operations and management of the chain. All these factors and forces influence the nature and state of the agro-based food value chains and the overall food system, which are categorized into the value-added ladder ascendancy archetypes: traditional (belonging to the bottom rung of the ladder) that can progress to transitioning, and further up the ladder, as modern (see **Figures 2 and 4**). The dominant value-added ladder typology of the food system has implications on the modernization pathway of the agriculture sector in general and in turn, can shape the nature and pace of rural and structural transformation (**Figure 4**). Because of the dynamic and complex landscape, the supply chains in the food system can display a range of value-added ladder typologies as in the Philippine case and which is elaborated in the succeeding sections.

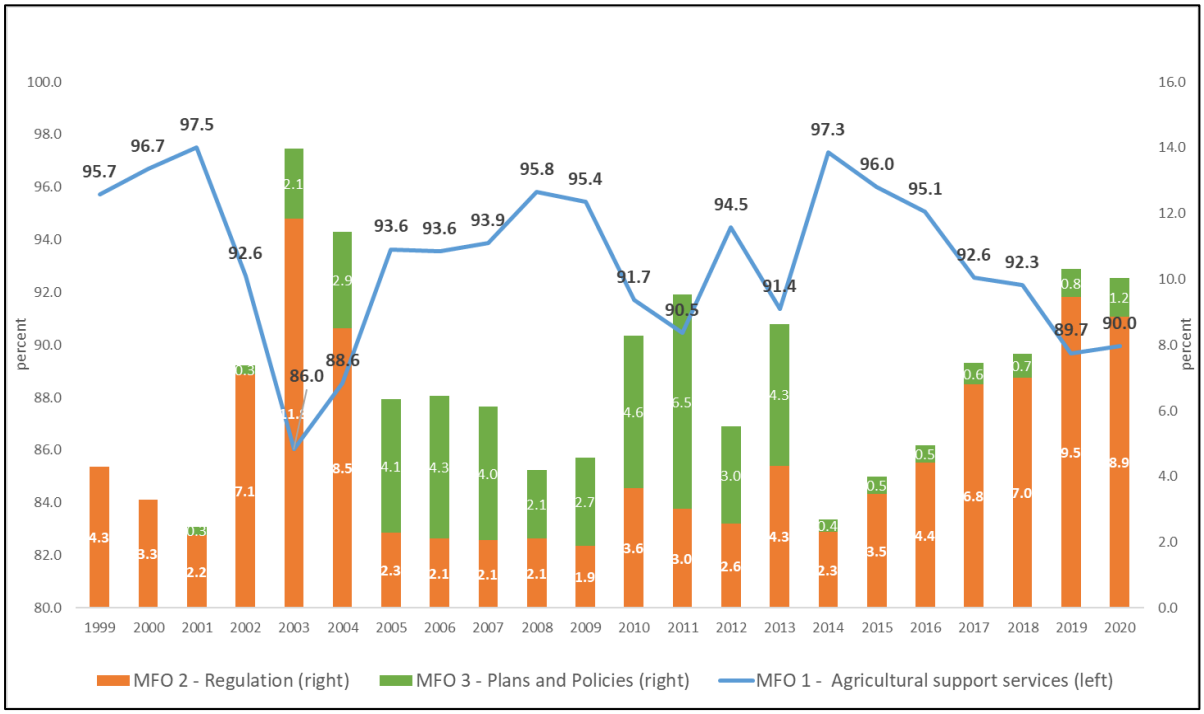
AFMA's focus was mainly on just one segment of agro-based value chains. Suffice to say at this stage that AFMA's influence in accelerating the value-added ladder ascendancy of the agriculture and fishery sectors (i.e., from traditional to modern agro-based value chains and food and/or nonfood systems) and for that matter, even within the limited confines of its definition of agro-based value-added ladder ascendancy (shift from commodities to products), were at best tangential. AFMA's focus was confined on just one segment of the agro-based value chains, specifically on the primary production of the agriculture and fishery sectors. The mix of interventions of AFMA was purposively aimed at improving the primary production and productivity of the agriculture and fishery sectors. Except for some of the connectivity infrastructure (e.g., farm to market roads), public support for the other economic segments of agro-based value chains – midstream, downstream, and the upstream (input provision and services) segments – in contributing to the modernization of agro-based value chains was not addressed in the AFMA. As seen in the **Figure 6**, there was a spending bias of the DA for the provision of input subsidies and support services wherein its budget share out of the total major final output expenditure is 93.2 percent from 1999 to 2020.

One can contend that this supply focus at the primary production level of AFMA may be justified considering that many studies identified this segment of the agro-based value chains as the "weakest link"[10] (e.g., Esposito et al. 2020, and Briones 2014). In a stocktaking study on agro-based value chains (Briones 2014), the lack of reliable supply and consistent quality of agriculture commodities was one of the major concerns raised by the players in the midstream and distribution segments of the food chain. This had impeded them from optimizing their operations and from being competitively at par with their foreign rivals. In a recent diagnostic of the rice value chains, the assessment also affirmed that most of the weaknesses and constraints for efficient and effective value chain linkages were at the production and aggregation levels (Philippine Rice Industry Roadmap [PRIR] draft 2022). Conceptually, more efficient, productive, and profitable production of agriculture and fishery produce can impact positively on the agro-food value chains if at the production segment of the value chains, affordable, reliably accessible and stable supply of raw materials that are of sufficient volume and quality for food production are achieved. However, the transformation of the sectors' primary production segment to one that is efficient and competitive, has been sluggish during the AFMA's nearly quarter century of implementation. As documented in the three assessment

[10] It should be stressed that the weak feature of this segment highlights the fact that it operates ***not in isolation*** of the other components of the value chain.

reports of AFMA,[11] the economic performance of the agriculture and fisheries sectors was weak in terms of production, productivity, per capita volume, and high costs (and low returns) in the production of the major commodities (especially rice and corn), fisheries, and livestock and poultry (see **Figures 7 and 8**). The performance indicators, such as agri-food exports, of the AFF sector also dismally paled especially when compared to the country's Association of South East Asian Nation (ASEAN) neighbors (see **Figure 9**). Philippine agriculture trade deficits were likewise widening and the composition of agriculture exports and their country destinations were on the downtrend (**Figure 10**). As a result, Clarete (2021) estimated that the country incurred large potential export income losses of approximately USD 230 million in 2018 (see **Table 3**).

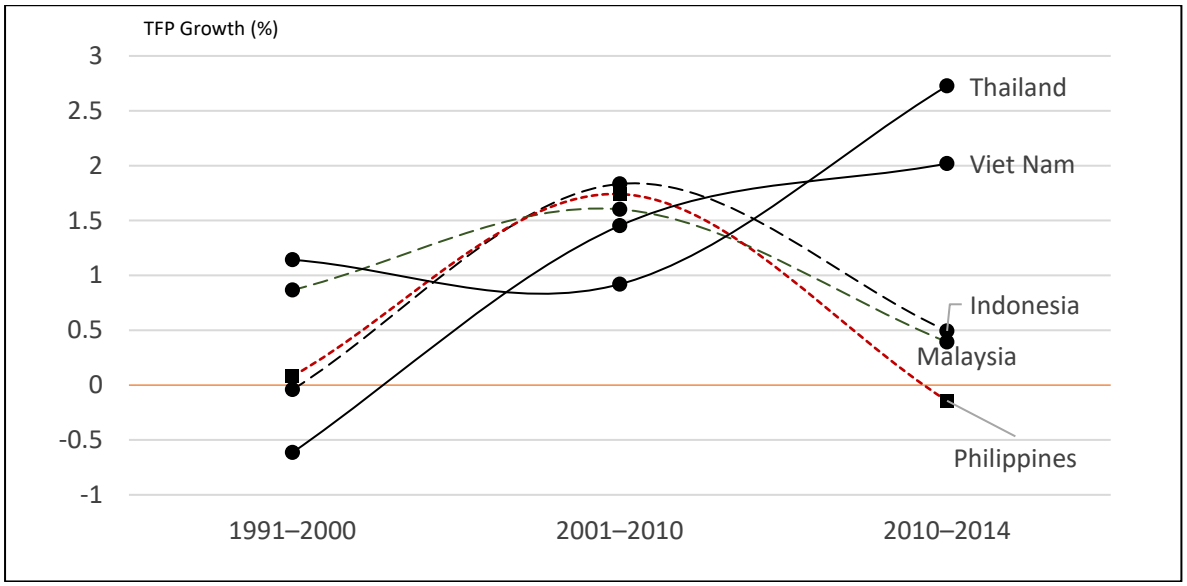
Figure 6. Budget shares of the major final outputs from 1999 to 2020



Source: DA

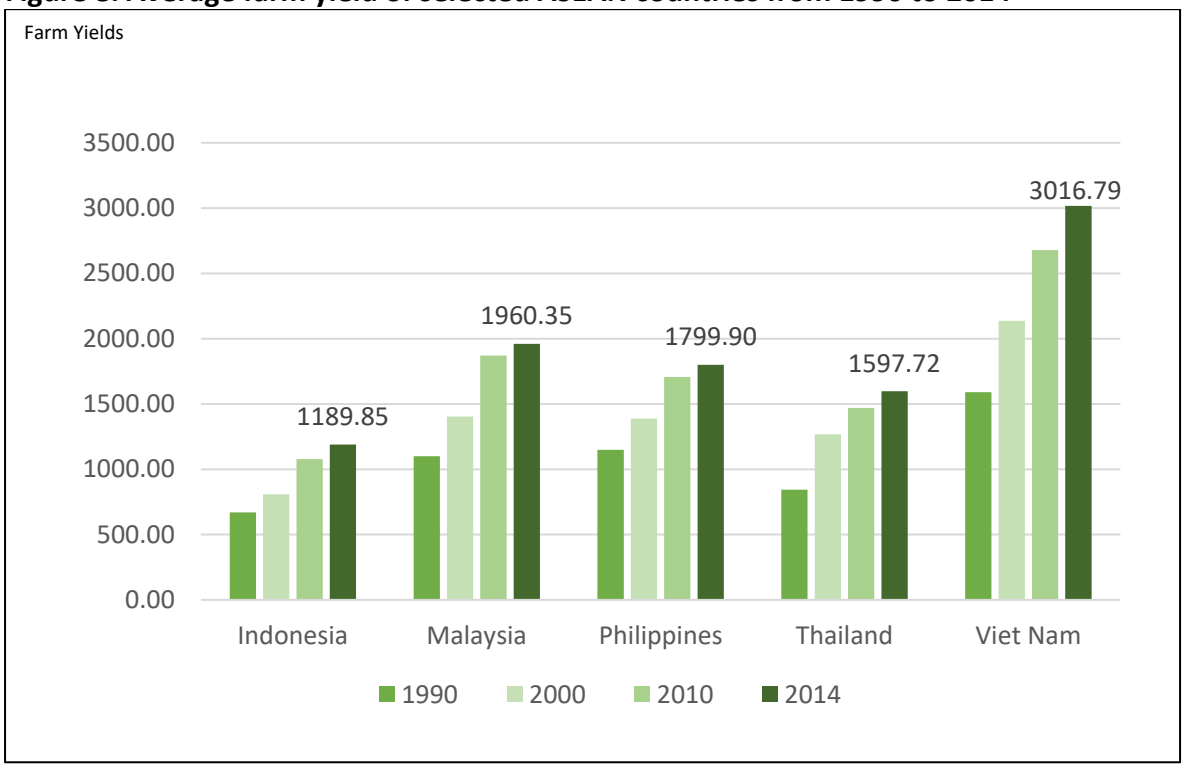
[11] Three assessments of the AFMA have been done since its time of implementation. The first was conducted by the University of Asia and the Pacific, which covered the years 1998 to 2008. The second and third assessments were done by the Development Academy of the Philippines for the years 2009 to 2013, and the most recent for 2014 to 2019. The focus of these three evaluations has been largely on the implementation and financing status of the intervention components and measures and the corresponding issues and concerns that ensue or remain unattended.

Figure 7. Total factor productivity in agriculture of selected ASEAN countries from 1991 to 2014



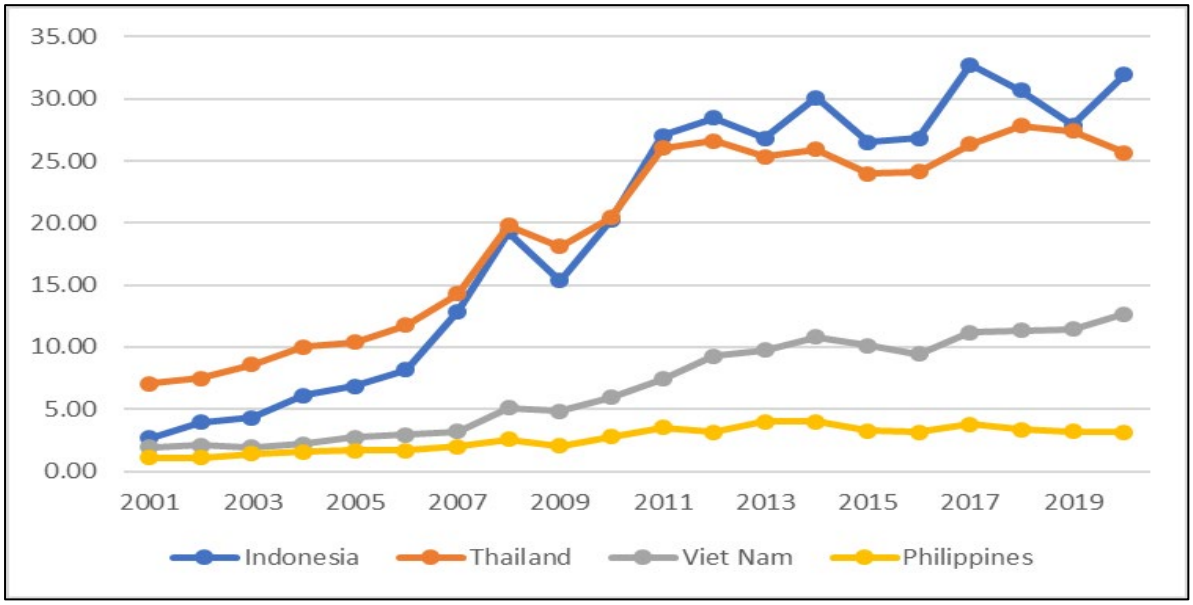
Source: Clarete (2021)

Figure 8. Average farm yield of selected ASEAN countries from 1990 to 2014



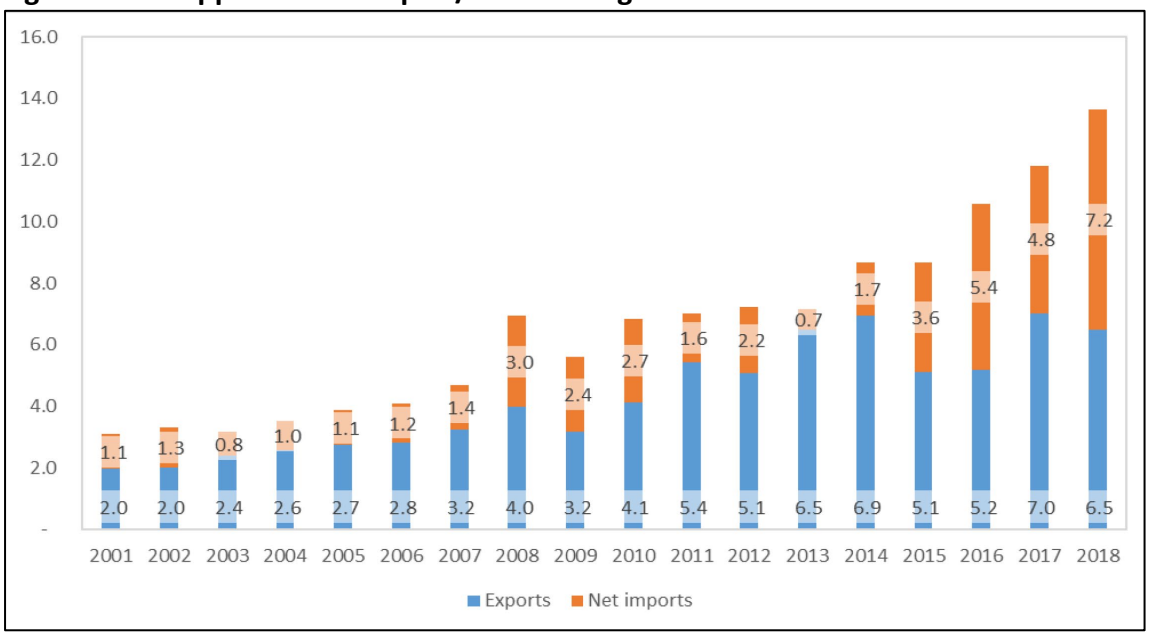
Source: Clarete (2021)

Figure 9. Agri-food exports of selected ASEAN countries from 2001 to 2019 (in USD billion)



Source: Briones (2021)

Figure 10. Philippine trade surplus/deficit on agri-food from 2001 to 2018



Source: Briones (2020)

Table 3. Estimated potential lost income of the Philippines arising from differential growths on agri-food exports in 2018 (USD million)

Top 20 Destinations	Imports From Rest of the World		Philippine Export to Country		Growth Differen-tial	Potential Forgone Income
	Annual Mean	Mean Growth	Annual Mean	Mean Growth		
United States	17,488	5.1%	1,161	-7.7%	12.8%	148.8
Germany	8,272	0.4%	114	-1.1%	1.5%	1.7
United Kingdom	7,222	-1.5%	100	5.3%	-6.8%	0.0
China	6,234	10.1%	380	12.6%	-2.5%	0.0
Netherlands	6,089	2.0%	526	0.3%	1.7%	8.8

Top 20 Destinations	Imports From Rest of the World		Philippine Export to Country		Growth Differen-tial	Potential Forgone Income
	Annual Mean	Mean Growth	Annual Mean	Mean Growth		
Canada	5,457	5.1%	78	-10.7%	15.7%	12.2
Italy	5,262	0.2%	73	-11.2%	11.4%	8.3
Japan	4,939	-2.4%	601	0.7%	-3.1%	0.0
Belgium	4,684	-0.3%	43	-4.3%	4.0%	1.7
Spain	3,951	3.1%	75	26.2%	-23.1%	0.0
Saudi Arabia	3,353	-10.5%	48	-6.1%	-4.3%	0.0
United Arab Emirates	3,228	-5.2%	108	-2.2%	-3.0%	0.0
Australia	3,212	1.7%	53	2.1%	-0.4%	0.0
Hong Kong, China	2,802	4.6%	66	-23.0%	27.6%	18.2
Vietnam	2,660	10.9%	45	5.0%	5.9%	2.6
Korea, Rep.	2,344	2.6%	292	4.6%	-2.0%	0.0
Malaysia	2,229	-4.2%	57	-4.6%	0.4%	0.2
Singapore	1,709	2.2%	60	-21.4%	23.6%	14.1
Thailand	1,584	2.9%	104	-9.4%	12.3%	12.8
Iran, Islamic Rep.	936	-6.2%	57	-5.3%	-0.8%	0.0
Total	**93,980**	**1.9%**	**4,128**	**-1.5%**	**3.4%**	**229.7**

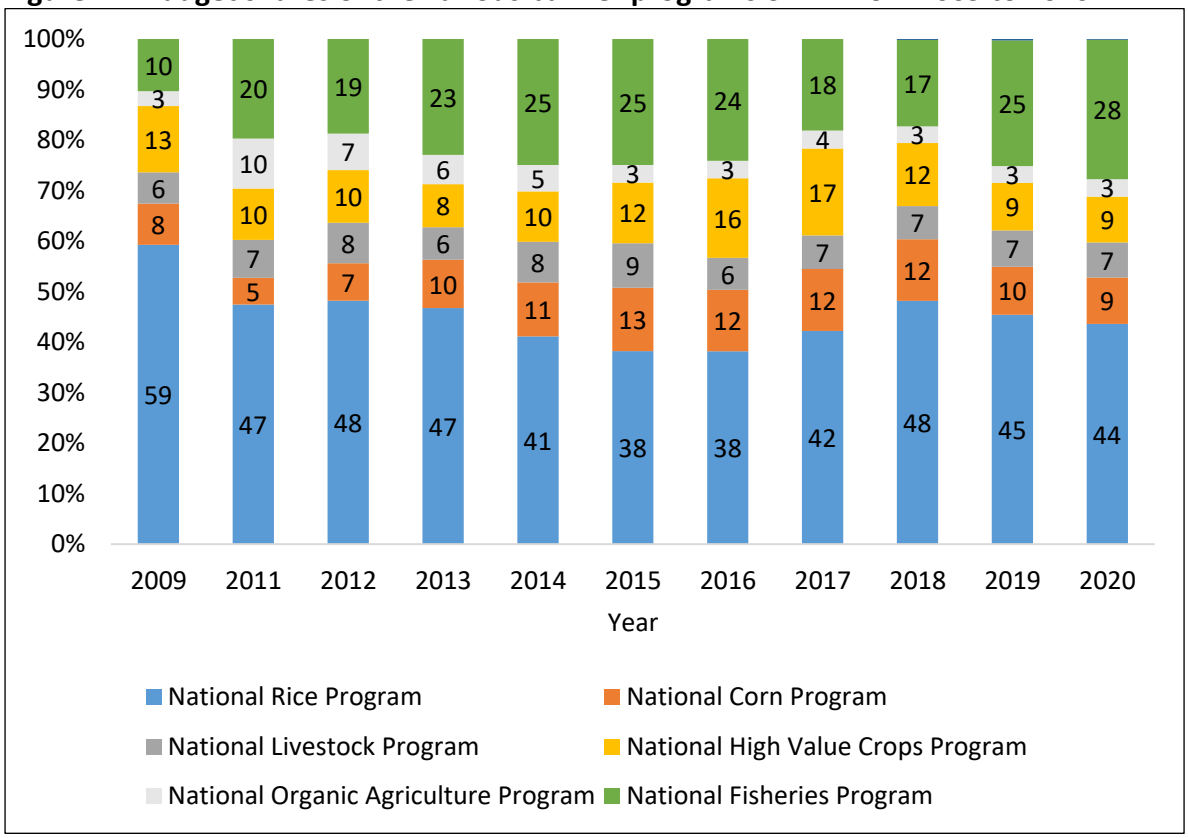
Source: Clarete (2021)

Maintaining the rice self-sufficiency position impeded growth of other agro-based value chains. Diversification of agriculture produce, an index for expanding income sources in the rural areas and an impetus for robust agro-based value chain development, was at a turtle pace, rising minimally in the last two decades from 19.6 percent in 2000 to 20.6 percent in 2018 and 22.9 percent in 2019 (World Bank 2020). This is despite the fact that the High Value Crop Law was already in place in 1995, two years before the AFMA. The low growth of high value crops was in stark contrast with the robust growth of the high value crops especially in Southeast Asia, where governments adopted a more outward-oriented policy of targeting the export markets and aligning local practices with global standards (PRIR draft 2022).

Limited agriculture diversification was due in large measure, to the lopsided attention accorded by the government to a few traditional crops, principally rice. Rice value chains were provided special treatment by government and de facto, by AFMA implementation. This was to the detriment of the growth of potentially competitive agro-based value chains. Although market orientation was an integral approach espoused by the AFMA, the rice sector was exempted from it as AFMA maintained the rice self-sufficiency stance wherein the policy landscape in the provision of public goods and services was dominantly protective. A combination of trade and distortive domestic support policies were enforced in the rice value chains. Trade policy barriers that served as market access barriers included tariffs, non-tariff measures, and technical barriers to trade. Domestic support policies such as market price support and payments based on input subsidies, distorted the inputs and outputs markets of agri-based goods. Until 2017, the sector was in the highly sensitive list of the WTO where high tariffs and quotas were implemented subject to increasing minimum access volume from the country's selected rice exporting partners. Aside from these trade restrictions, the government-imposed market price support and input subsidies. An Organization for Economic Co-operation and Development (OECD) study computed the Producer Single Commodity Transfer (PSCT) for the rice sector in the Philippine. PSCT is a measure of the degree of protection accorded to the sector. Historical data for 2010 to 2020 showed an upward trend, increasing from 39 percent in 2010

to 62 percent in 2020. From 2013 to 2020, the PSCT was averaging at 62 percent implying that domestic rice producers were essentially non-competitive when compared to its ASEAN counterparts whose PSCT ranged from 18 percent in 2010 declining to -13 percent in 2019 for Vietnam. Similarly, Indonesia's, an equally big rice importer, PSCT on rice was 30 percent in 2010, increasing only slightly to 39 percent in 2019 (PRIP 2022 draft). The important role and strategic position of the rice value chain in the economy had significant effects on the agriculture sector's economic performance. Specifically, the lopsided rice-centric focus of the government in the provision of public goods as also illustrated in the AFMA implementation and other programs of the DA diverted scarce public resources to the rice subsector as shown in **Figure 11** wherein, on average, approximately 50 percent of DA's banner program budget went to rice from 2009 to 2020. As observed by the Philippine Rice Industry Roadmap draft report (2022), the lack of competitiveness of the rice subsector directly contributed to the slow agriculture transformation as it did not incentivize rural labor from moving to rural non-farm and urban employment (PRIR draft 2022).

Figure 11. Budget shares of the various banner programs of DA from 2009 to 2020



Source: DA

Unfortunately, the rice-centric budget of the DA did not translate to greater forward linkages on the rice sector. As seen in **Table 4**, there is relatively larger forward linkage gains to the non-rice sectors after the enactment of AFMA. More specifically, fruits and nuts subsector obtained the highest forward linkage improvement of 43 percent from 19994 to 2012. It is then followed by the livestock and poultry, and corn sub-industries with forward linkages gains of 41 and 36 percent, respectively, given the same period (see **Table 4**). In contrast, coconut, which is one of the country's top agriculture export product, has seen its forward linkages to other sectors deteriorated after the implementation of AFMA (see **Table 4**).

Table 4. Estimated forward linkages improvement of the various AFF subsectors from 1998 to 2012

Agriculture sector	Forward linkage					1988-94 (a)	2000-12 (b)	(b) - (a)	1994 to 2012
	1988	1994	2000	2006	2012	Avg	Avg	Diff	% change
Fruits and nuts	0.48	0.59	0.55	0.65	0.84	0.53	0.68	0.14	43
Livestock and poultry	0.73	0.64	0.83	0.75	0.9	0.68	0.83	0.15	41
Corn	0.98	0.92	0.99	1.03	1.25	0.95	1.09	0.14	36
Palay	0.95	0.91	0.97	1.09	1.17	0.93	1.07	0.14	28
Fisheries	0.61	0.57	0.54	0.67	0.71	0.59	0.64	0.05	25
Vegetables, tubers & root crops	0.54	0.68	0.55	0.8	-	0.61	0.68	0.07	19
Other agricultural activities	1.24	1.18	1.25	1.24	1.22	1.21	1.24	0.03	4
Sugarcane	0.92	0.97	1.25	0.99	0.98	0.95	1.07	0.13	1
Fiber crops	1.12	1.24	0.92	1.2	-	1.18	1.06	-0.12	-4
Other crops, n.e.c.	1.19	0.81	1.44	1.22	0.73	1	1.13	0.13	-10
Coconut, including copra	1.54	1.24	0.97	0.94	1.11	1.39	1.01	-0.38	-10
Forestry and logging	1.14	1.32	1.11	2.06	0.67	1.23	1.28	0.05	-49

Source: PSA and authors' computations

AFMA's beneficiaries were mainly for small-scale farmers and fisherfolk. The numerous and geographically dispersed small-scale farmers and fisherfolk were the major beneficiaries of AFMA's interventions. There are no exact numbers of these economic stakeholders, but rural workers and producers in general are estimated at 5 million (Dy 2008)**.** In terms of farm sizes, there were 5.56 million farms in 2012, of which 57 percent are less than 1 hectare, and only 0.03 percent are farms with an area of 50 ha and over (Ballesteros 2019).[12]

Concerns relating to the post-harvest activities of agro-based value chains (such as logistics, processing and marketing) were addressed partly through provisions of "Other Infrastructure" facilities. However, recipients of these facilities were limited to small-scale farmers, fisherfolks, and their associations. Excluded from access to these measures are the largely private economic agents who already perform a gamut of roles in the midstream and downstream components of the value chains.

Major stakeholders engaged in the midstream and downstream segments of the agro-based value chains comprise private-run micro, small, and medium enterprises that are, in fact, form

[12] The country's Comprehensive Agrarian Law succeeded in abolishing the hacienda estate system in all but the sugar-producing province of Negros Occidental and reducing the prevalence of inefficient tenancy arrangements.

the backbone of the industry and service sectors of the country. In 2018, there were about 1 million registered establishments of which around 90 percent were micro and small enterprises[13], many of whom were involved in agro-based value chain related activities.[14] Economic contribution of the micro, small, and medium enterprises in 2018 was substantial - 36 percent of GDP, and about 5.7 million jobs generated.[15] Their non-inclusion in AFMA is a big gap considering that value chain improvements are important in expanding the rural producers' incomes through better access of the input and output markets, technological advancements for enhancing their produce, as well as access to value chain financing. Understanding the value chains can also reduce the marketing margins and postharvest losses. From a value chain perspective, the high costs of transportation, milling, packaging, and working capital were the largest sources of the higher costs and lack of competitiveness of the rice value chain in general, which could have been addressed in the AFMA.

4.3. Way forward in enhancing the value-added ladder ascendancy

Five worthwhile areas of AFMA intervention that need expanding for enhanced value-added ladder ascendancy are the market-determined credit facilities and the food safety and quality standards. The first expands the credit outreach to the often-disadvantaged rural producers, while serving as vehicle or catalyst for strengthening the links between primary agriculture production and the backward and forward links to the final consumer markets. The second deals with developing competitive agri-based commodities and products that are consumer safe and are of internationally acceptable quality which can facilitate the modernization of traditional retail markets. The third is the promotion of clustering of small-farmers or backyard raisers into formal groups which can facilitate the efficient coordination, transfer, and adoption of government interventions or programs. The fourth is the inclusion of ICT market related advancements given the new normal. Finally, the fifth entails the transition of AFMA from a supply- or commodity- driven approach to the adoption of a holistic food system framework (or farm to plate approach).

First, the gains from AFMA's financial reforms can be broadened with the engagement of the private sector-run backward and post-harvest segments of the agro-based value chains. Financial reforms of AFMA were in tune with the current policy thrust of enabling the private sector in providing financial services to small farm and fisherfolk holders. Specifically, AFMA:

(i) phased out the subsidized direct credit programs of the government;
(ii) established the Agriculture Modernization Credit and Financing Program (AMCFP) that served as the umbrella credit program for the agriculture sector by transferring the funds from the direct credit programs to government financial institutions. Subsequently, these institutions served as wholesalers of the funds for channeling to qualified private banks, cooperatives, microfinance non-governmental organizations (NGOs) that retailed these funds to agricultural and fishery producers; and

[13] Collectively, micro, small and medium enterprises are activities with less than 200 workers and asset size below PhP100million.
[14] These included in the upstream segment of agro-based value chains the input suppliers and distributors, agriculture machinery repair entrepreneurs and rental services, labor contract services, etc.; the midstream-related economic agents including those who perform the functions of aggregation, processing, logistics; and downstream segments or those who do wholesale and retail activities. Consumers, both domestic and foreign, are the final destination of the agro-based value chains.
[15] https://cpbrd.congress.gov.ph/images/PDF%20Attachments/Facts%20in%20Figures/FF2020-19_MSMEs.pdf

(iii) adopted market-determined interest rates for participating financial institutions to fully cover their operations.

The market-based principles espoused by AFMA may have somewhat facilitated the increase in the flow of credit to the agriculture and fisheries sectors (DAP 2021). Loanable funds to agriculture by private banks (commercial banks, thrift banks, and rural banks) grew and were higher than those granted by government banks between 2008 and 2018 (DAP 2021: 324-325). Surveys conducted by the Agriculture Credit and Policy Center (ACPC) further showed that the proportion of small farmer borrowers increased from 47 percent in 1997 to 52 percent in 2017 (DAP 2021:326-327). The incidence of small farmers borrowing from formal financial institutions (mainly rural banks, cooperatives, and microfinance NGOs) expanded from 24 percent in the late 1990s to 60 percent in 2016-2017, while the share of those who borrowed from informal financial sources (e.g., family relatives, friends, traders, etc.) decreased during the same period. In the ACPC survey, only 6 percent of the loans of the farmers surveyed by ACPC were sourced from traders, millers, and input suppliers.

However, the overall ratio of total agriculture credit funds sourced from informal sources was still higher relative to the AMCFP which mediated formal financial institutions' funds especially among those engaged in fisheries, livestock, and permanent crops (DAP 2021: 327-328). Although there was a noticeable increasing trend of credit for diversified production that were sourced from formal financial institutions (cooperatives and microfinance NGOs), there is still lack of financial depth in the outreach of formal financial institutions to small-scale farmers and fisherfolk and credit funds that they provide remain inadequate.

Despite this good progress in increasing the flow of credit to the agriculture and fisheries sectors, the proportion of loans for these sectors to total bank loans remain low averaging at 3 percent from 2008 to 2019. It is important to note that this is way below the mandatory bank regulation of allocating 25 percent of total loanable funds to agrarian and agriculture ventures (DAP 2021: 330-331). The low appetite of formal financial institutions to provide credit to these sectors has been attributed to the perceived high risks and high transactions costs of funding agriculture and fishery projects, mainly because of:

(i) systemic risks due to the seasonality and vulnerability of these sectors to weather and climate changes and insufficient diversification of rural economies (UAP 2008:152);
(ii) highly dispersed and miniscule farming and fishing operations;
(iii) land reform which impacted negatively the land and credit market (impeding especially the development of collateral instruments (UAP 2008);
(iv) unfamiliarity of banks and their lack of expertise and data on agriculture operations and viable credit retailers like cooperatives and microfinance institutions (MFIs), constraining them from developing tailor-made financing products and expanding their outreach in the rural areas; and
(v) poor management activities of the sectors in production contributing to low productivity and unreliable supply of quality produce (DAP 2021).

Moreover, there is also the political exigency accorded to credit. Recently, the national government has embarked again on subsidized agriculture credit. AMCFP funds of about PhP 530 million were earmarked to ACPC for the Production Loan Easy Access (PLEA) and the Survival and Recovery (SURE) credit program with terms of low to zero interest rates, and reversal of past due loans to ACPC (DAP 2021). On the other hand, other subsidized credit

was embedded in the machinery access and credit components of the Rice Competitiveness Enhancement Program (RCEF). Unfortunately, these are crowding out especially the viable formal financial institutions from performing this vital credit service to the farmer and fisherfolk. One option would be to ensure time-bound provision of this credit facility.

More viable options for the government are to actively enjoin the private sector entities that are already providing informal credit to these sectors while performing the upstream, midstream, and downstream activities. These agents (traders, agro-processors, input suppliers, and market agents) have "intimate knowledge of the cash flows and reliability of their primary agricultural producer clients" (UAP 2008: 147). These private entities provide timely financing and can be a source of additional financing considering that more than 40 percent of the added value are outside the primary agriculture production (Reardon 2012). More importantly, they link the small rural producers effectively to the local and global supply chains. Moreover, with the rise in the share of non-farm rural incomes many of which involve agriculture trading, small scale agriculture food enterprises, and food services (especially online services), etc., there will be a need to broaden the outreach of rural credit to both the farm and fisherfolk producers and the MSMEs in the rural and peri urban areas (UAP 2008). Innovative financial products can ensue whereby both short-term, medium-, and long-term credit services can develop, paving the way for more competitive and robust rural financial markets based on demand. For example, large agro-processors, big traders, and institutional buyers can serve as wholesale credit conduits from the banks to credible traders, and cooperatives who in turn will link with the rural producers. Others are forward contracts, warehouse receipts, leasing, insurance, inventory credit, venture capital, and even deposits.

Second, the Product Standards and Consumer Safety (PSCS) measures of AFMA were an opportunity for the government to pro-actively modernize the value chain segments and facilitate value-added ladder ascendancy through the promotion and development of competitive agri-based commodities and products that are safe, of desired quality and are fit for consumption in key segments of the agri-based value chains (primary production, retail, and consumption). The key public roles in this area are firstly, the promotion and adoption of local and internationally acceptable Product Standards and the Codes of Practices from farm to fork, and secondly, the enhanced awareness and active engagement particularly of the local consumers. Under AFMA, the Bureau of Agricultural and Fisheries Product Standards (BAFPS) was established with the intent of linking agri-based commodity and product standards from farm to fork and in the process of ensuring consumer health and safety. Its all-encompassing roles included policy formulation and oversight as illustrated in the AFMA Section 63 (items a to c):

> "(a) (the enforcement of) standards of quality in the processing, preservation, packaging, labeling, importation, exportation, distribution, and advertising of agricultural and fisheries products;
> (b) the conduct of research on product standardization, alignment of the local standards with the international standards; and
> (c) the conduct of regular inspection of processing plants, storage facilities, abattoirs as well as public and private markets in order to ensure freshness, safety, and quality of products."

The performance of these roles was challenging. Within the DA, there were existing regulatory bodies (such as the Bureau of Plant Industry [BPI], Bureau of Animal Industry [BAI], Bureau of Fisheries and Aquatic Resources [BFAR], etc.) that enforced their own regulations on quality and conformity with sanitary and phytosanitary standards (SPS). Consequently, these

resulted to overlapping functions and struggles on jurisdiction. The major regulatory agencies in the DA are the BPI for crop protection, SPS compliance, supply of safe and quality fresh produce, seed development and pest residue analysis. There are also other specialized crop related agencies that have both developmental and regulatory functions, such as the National Tobacco Administration, Philippine Coconut Authority, the Fiber Industry Development Authority, National Food Authority, and the Sugar Regulatory Authority. For animal and livestock, there is the BAI with attached agencies – the National Meat Inspection Services (NMIS), the National Dairy Authority (NDA), and the Philippine Carabao Center (PCC). For fish and fish products, BFAR is in-charge of regulations and compliance for fishery and aquatic commodities and products.

The "tug-of-war" on jurisdiction between BAFPS and the regulatory agencies of the DA has impacted the formulation and implementation of the Codes of Practices. For example, the Good Agriculture Practices (GAP) and the Good Animal Husbandry Practices (GAhP) which were started by BAFPS were eventually transferred to the BPI and BAI, respectively. The NMIS performed the Good Manufacturing Practices (GMP) and the Hazard Analysis and Critical Control Points (HACCP) for slaughtering and dressing. On the other hand, BFAR took charge of the fish processing and mechanization as well as the GMP and HACCP related to fish. Overall, transport and logistics regulations and compliance for the livestock and fishery products were done by NMIS and BFAR. By 2017 and despite the AFMA's stipulations on the jurisdiction of BAFPS on the food and safety standards and protocols for agri-based food and nonfood commodities and products, BAFPS' powers and functions were significantly clipped to product and food safety standards formulation, while the regulatory agencies of the DA maintained its functions of enforcement and inspection on the quality and safety measures in both local and trade matters. Additionally, these regulatory bodies did not delegate their developmental roles on food standards and safety. Without decoupling the regulatory policy from enforcement, the opportunity for illicit rents increases. Further, as there are inadequate preventive systems (audit and inspection) and early warning systems in place to preempt, manage, and control in a timely manner external shocks such as plant and animal disease outbreaks, food poisoning, food fraud incidences, etc., the chances of regulatory capture due to lack of accountability measures are intensified (DAP 2021: 441).

Moreover, efficient provision, delivery, and dissemination of food safety standards as well as the associated consumer protection protocols became more challenging due to the need for BAFPS to interface with various government agencies that already play multifarious roles. With the passage of the Food Safety Act of 2013, the BAFPS and the DA's regulatory agencies (e.g., Fertilizer and Pesticide Authority [FPA], BAI, BFAR, and BPI) have to coordinate with the Department of Health (specifically, the Food Development Authority [FDA]) on consumer health and safety, and with the Department of Trade and Industry (DTI) on trade related matters[16]. Close coordination with the local government units (LGUs) is also essential

[16] On determining which are processed products for monitoring, inspection, and enforcement of product quality (safety is FDA concern) for processed products, the conventional approach is that DA takes charge of fresh produce and minimally (primary) processed products (no alteration in product forms) while DTI is responsible for processed and packaged products whether primary or secondary-processed products. However, the Food Safety Act has broadened the coverage of agri-processed products that are under the jurisdiction of BAFPS. Similarly, NMIS, BPI, BAFPS, BFAR, National Dairy Authority, Philippine Coconut Authority on one hand and FDA on the other struggle on what is considered as semi- processing or full processing and hence. Often, the agriculture-related agencies apply products safety and quality standards and regulations for the produce that are of their concern, but FDA would still require similar if not the same tests and analysis before granting the sectors business entities

especially in terms of ensuring freshness, safety, and quality of agriculture and fishery commodities and additionally, ascertaining the hygiene and sanitation, and occupational safety standards of public and private markets. In sum, the convergence initiative among government institutions that was instituted in 2015, while good in principle, was highly problematic when put into operation.

"Political turfing" at the intra-DA level and the poor coordination among government agencies that have hampered full-scale adoption of food and consumer safety standards may have also contributed in stymying the modernization and value-added ladder ascendancy of agro-based value chains and in contributing to the heterogeneity of agri-based value chains. This is evidenced by the large number of small-scale farmers, livestock producers, and fisherfolk who are not convinced on the merits of and thus do not practice the codes of practices such as GAP, GAhP, etc. (DAP 2021). Major reasons for their non-adoption are the additional costs (such as transportation) entailed and the cumbersome and long processing time required in acquiring the certification for these practices. Additionally, the costs for applying for recertification are so prohibitive for small rural producers and MSMEs discouraging them to continue their adoption of the protocols. Those who do avail of and apply these codes of practices are mainly the large farms owners can afford the costs of applying these codes of practices. Consequently, the commercial farms gain economically from certification as these open their market opportunities with better links on their supply chains not just domestically but also globally (DAP 2021:457-458). The disparity in the adoption of the codes of practice by farm size and scale of operation puts a wedge between the low adopters but largely comprising the numerous small-scale rural producers and MSMEs on one hand, and on the other, the high adopters but are the few large-scale rural producers who satisfy the technical requisites of modern supply chain networks. In the context of the value-added ladder schema, this situation can exacerbate the technical divide and impede the transition of the majority of rural producers to progress up the value-added ladder unless measures are instituted that would incentivize the small-scale rural producers and MSMEs to adopt the codes of practices.

Another evidence of the heterogeneity of agro-based value chains in the country is illustrated at the retail markets where there are numerous traditional informal wet markets co-existing with modern retail outlets. There are more than 42,000 traditional public wet markets, and about 1.3 million micro retail stores (mom and pop or sari-sari stores) nationwide (Singian 2020) that represent the organizational retail structures belonging to the bottom rung of the value-added ladder (see **Table 5**). In the past decades when consumer incomes have been rising and tastes for varied and quality food products expanded, modern retail shops like supermarkets, hypermarkets, convenience stores, and warehouse clubs increased rapidly and co-exist with the predominantly traditional retail outlets. SM markets (the dominant player), Robinsons, and Puregold Price Club are the biggest retail chains but account only for 20 percent of total sales. These modern retail shops provide alternative shopping through mobile online, which became the trend during the COVID-19 pandemic.

which qualify as semi-processed commodity producers with the Licenses to Operate (LTOs) and Certificates of Product Registrations (CPRs) (DAP 2021).

About four-fifths of the total food supply are domestically produced, with majority being accessed by Filipino food consumers in the traditional wet markets. One of the differentiating features of these two retail market archetypes is their access to and adoption of food safety and quality related standards and protocols. More specifically, there is asymmetry of information on food safety standards and protocols whereby modern retail outlets have the knowledge and resources to develop and follow their own standards and specifications, while the prevalent traditional retail markets are highly constrained in accessing and adopting these protocols. Unfortunately, AFMA does not particularly address these technical knowledge gaps on food safety and standard protocols that prevail in the traditional retail market outlets.

Consequently, these have adverse implications on inclusive growth as majority of Filipino consumers (especially the rural poor) buy their agri-food commodities from these traditional markets and these outlets are their main sources of nutritious food. Between the modern retail and the traditional markets, there is a more urgent need to pay close attention on the traditional markets in terms of providing and disseminating food safety and standard protocols. For AFMA to contribute in the value-added ladder ascendancy of traditional agri-based value chains, tackling the technical gaps in the food safety standards and protocols of the traditional retail markets can catalyze the modernization of traditional agri-based value chains. In traditional retail wet markets, there are a numerous suppliers, rural producers and vendors, and traders and retailers who subject the agri-commodities to multiple handling and thus, exposing these commodities to the ill-effects of improper sanitation and hygiene. Unfortunately, the existing sanitation and hygiene practice of the players can pose significant food safety hazards.

> Similarly, traditional markets that supply small-scale food service establishments like "carenderias", eateries, and canteens with raw food materials that make the latter vulnerable to food safety hazards. In fact, foodborne diseases and zoonoses have become a major public health concern in these markets, small mom and pop stores, and small eatery outlets (Muhammad 2020). Observance of food safety standards becomes imperative and can become one of the vehicles for progressing the traditional markets to transition into modern archetypes. Other infrastructure and policy measures that need to be in place especially in small eateries and wet markets that are mainly availed of by the major low-income groups include: (i) water, sanitation and hygiene facilities and their periodic monitoring to ensure that these are operational, particularly such as good water supply, handwashing and toilet stations, cold storage facilities, proper drainage systems, light and air ventiallation systems, etc.; (ii) strict enforcement of and regular training on proper safety management protocols such as Good Manufacturing Practices, HACCP, and proper food handling, food safety, and sanitation practices; (iii) promotion and use of digital traceability and recall systems; and (iv) transparent, accountable and effective inspection and incentive systems at local government levels (Barrakat, M. "Modernized Wet Markets: An Approach to Prevent Future Global Public Health Crises" (https://www.food-safety.com/articles/6611-modernized-wet-markets-an-approach-to-prevent-future-global-public-health-crises).

Education and communication of these standards and safety procedures can serve as catalysts to the modernization pathways of these types of retail markets. There are also modalities of arrangements that can link the modern retail with the traditional retail markets into productive collaboration models. These interventions on food safety and protocols however, are major lacuna in the AFMA legislation.

Table 5. Modern and Traditional Retail Outlets in the Philippines, 2019

Retail	Description	No.
Landers Superstore	hypermarkets cum warehouse club	5
SM hypermarkets SM, WalterMart, Alfamart, and Savemore (hypermarkets, supermarkets & convenience stores)	65 percent of which is allocated for food products; non-food items offered include furniture, appliances, clothing, etc.; also has convenience stores (mostly found in condominiums, beside gasoline stations, near corner streets, or near a business process outsourcing (BPO) office that operates around the clock; offers ready-to-eat meals and has limited lines of foods, beverages, and personal care items), supermarkets, online	1,189
Puregold	Combination of warehouse-type, hypermarkets & supermarket, online	300+
Robinsons supermarket	Devoted to food and everyday goods that is usually located inside shopping malls, department stores, or within a commercial complex; mobile online; supermarkets, express stores, and convenience stores	500+
Rustan's Supercenters (supermarkets, express stores, and neighborhood stores)	Recently acquired by Robinsons Retail Holdings Includes online	75
Phil. Seven Corp/ 7-Eleven	Convenience stores	2,700
S&R (warehouse club)	A supermarket and warehouse hybrid that sells goods in bulk to small businesses and consumers, usually exclusive to members that pay a one- time joining fee; online	
LazMart, ShopeeMart, MetroMart	Top e commerce platforms	
Sari-sari stores	Small neighborhood stores that sell basic goods, such as rice, instant noodles, cooking oil, salt, sugar, etc. Usually built in front of or beside the owner's house	1.3 million
Wet markets, talipapas	Slls basic goods, meat, poultry, fish, vegetables, and fruits kept in ambient temperature.	42,000

Source: Singian 2020 and USDA FAS 2019

More importantly, the consumers who represent the end of the value chain spectrum and supposedly are the real benefactors of the food safety standards and codes of practices, are accorded by government with limited support in terms of awareness and education programs on the food and consumer safety standards and protocols. Dissemination of these measures is practically "non-existent" (DAP 2021:458), and technical support to facilitate the development of consumer groups that can provide effective platforms for their active engagement in the formulation and monitoring of consumer-friendly food safety standards that reflect consumer demands was most wanting (DAP 2021: 459).

Third, AFMA has to promote clustering of farmers into formal groups to achieve economies and scale and to provide efficient transfer and/or coordination of government interventions and programs. A large number of the farmers (including livestock and poultry raisers) in the Philippine is considered as small-scale farms and unorganized wherein the average farm size is around 1 hectare in 2012 (PSA). This fragmented structure of farmers is evident in the absence of economies of scale and the inadequacy of the utilization of technology

for farm production and primary post-harvest. According to Briones (2021), government interventions and/or regulations such as capacity development, regulatory compliance, technology transfer, and delivery of other production and support extension services are more efficiently coordinated and disseminated through organized groups such as farmer organizations, associations, or cooperatives. Given this, AFMA has to include in its interventions or programs the clustering of small agricultural producers to formal groups. This is critical not just for the enhancement and modernization of the value chains in the agriculture sector but also for the strict compliance of farmers to safety regulations and standards along the chain.

Fourth, given the COVID-19 pandemic, it is imperative that AFMA interventions and programs to include ICT related market advancements. The government needs to improve, in collaboration with the private sector, the ICT infrastructure and the use of e-commerce in the agri-food chain. As supply chains were disrupted by government-imposed lockdowns and restrictions due to the COVID-19 pandemic, agri-food value chains especially the modern and more integrated agri-food value systems quickly adapted and innovated through the application of e-commerce, e-procurement, and e-payment mechanisms (Reardon and Vos, 2021). An example of such an innovation is the e-Kadiwa program of the Department of Agriculture, launched in partnership with the private sector, which digitally connected the consumers directly to the producers of agricultural goods or commodities.

Lastly, in moving proactively on the contribution of AFMA to the value-added ladder ascendancy, the adoption of the more holsitic food systems framework of the ensuing National Agriculture and Fisheries Moodernization Industrialization Plan coupled with the Philippine Rice Industry Roadmap is the way to go. The AFMA stipulated the formulation of the Agrciculture and Fisheries Modernization Plan (AFMP). The framework applied was essentially a supply and commodity driven in approach. The shift to a value chain paradigm commenced only when the Agriculture and Fisheries Modernization Plan for 2011to 2016 took this perspective after a technical support from a World Bank project. However, the implementation of AFMA still took a supply-and commodity-driven approach from 2011to 2020, with emphasis in particular on the rice sector (disccussed in rice value chain). Under the present Duterte administration, DA is pursuing major transformational changes in the agriculture and fisheries sector. These need to be embodied in the National Agriculture and Fisheries Modernization Industrialization Plan (NAFMIP) that will replace the AFMA's AFMP, and the competitively diversified Philippine Rice Industry Roadmap. The Philippine Rice Industry Roadmap (PRIR) is in fulfillment of one of the provisions under the Rice Tariffication Law.

However, both plans are still in draft versions. The draft NAFMIP envisaged for 2021 to 2030 (**Figure 12**) and the PRIR espouse paradigm shifts from a singular commodity lens to sustainable diversification, integrated value chains, spatial, and economic clustering to achieve economies of scale, digitalization, and focus on food and nutrition security. The difference may be in the scope of government intervention such as domestic support (NAFMIP for example, has one of its paradigm modalities as "controlled production environment", while the PRIR puts emphasis on market orientation and possibly, use of limited smart subsidies that are time-bound, transparent, and efficiently implemented). The PRIR is operating within a major policy game changer, which is the Rice Tariffication Law that shifted the rice trade policy from quantitative trade restrictions to tariffs. This can significantly move the AFMA implementation to one that can accelerate the sector's structural transformation. It is important to note that the

AFMA prescribed self-sufficiency for rice, but has been shelved with the implementation of the Rice Tariffication law.

Figure 12. The summary framework of the draft NAFMIP (as of February 2022)

Paradigm	Strategy	Interventions	Sector-Wide Outputs	Outcomes (based on Economy-wide development plan)
Commodity-systems approach* Shorter food miles/spatial planning Greater smallholder share of conusmer peso Multi-risk proofing Low external inputs Filipino nutritious balanced diet Metro markets & controlled production environment Integration of non-food commodities ICT applications	Consolidation	• Bayanihan Agri Clusters • Province-led agriculture and fisheries extension system • Collective action cooperatives development • Modernization & empowerment of partners • Diversification • Crop support	▪ Agri-fishery industrial business corridors established ▪ Commodity systems based value chains ▪ Transformative market support systesm established ▪ R&D, training & extension system strengthened ▪ Capacities of agri-fisheries stakeholders strengthened ▪ Enabling environment enhanced	▪ Economic opportunities in agriculture, forestry, fishery products expanded ▪ Access to economic opportunities of small and subsistence farmers & fishers increased ▪ Consumer options for more affordable, nutritious, food expanded (DA-FNRI)
	Modernization	▪ Technology & innovation including digital agriculture ▪ Farm mechanization & infrastructure investments ▪ Climate change adaptation & mitigation measures ▪ Food safety & regulation		
	Industrialization	▪ Agri industrial business corridors ▪ Global trade, export development & promotion ▪ Postharvest processing logistics & marketing support		
	Professionalization	▪ Agriculture career system ▪ Education & training agribusiness management ▪ Ease of doing business & transparent procurement		

*Commodity-systems based approach includes at the hosuehold level the promotion of diversification or production of a mix of crops, livestock, & fisherfies

Source: Powerpoint presentation of the draft framework for the National Agriculture and Fisheries Modernization and Industrialization Program in one of the Management Communications meeting, 2021.

Furthermore, there are concerns that are outside the AFMA jurisdiction and impede value chain development. Although more substantive empirical research will need to be done on these concerns and are out of the coverage of this study, there is need to highlight their importance as tackling them will be significant in accelerating the modernization of the agriculture and fisheries sectors, including the the hastening of value added ladder ascendancy to more modernized agro-based value chains.

One of the major concerns deals with farm or land consolidation, and in particular the Comprehensive Agrarian Reform Law (CARL). It may be time to phase out CARL implementation. Considering that Comprehensive Agrarian Reform Program (CARP) has actually achieved its primordial role of subdividing agriculture lands and in expanding the coverage and scope of more inclusive land ownership, it is to free the land market especially

because the number of burgeoning small-sized farm owners of CARL are illicitly undertaking land pawning activities. Moreover, global experience shows that consolidating individual and small farm plots through various forms of farm management and land-based contractual arrangements provides several benefits (World Bank, 2020) among which are:

(i) greater bargaining power of farmers vis-a-vis buyers, input suppliers, and traders;
(ii) expands the utilization and adoption of pre-, during, and post- production mechanization or technology;
(iii) increase investments for agricultural production; and
(iv) attainment of economies of scale in production.

Secondly, modernizing agro-based value chains are emerging largely through private sector and agribusiness initiatives (see livestock, poultry, and tuna case studies). Enabling policies conducive for more collaboration and networking activities of the public sector with the private sector that encourage vertical coordination and horizontal integration need to be developed. In this regard, DA has to work in tandem with the Department of Trade and Industry (DTI) in policy and institutional areas that will promote an array of public-private partnership programs. Bringing in the agri-based MSMEs into the formal public-private partnerships can hasten the step-up movement in the value-added ascendancy ladder. Key areas would be on incentivizing the MSMEs to adopt good industry and services practices, food quality standardization, and food safety protocols

Lastly, there is need for the DA to veer away from a banner program budget of that is rice-centric to programs that push for diversification. Given this, the DA needs to divert more of its resources to the non-rice industries to ensure the provision of necessary government support and programs to develop the non-rice sectors. It is important to note that the rice sector is receiving at least PhP 10 billion annually until 2025 as stipulated by the Rice Tariffication Law (RTL). Additionally, the DA programs have to move away from the provision of private goods, such as input subsidies and production support interventions, to public goods (i.e., research and development, risk mitigating infrastructure, etc). As seen in **Figure 6**, DA MFO expenditure is biased towards input subsidies and support services wherein its average share was more than 90 percent from 1999 to 2020. This type of spending has the unintended consequence of crowding out private investments and insufficient supply of public goods which generate positive externalities.

These recommendations that go beyond AFMA but are germane in modernzing the agriculture and fishery sectors and in contributing to strucrtural transformation will need to be undertaken in tandem with an overhauled but robust AFMA that can just focus on strengthening the links of agriproduction with its upstream, midstream, and downstream segments. Important policy areas will be the productivity related measrues, trade reforms, value chain financing and risk insurance schemes, and competition provisions that will minimize the potentials of illicit rent capture.

5. Case studies of agro-food value chains

5.1. Corn-Animal Feed Value Chain

5.1.1. Overview of the corn industry

Corn is one of the major crops grown in the country. It ranks third among all agricultural crops in terms of average Gross Value added (GVA) from 2010 to 2019, the first two major commodities being rice and bananas. In particular, corn has an average GVA of PhP 93.5 billion at constant 2018 prices during the same period. On the other hand, rice and banana have an average GVA of PhP 367.7 billion and PhP 136.5 billion at constant 2018 prices, respectively, given the same reference period, or more than 4 and 1.5 times greater than the value of corn (Philippine Statistics Authority [PSA]).

There are two major types of corn being planted and harvested in the country. The first one is the white corn or open pollinated variety, and the other is yellow corn. White corn is mostly utilized for human consumption. It is considered as one of the most important substitutes for rice (Gerpacio et al. 2004). In contrast, yellow corn is mostly used as one of the primary inputs for the animal feed industry (Cardenas et al. 2005). Moreover, it is also utilized for human and manufacturing consumptions such as cornstarch, food snacks, etc. (Gerpacio et al. 2004).

In terms of production, the Philippine corn industry is dominated by yellow corn. Although the area harvested is evenly distributed between the two types of corn (49 percent for white corn and 51 percent for yellow corn), yellow corn accounts, on average, 71 percent of the total production (or 7.4 million mt) while white corn, on average, only comprises approximately 29 percent (2.1 million mt) from 2010 to 2019 (see **Table 6**). Out of all the regions, Cagayan Valley, SOCCSKSARGEN, and Northern Mindanao are the top producers of yellow corn in the country with average productions of 1,661.1, 966.8, and 817.6 thousand metric tons from 2010 to 2019, respectively (see **Table 7**). These are equivalent to average shares to total production of 31.4 percent, 18.3 percent, and 15.6 percent, respectively, given the same reference period (see **Table 7**). Overall, the top three regions contribute approximately equal to 65.3 percent of the total production of yellow corn in the country from 2010 to 2019.

Table 6. Philippine white and yellow corn production, area harvested, and yield from 2000 to 2019

Year	Production (in mt)			Area Harvested (in ha)			Yield (in mt/ha)		
	White	Yellow	Total	White	Yellow	Total	White	Yellow	Average
2000	1,889,338	2,621,766	4,511,104	1,573,408	936,934	2,510,342	1.20	2.80	2.00
2001	1,917,654	2,607,358	4,525,012	1,565,112	921,476	2,486,588	1.23	2.83	2.03
2002	1,796,929	2,522,333	4,319,262	1,503,118	892,338	2,395,456	1.20	2.83	2.02
2003	2,052,684	2,562,941	4,615,625	1,564,943	844,885	2,409,828	1.31	3.03	2.17
2004	2,227,430	3,185,956	5,413,386	1,562,347	964,788	2,527,135	1.43	3.30	2.37
2005	2,251,617	3,001,543	5,253,160	1,492,202	949,586	2,441,788	1.51	3.16	2.34
2006	2,360,840	3,721,269	6,082,109	1,471,453	1,099,220	2,570,673	1.60	3.39	2.50
2007	2,527,633	4,209,307	6,736,940	1,469,327	1,178,990	2,648,317	1.72	3.57	2.65
2008	2,254,567	4,673,658	6,928,225	1,367,410	1,293,611	2,661,021	1.65	3.61	2.63
2009	2,316,434	4,717,599	7,034,033	1,402,845	1,281,045	2,683,890	1.65	3.68	2.67
2010	2,169,103	4,207,693	6,376,796	1,338,943	1,160,097	2,499,040	1.62	3.63	2.63
2011	2,150,222	4,820,999	6,971,221	1,283,701	1,260,911	2,544,612	1.68	3.82	2.75
2012	2,165,548	5,241,520	7,407,068	1,311,619	1,282,304	2,593,923	1.65	4.09	2.87
2013	2,129,091	5,248,203	7,377,294	1,278,635	1,285,083	2,563,718	1.67	4.08	2.88
2014	2,262,234	5,508,369	7,770,603	1,290,213	1,321,219	2,611,432	1.75	4.17	2.96
2015	2,134,673	5,384,083	7,518,756	1,265,494	1,296,440	2,561,934	1.69	4.15	2.92
2016	2,022,508	5,196,309	7,218,817	1,174,038	1,310,427	2,484,465	1.72	3.97	2.85
2017	2,104,201	5,810,708	7,914,909	1,174,134	1,378,459	2,552,593	1.79	4.22	3.01
2018	2,145,306	5,626,612	7,771,918	1,153,744	1,357,692	2,511,436	1.86	4.14	3.00
2019	2,070,887	5,907,957	7,978,844	1,101,270	1,415,453	2,516,723	1.88	4.17	3.03
Average	**2,147,445**	**4,338,809**	**6,486,254**	**1,367,198**	**1,171,548**	**2,538,746**	**1.59**	**3.63**	**2.61**

Source: PSA

Table 7. The volume of production of yellow corn by region from 2010 to 2019 (in thousand mt)

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
PHILIPPINES	4,207.7	4,821.0	5,241.5	5,248.2	5,508.4	5,384.1	5,196.3	5,810.7	5,626.6	5,908.0	5,295.2
CAR	156.5	198.6	204.8	221.8	223.9	218.0	181.4	225.0	190.8	216.2	203.7
Ilocos Region	311.0	335.1	383.3	394.8	425.6	442.7	462.1	508.7	512.9	531.0	430.7
Cagayan Valley	1,212.7	1,544.9	1,809.0	1,660.0	1,810.2	1,757.3	1,640.7	1,803.4	1,590.4	1,832.9	1,666.1
Central Luzon	174.9	167.2	186.3	198.4	211.4	239.3	228.3	221.6	230.9	243.8	210.2
CALABARZON	24.5	24.8	28.6	38.9	43.4	39.4	66.0	62.8	64.8	45.9	43.9
MIMAROPA	57.1	69.7	73.0	89.2	91.4	109.1	97.3	103.5	114.7	91.2	89.6
Bicol Region	128.9	167.8	182.8	208.9	228.2	188.4	201.7	222.0	214.7	186.0	193.0
Western Visayas	193.7	242.4	256.1	266.0	267.8	254.9	202.8	212.5	223.1	227.5	234.7
Central Visayas	1.4	1.3	0.8	3.2	2.0	1.4	2.1	2.9	3.0	1.9	2.0
Eastern Visayas	12.6	12.8	13.2	13.2	13.4	13.4	12.6	8.9	7.7	7.0	11.5
Zamboanga Peninsula	31.4	50.1	43.8	32.9	30.3	34.8	41.3	42.2	47.6	37.8	39.2
Northern Mindanao	780.4	862.5	864.8	829.8	795.9	809.0	759.8	815.7	830.1	827.6	817.6
Davao Region	35.9	37.7	47.9	53.7	67.6	50.9	48.5	59.2	72.2	63.4	53.7
SOCCSKSARGEN	817.9	916.7	960.3	1,036.0	1,072.9	1,005.4	926.2	1,026.2	1,002.4	904.2	966.8
Caraga	45.7	40.6	45.1	53.3	68.3	62.7	78.3	73.0	82.6	80.9	63.0
ARMM	222.9	148.8	141.9	148.0	156.0	157.3	247.2	423.2	438.7	610.6	269.5

Source: PSA

As mentioned above, the primary demand for yellow corn is originating from the animal feed industry. In particular, the average utilization of yellow corn for feeds and waste is 4,830 thousand mt from 2010 to 2019 (see **Table 8**). This means that, on average, 84.52 percent of the total supply of yellow corn (local yellow corn and imports) is used for feeds and waste given the same reference period (see **Table 8**). The remaining 933 thousand mt of yellow corn is used for other purposes by the manufacturing or processing industry in the production of starch, gluten, alcohol, cooking oil and snack foods from 2010 to 2019 (Cardenas et al. 2005). This is equivalent to only 15.48 percent of the total supply of yellow corn. As such, the yellow corn industry is highly linked to the local animal feed sector.

Table 8. Supply utilization of yellow corn from 2010 to 2019

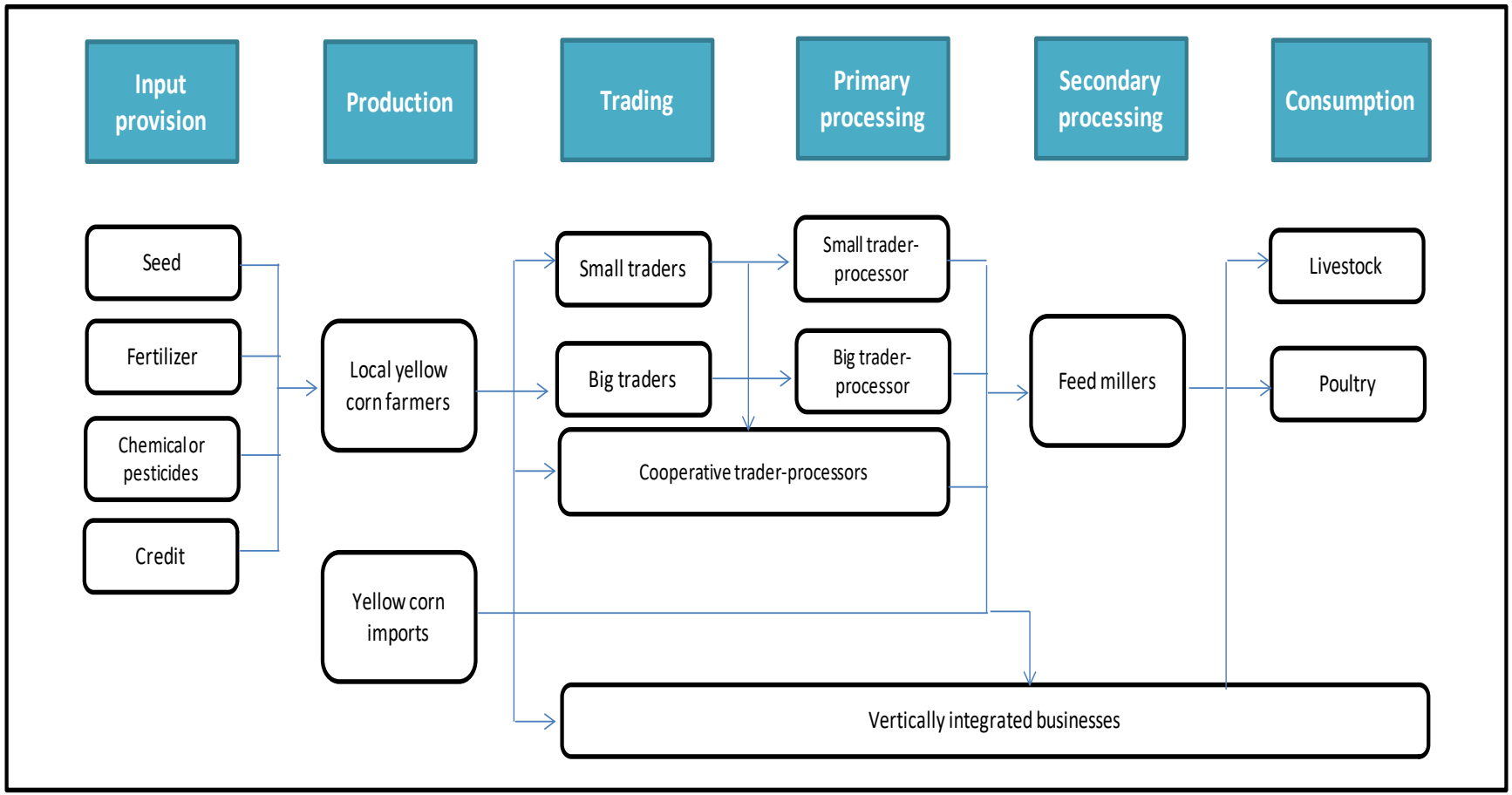
	Yellow corn production*	Yellow corn imports*	Total Supply*	Utilization to feeds and waste*	% usage to feeds/ waste (in %)	Utilization to others*	% usage to others (in %)
2010	4,208	88	4,296	4145	96.49	151	3.51
2011	4,821	66	4,887	4531	92.72	356	7.28
2012	5,242	137	5,379	4815	89.52	564	10.48
2013	5,248	342	5,590	4795	85.78	795	14.22
2014	5,508	575	6,083	5051	83.03	1,032	16.97
2015	5,384	712	6,096	4887	80.17	1,209	19.83
2016	5,196	806	6,002	4692	78.17	1,310	21.83
2017	5,811	475	6,286	5145	81.85	1,141	18.15
2018	5,627	1017	6,644	5052	76.04	1,592	23.96
2019	5,908	458	6,366	5186	81.46	1,180	18.54
Average	**5,295**	**468**	**5,763**	**4,830**	**84.52**	**933**	**15.48**

*in thousand mt
Source: PSA

5.1.2. Input provisions of yellow corn

Figure 13 illustrates a typical value chain of the yellow corn industry in the Philippines. As seen in **Figure 13,** the main inputs for producing yellow corn are: (1) seeds, (2) fertilizers, (3) chemicals, (4) credit, and (5) labor. Out of the main inputs, labor accounts for the highest contribution to total cost of production of yellow corn at 54 percent (see **Figure 14**). Consequently, the combine share of the other inputs to total cost of production is only approximately 46 percent (see **Figure 14**). As seen in **Figure 15**, out of the non-labor input provisions, fertilizers and seeds are the major cost contributors in the production of yellow corn wherein its share to total non-labor cost is more than 80 percent. More specifically, fertilizers and seeds account approximately 48 percent and 38 percent, respectively (see **Figure 15**). On the other hand, the share of chemicals such as herbicides and insecticides are around 4 percent and 3 percent to total non-labor cost, respectively (see **Figure 15**).

Figure 13. Value chain of yellow corn in the Philippines

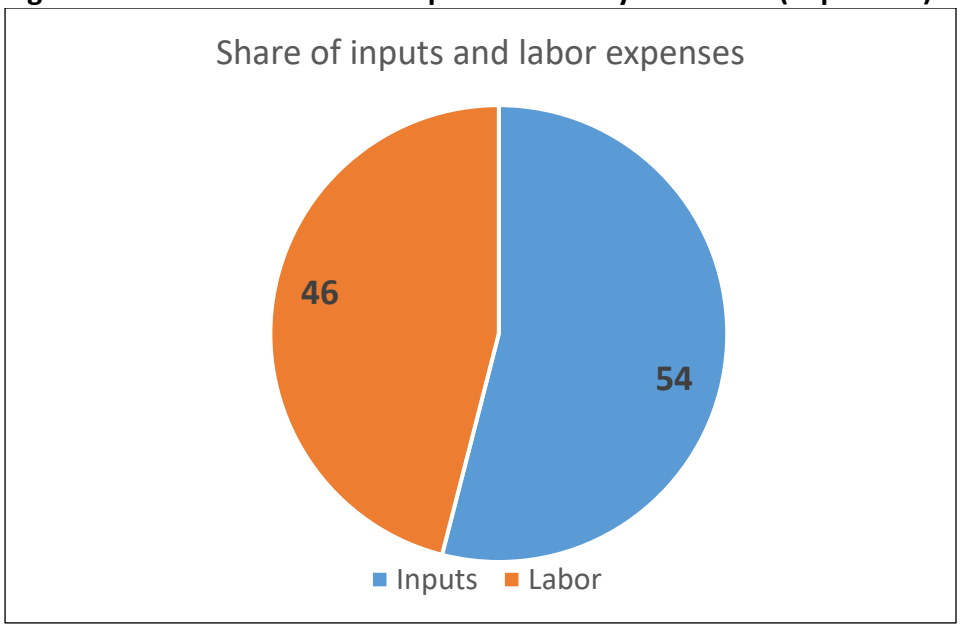


Source: ASPSI (2020), Gerpacio et al. (2004), and Gordoncillo et al. (2019)

According to Asian Social Project Services Inc (ASPSI, 2020) and Gerpacio et al. (2004), there are two types of seeds being utilized by the local corn farmers. One is the traditional or conventional seeds, while the other is the Genetically Modified Organism (GMO) corn seeds. The latter is significantly more expensive per bag than the former (around two times more expensive). However, GMO seeds require less labor (given that farmers do not have to implement insect and weed management), less chemicals, and have a higher yield than traditional corn seeds. According to the study of ASPSI (2000), the major suppliers of GMO corn seeds in the country are: (1) Syngenta (allied to China Chem), (2) Pioneer (now Corteva), and (3) Monsanto (now Bayer).

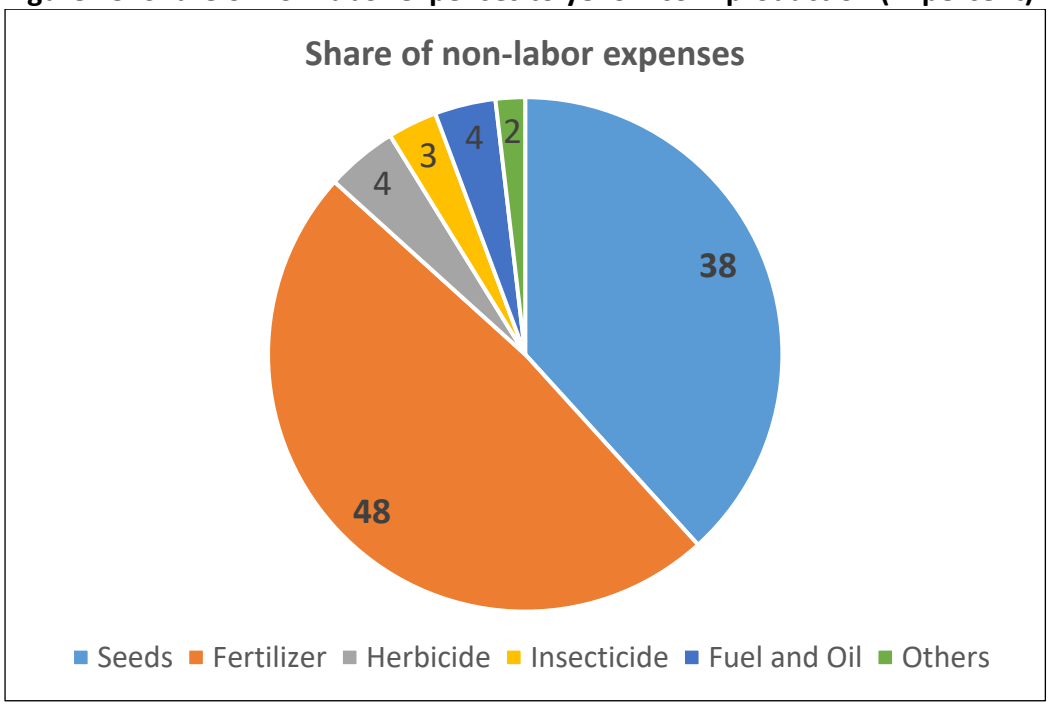
One critical issue that the government needs to resolve in the input provision of yellow corn production is the soaring prices of GM seeds. As seen in **Figure 16**, price of seeds increased by an average of 5.8 percent annually from 2002 to 2018 or from PhP 2,000 per hectare in 2002 to PhP 10,900 per hectare in 2018. This steep rise in GM seed prices is indicative of high market concentration. According to ASPSI (2020), the major cause of the high cost of GM seeds is the relatively high barrier of entry in the GM corn seed industry. This is because the current big players requiring royalties on the use of their technology even if the patent for such genes have already expired. As such, the study recommends that the Philippine Competition Commission investigate this "anti-competitive" behavior or conduct in order to significantly reduce the cost of seeds which will ultimately bring down production cost of yellow corn.

Figure 14. Share to total cost of production of yellow corn (in percent)



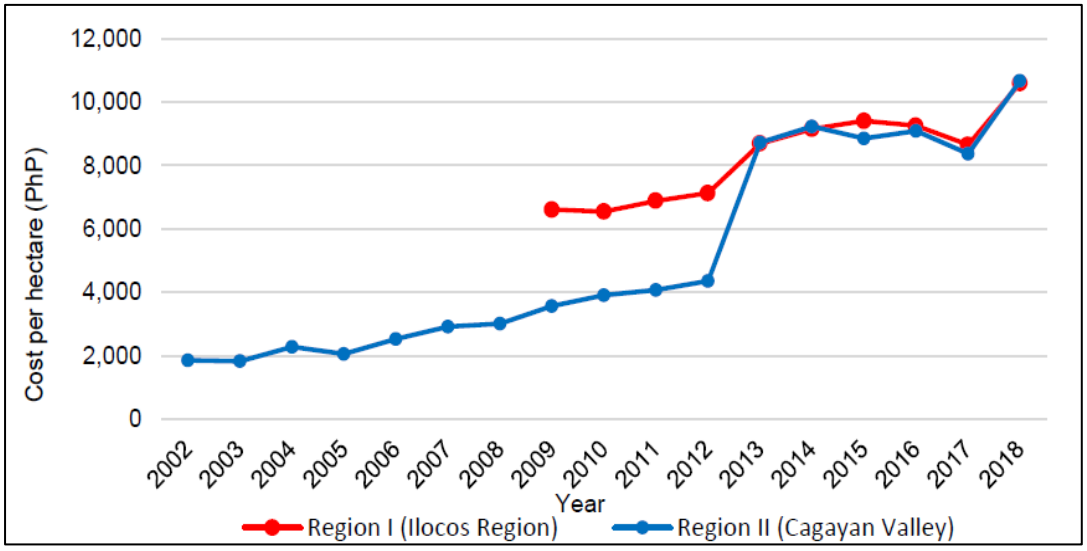
Source: DA Corn Program

Figure 15. Share of non-labor expenses to yellow corn production (in percent)



Source: DA Corn Program

Figure 16. Average GMO seed costs paid by yellow corn farmers in Regions 1 and 2



Source: PSA

5.1.3. Production, trading, and primary processing

Figure 17 provides a description of Philippine corn farmers. As seen in **Figure 17**, the average age is 49 years old where approximately 64 percent are male and 36 percent are female farmers (see **Figure 17**). Furthermore, most corn farmers have at least elementary educational attainment at 44.1 percent while around 37 percent and 16 percent have graduated high school and graduated college, respectively (see **Figure 17**). On the other hand, the industry is dominated by small farmers (approximately 82 percent) wherein the average farm size is significantly small. In particular, the average farm size is only 0.54 hectares (see **Figure 17**).

This meager average corn farm size in turn negatively impacts the productivity of corn producers due to the inability of farmers to achieve economies of scale. As seen in **Figure 18**, the Philippines has one of the lowest corn yield per hectare among the selected ASEAN countries at only 4.215 mt per hectare. This figure is approximately 1 mt lower than the most efficient ASEAN corn producer, which is Indonesia with a productivity of 5.2 mt per hectare (see **Figure 18**). Consequently, given the relatively low productivity, corn farming is considered as one of the poorest among the agricultural sectors. As seen in **Table 9**, the corn industry has the second highest poverty incidence among various agricultural activities at 45.12 percent in 2018.

Figure 17. Description of Philippine corn farmers and farm size

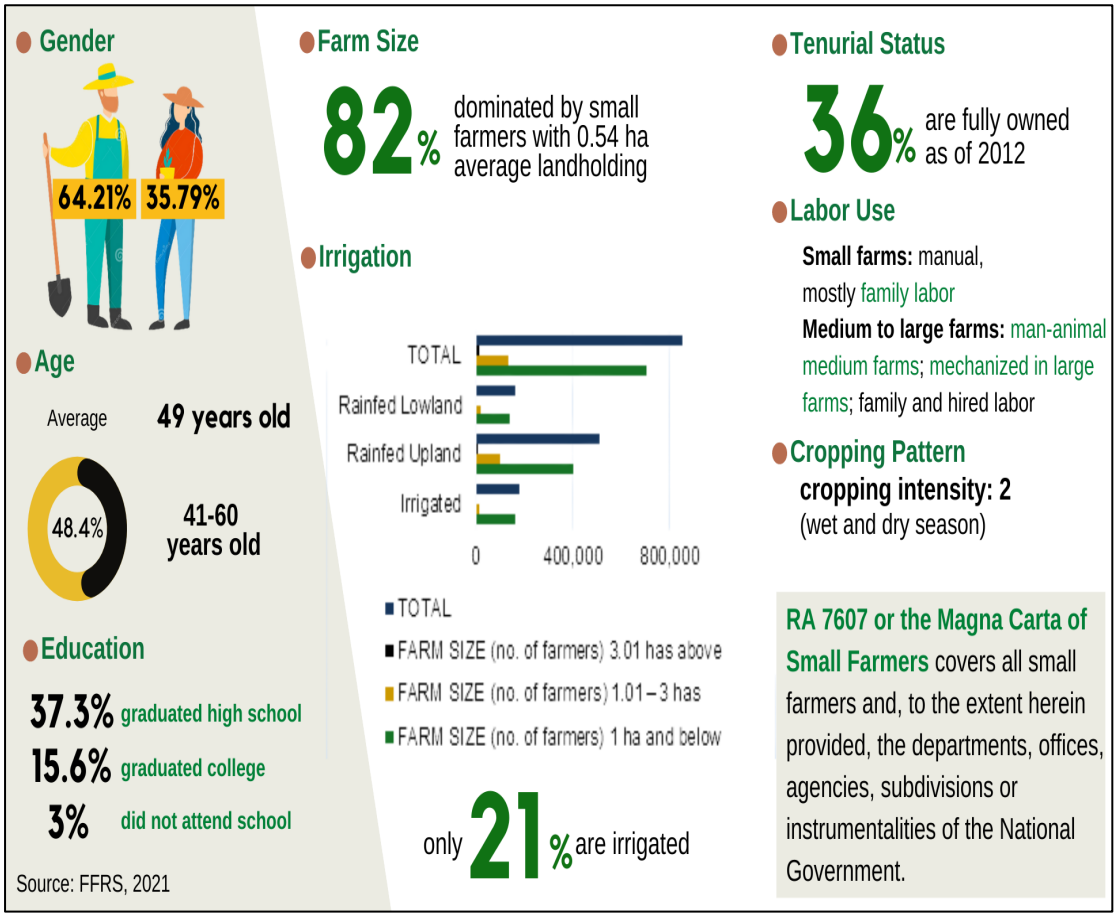
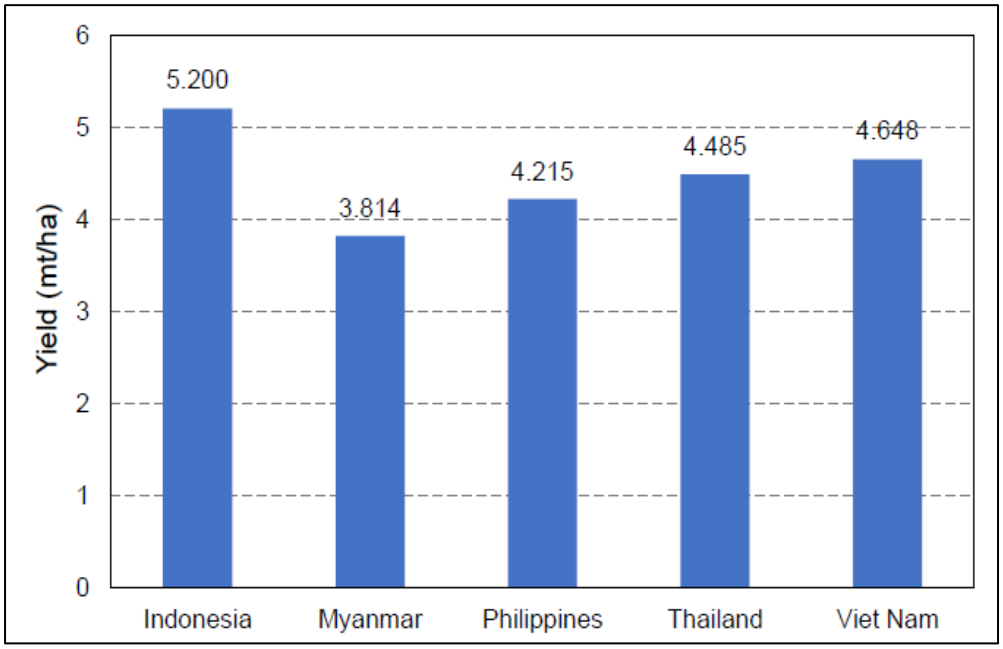


Figure 18. Corn productivity of various ASEAN countries (yield per hectare)



Source: FAOSTAT 2020

Table 9. Poverty incidence by kind of agricultural activity in 2018

Kind of business in primary occupation of household head	Poverty Incidence	Share to total poor families	Share to total families with agricultural business
Growing of palay	22.10	19.81	27.19
Growing of corn	**45.12**	**19.37**	**13.02**
Growing of coconut	42.64	16.58	11.80
Growing of banana	25.30	3.13	3.75
Growing of sugarcane	33.60	3.46	3.13
Growing of other fruits	35.42	3.07	2.62
Growing of vegetables	28.86	7.75	8.14
Growing of other crops	34.95	1.94	1.69
Animal farming/raising	10.53	2.12	6.11
Agricultural services	34.88	10.54	9.17
Fishing	27.69	12.22	13.39
Total	30.33	100.00	100.00

Source of basic data: merged FIES 2018-LFS 2018 Q1

Once the corn has been harvested, local farmers usually collaborate with traders or consolidators to handle the transportation and processing (drying) of corn due to capital and logistics[17] constraints. It is important to note that these traders sometimes act as sources of credit for the local farmers. According to Gerpacio et al. (2004), some farmers avail loans from traders instead of formal financial institutions due to the following reasons:

(i) traders do not require collateral;
(ii) traders are relatively more accessible;

[17] Given that many of the corn farmers are located in far-flung areas. Further, see the study of Llanto, et.al (2012) on Philippine logistics constraints.

(iii) the required paper work and requirements from financial institutions are exceedingly stiff; and
(iv) farmers find that banks prefer to lend to farmer associations and not to individual farmers.

These loans are usually paid in cash at a 5 percent interest rate or in charge-to-crop scheme wherein local farmers sell to traders a portion of their harvest at a lower than market value price (ASPSI 2020, and Gerpacio et al. 2004).

As seen in **Figure 13**, farmers can sell their yellow corn to: (1) small traders and processors, (2) larger traders and processors, and (3) cooperative traders and processors. Small traders can accommodate and transport around 200 mt of corn, while large traders can transfer and process around 980 mt (ASPSI 2020). On the other hand, farmers who are members of cooperatives can avail transport and postharvest processing services of the cooperative for a fee (ASPSI 2020).

5.1.4. Yellow corn secondary processing and final consumer

Subsequently, once the corn has been dried, the produce is sold to the feed millers, which process the corn to transform it as feed inputs to the livestock, poultry, and fishery sectors. The country's feed mill sector can be classified into three categories: (1) commercial feed millers, (2) integrated farm feed millers, and (3) home-mixer feed millers (Cardenas et al. 2005, and Esplana and Soliaban 2005). Commercial feed millers are only engaged in the production of feeds. On the other hand, similar to commercial feed millers, integrated farm millers sell feeds commercially. However, this type of feed miller is also vertically integrated or connected with the livestock and poultry production. Lastly, home-mixer feed millers are backyard feed millers wherein the feeds they produced are used in their own farms.

Tables 10, 11, and 12 provide information on the feed mill industry in the Philippines. The top registered animal feed producers (both commercial and integrated) based on capacities are listed in **Table 10.** As seen in **Table 10**, the top five suppliers of feeds in 2002 are (1) San Miguel Foods, (2) Cargill Philippines, (3) Swift Foods, (4) General Milling, and (5) Vitarich Corporation. These firms have a daily capacity per eight-hour shift of 3,229 mt, 1,760 mt, 1,612 mt, 1,520 mt, and 1,387 mt, respectively (see **Table 10**). Of the 389 registered feed millers, the top ten companies contribute approximately 56 percent of the total capacity (Esplana and Soliaban 2005) (see **Tables 10 and 11**). Furthermore, according to Gordoncillo et al. (2019), San Miguel Foods supplies approximately 25 percent of the total commercial animal feeds. Given the daily capacity of various feed millers in **Table 10**, it can be approximated that the top five companies supply around 75 percent of the commercial feed demand. Thus, the animal feed industry is dominated by big players and characterized by high market concentration.

Table 11 outlines the production of different feed miller groups. As seen in **Table 11**, majority of the animal feed supply is originating from the registered feed mills (commercial and integrated), wherein it has a 60 percent share in the total production of feeds. As of 2002, there are 389 registered feed mills in which 300 is categorized as commercial with a total rated per eight-hour shift of 20,363.4 mt (see **Tables 11 and 12**). Of the total commercial feed mills, 221 or approximately 73.7 percent are located in Luzon wherein 30 percent (or 89) is in Region III, 22 percent (or 67) is in Regions IV-a and IV-b, and 14 percent (or 41) is in the National Capital Region (NCR) (see **Table 11**). Consequently, out of the three major island groups, Luzon accounts for 84.7 percent of the total feed mill capacity in the country wherein Regions III, IV-

a, IV-b, and NCR have a 73 percent share to the total rated capacity of the industry as of 2002 (see **Table 12**).

In contrast, Visayas and Mindanao have relatively minimal contribution to the production of animal feeds. This is evident in the number of registered commercial feeds operating in the two regions. More specifically, Visayas and Mindanao have 39 and 40 commercial feeds in 2002, respectively (see **Table 12**). Moreover, the shares to the total feed mill capacity of Visayas and Mindanao are only 9.2 percent and 6.1 percent in 2002, respectively (see **Table 12**). This is equivalent to a total rated capacity per eight-hour shift of 1,877.6 mt and 1,240.1 mt, respectively, given the same reference period (see **Table 12**).

While Mindanao is a major producer of yellow corn in the country (on average, 42 percent of yellow corn is supplied by Mindanao from 2010 to 2019), its share to animal feed production is ironically low (see **Table 12**). As discussed in the previous section, the animal feed industry is the primary consumer of yellow corn wherein, on average, 84.52 percent of the total supply of yellow corn (local production and imports combined) is utilized for the production of feeds from 2010 to 2019 (see **Table 8).** As seen in **Table 12**, Mindanao only accounted for 14 percent out of the total registered commercial feeds and 6 percent of the total feed production capacity of the country while its share to total local supply of yellow corn is 47.5 percent in 2002. This substantial difference in Mindanao's production of corn and animal feeds implies that the majority of the yellow corn produced in Mindanao is being transported to Luzon given that the country does not export corn. According to Cardenas et al. (2005), though Mindanao produces almost half of the total supply of yellow corn in the country, many of the feed millers opted to operate in Luzon given that most livestock and poultry raisers or producers are mainly concentrated in this region.

Moreover, yellow corn accounts for a significant share to the total input requirement cost of the animal feed industry. According to Esplana and Soliaban (2005), yellow corn's share to total input cost is approximately equal to 50 to 70 percent. On the other hand, based on the survey done by Elca et al. (2020) on the operating and investment requirements of feed millers, yellow corn accounts for around 46 percent and 41 percent of the total input cost of small-scale and large-scale feed millers, respectively. Hence, the availability and affordability of yellow corn can significantly impact the cost and operation of the animal feed sector.

Table 10. Top ten registered feed millers based on capacity in 2002

Name of company	Brand name	Daily capacity (mt)
San Miguel Foods	B-Meg feeds	3,229
Cargill Philippines	Purina feeds	1,760
Swift Foods	Blue Ribbon feeds	1,612
General Milling	General Feeds and Megamix	1,520
Vitarich Corporation	Vitarich, Vitalux, and Bionic	1,387
Tyson Agro-Ventures	Tyson feeds	800
Sun Jin Philippines	Sun Jin Meals	760
Foremost Farms	Famous and Rich feeds	720
Universal Robina Corporation	Star Feeds 555	598
Grain Handlers	Mighty Feeds	450
	Total	**12,836**

Source: Esplana and Soliaban (2005)

Table 11. Percentage share of production of different feed miller groups in 2002

Feed mill group	M 50kg - bags	M mt	Share (in %)	No. of feed mills
Commercial feed mills	39.2	1.96	38	
Integrated feed mills	23	1.15	22	
Registered feed mills	62.2	3.11	60	389
Home-mixer feed mills	42	2.1	40	590
Total	104.2	5.21	100	979

Source: Esplana and Soliaban (2005)

Table 12. Geographical distribution of commercial feed mills, rated capacities and yellow corn production by region in 2002

Region	Commercial		Rated capacity/ 8hr shift	Distribution (in %)	Yellow corn prod'n(in '000 mt)	Share to total supply (in %)
	Number	Percent				
NCR	41	13.7	4555	22.4	0.0	0.0
Ilocos Region + CAR	8	2.7	1542	7.6	212.7	8.4
Cagayan Valley	6	2.0	500	2.5	790.4	31.3
Central Luzon	89	29.7	7009.2	34.4	111.8	4.4
CALABARZON + MIMAROPA	67	22.3	3307.5	16.2	91.8	3.6
Bicol Region	10	3.3	332	1.6	51.5	2.0
Western Visayas	12	4.0	466	2.3	52.5	2.1
Central Visayas	24	8.0	1311.1	6.4	12.1	0.5
Eastern Visayas	3	1.0	100.5	0.5	2.2	0.1
Zamboanga Peninsula	4	1.3	57.5	0.3	3.4	0.1
Northern Mindanao	8	2.7	228	1.1	357.3	14.2
Davao Region	17	5.7	775.6	3.8	26.7	1.1
SOCCSKSARGEN+ ARMM	10	3.3	177	0.9	800.2	31.7
Caraga	1	0.3	2	0.0	9.7	0.4
Total	**300**	**100.0**	**20363.4**	**100.0**	**2522.3**	**100.0**

Source: Cardenas et al. (2005)

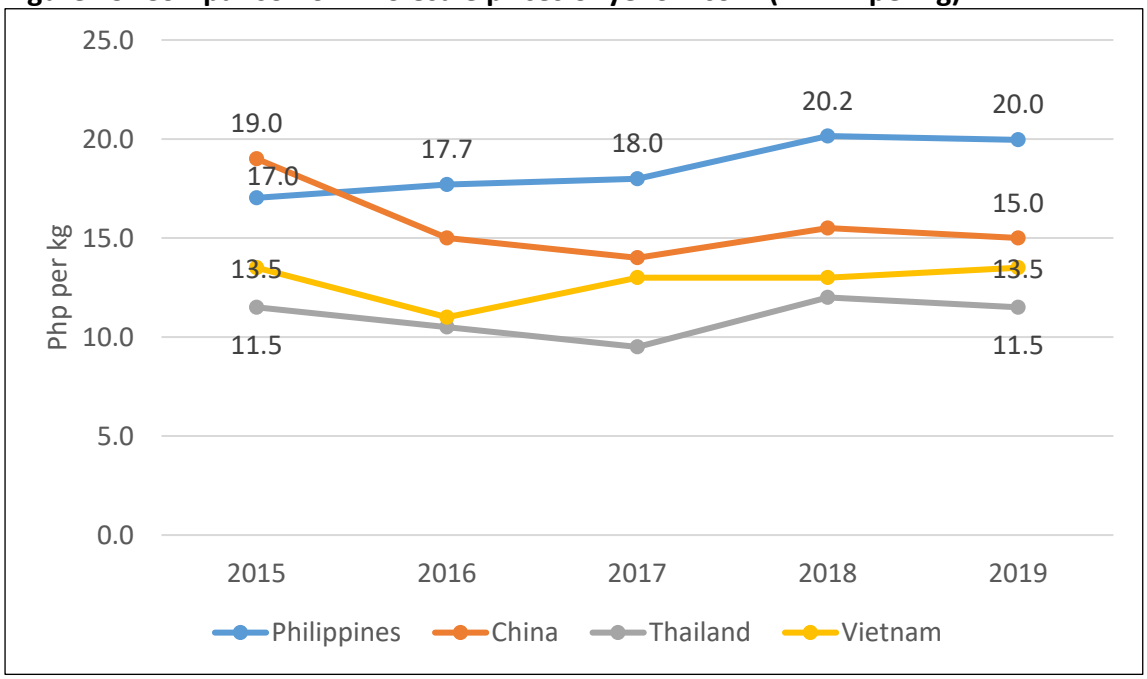
4.1.5. Summary of corn-animal feed value chain

In summary, the corn value chain can be characterized as mostly transitioning value chains wherein the industry is still dominated with small farmers who are still heavily relying to traders or "middlemen" to process their goods and sell to the final consumers, which is the feed millers. Given this, there is essentially an absence of vertical integration between feed millers and the yellow corn producers. This can be attributed to the relatively meager corn farm size and inadequate infrastructure, particularly in logistics. With the corn industry being dominated by small farmers with limited farm size, the quantity and quality of yellow corn produced per farmer restricts contract farming or growing agreements between feed millers and the corn producers. This is further exacerbated by the high cost of transporting yellow corn produced in Mindanao to Luzon where majority of the feed millers are located. As discussed in the previous section, there is a "mismatch" in terms of supply and demand locations between the yellow

corn producers and the final consumer, which is the animal feed industry, wherein approximately 50 percent of yellow corn is produced in Mindanao while majority of the end user of yellow corn (feed millers) are located in Luzon. Moreover, given the lack of vertical integration and/or contract farming agreements between corn producers and feed millers, the contribution of corn farmers to the consumer price is relatively low (ASPSI 2020). As seen in **Tables 13** and **14**, the average share of farmers to consumer price is only 29 percent, while that of the feed producers is 68 percent.

Furthermore, it seems that interventions of the government in the provision of inputs, where government programs are highly concentrated (as mentioned in the previous section), have limited impact to the productivity and efficiency of corn farmers. As seen in **Figure 18**, the country's yield per hectare in corn is second to the lowest among the selected ASEAN countries. Furthermore, as seen in **Figure 19,** the country has the highest wholesale price of yellow corn per kilogram among the selected ASEAN neighbors and China. In particular, in 2019, the wholesale price of yellow corn per kilogram in the Philippines is approximately PhP 9 per kg, PhP 7 per kg, and PhP 5 per kg higher than in Thailand, Vietnam, and China, respectively (see **Figure 19**).

Figure 19. Comparison of wholesale prices of yellow corn (in PhP per kg)



Source: PSA and Briones (2021)

Table 13. Contribution of the corn-animal feed players to consumer price in Isabela

Chain player	Buying price (PhP/kg feed basis)	Selling price (PhP/kg feed basis)	Marketing margin (PhP/kg feed basis)*	Breakdown of consumer's peso (in %)
Farmer	0.00	7.30	7.30	**33.2**
Trader-processor**	7.30	8.05	0.75	**3.4**
Feed miller-retailer***	8.05	22.00	13.95	**63.4**

Source: ASPSI (2020)

*margin = selling price – buying price

**processing in terms of drying

***the retail price Is based on the average price of various feeds given to hogs

Table 14. Contribution of the corn-animal feed to consumer price in Bukidnon

Chain player	Buying price (PhP/kg feed basis)	Selling price (PhP/kg feed basis)	Marketing margin (PhP/kg feed basis)*	Breakdown of consumer's peso (in %)
Farmer	0.00	6.00	6.00	**25.0**
Trader	6.00	6.25	0.25	**1.0**
Cooperative-processor**	6.25	6.35	0.10	**0.4**
Feedmiller-retailer***	6.35	24.00	17.65	**73.5**

Source: ASPSI (2020)
*margin = selling price – buying price
**processing in terms of drying
***the retail price Is based on the average price of various feeds given to hogs

5.2. Animal Feed-Livestock-Poultry Value Chain

5.2.1. Overview of the livestock and poultry industry

The previous section demonstrated how the yellow corn industry is closely interlink with the animal feed sector. This section will show the important role of the feed milling industry to the livestock and poultry sectors and hence, inextricably correlating the yellow corn sector with the livestock and poultry.

The livestock, and poultry and egg production are not just the primary non-agricultural crops in the Agriculture, Forestry, and Fishing (AFF) but they are also the major contributors to the total gross value added (GVA) of the AFF sector before the pandemic. More specifically, the livestock and poultry and egg productions rank second and third in terms of GVA among all the non-crops commodities wherein the average GVAs of the two sub-industries are PhP 208.6 and PhP 146.6 billion at constant 2018 prices from 2010 to 2019, respectively (see **Table 15**). These translate to almost 50 percent, or 46.9 percent, of the total GVA share of non-agricultural crops. Subsequently, the two sub-sectors accounted for approximately one-fourth of the country's total GVA of AFF from 2010 to 2019. In particular, livestock and poultry and egg production shares to total GVA of AFF are 13 percent and 9 percent given the same reference period, respectively (see **Table 16**).

Table 17 describes the country's inventory and production of the livestock, poultry, and egg production from 2000 to 2019. As seen in **Table 17,** hogs, chicken, and chicken eggs have the highest average shares out of all the livestock, poultry, and egg production from 2000 to 2019. In particular, the three sub-sectors account for almost 90 percent of the total production of the sub-industry given the same reference period.[18] As seen in **Table 17**, the average swine production is 1.9 million mt, while chicken and chicken eggs have average productions of 1.4 and 0.38 million mt given the same reference period, respectively. These translate to average contributions to total production of livestock, poultry, and egg production of 45.1 percent, 32.9 percent, and 8.9 percent, during the same period, respectively (see **Table 17**). The three sub-

[18] Given that the three sectors, namely hogs, chicken, and chicken eggs account for approximately 90 percent of the total production in the livestock, poultry, and egg production, the paper will mainly focus on these three sub-sectors in the non-crop commodities in AFF.

sectors are then followed by cattle, carabao, goat, duck eggs, and duck with average shares of 6 percent, 3.2 percent, 1.8 percent, 1.1 percent, and 0.9 percent from 2000 to 2019, respectively (see **Table 17**).

Out of all the regions, Central Luzon, CALABARZON, and Western Visayas are the top producers of swine or hogs with average productions of 390.3, 334.1, and 184.2 thousand mt from 2010 to 2019 (see **Table 18)**. These translate to average shares to total swine production of 18.4 percent, 15.8 percent, and 8.8 percent given the same reference period, respectively (see **Table 18**). In total, the two Luzon regions, on average, account for approximately 34.2 percent of the total supply of swine in the country from 2010 to 2019 (see **Table 18**).

Moreover, the majority of the swine farms in the country is considered as backyard farms. In particular, according to Gordoncillo et al. (2019), around 64 percent of the total swine farms is backyard while the remaining 36 percent is composed of the commercial farms. However, according to PSA data, the share of commercial farms has been increasing, while the contribution of backyard farms has been stagnant and/or declining. This implies that there is an increasing scale in the operations of swine in the country (Gordoncillo et al. 2019). In terms of swine inventory distribution, Western Visayas, Central Visayas, Bicol region, and Davao region are the top backyard farm regions in 2018 (PSA). These regions account for approximately 43 percent of the total backyard farms in the country (PSA). On the other hand, Central Luzon, CALABARZON, and Northern Mindanao have the largest share of commercial farms out of all the regions in 2018 (PSA). The top 2 regions account for roughly two-thirds (60 percent) of the total commercial farms in the country during the same reference period (PSA). Lastly, in terms of major markets for fresh pork, the highly urbanized cities, such as Metro Manila, Cagayan de Oro, Iloilo, and Cebu, are the largest consumers (Gordoncillo et al. 2019).

Similar to swine production, Central Luzon and CALABARZON are the top producers of chicken meat in the country with average productions of 574.2 and 311.7 thousand mt from 2010 to 2019, respectively (see **Table 18**). Subsequently, Central Luzon and CALABARZON account for approximately 54.6 percent of the total chicken meat production during the same period (see **Table 18**). According to Gordoncillo et al. (2019), these two regions, compared to other regions, have the advantage of relatively easier market access to Metro Manila, which is the largest consumer of chicken meat. The two regions are then followed by Northern Mindanao, Western Visayas, and Central Visayas with average shares to total chicken meat supply of 8.9 percent, 5.9 percent, and 5.9 percent from 2010 to 2019 (see **Table 18**).

Moreover, CALABARZON and Central Luzon regions dominate the supply of chicken eggs similar to swine and chicken meat production. As seen in **Table 18**, the average productions of chicken eggs of CALABARZON and Central Luzon are 136.3 and 91.9 thousand mt from 2010 to 2019. These are equivalent to average contributions to total chicken egg production of 30 percent and 20.1 percent, respectively, or a total of approximately one-half of the total supply of chicken eggs in the country given the same reference period (see **Table 18**). The other top regional producers of chicken eggs are Central Visayas, Northern Mindanao, and Western Visayas with average shares of 9.5 percent, 9.2 percent, and 7 percent from 2010 to 2019, respectively (see **Table 18**). However, it is important to note that the total share of the three regions mentioned is even less than the contribution of the largest regional producer of chicken eggs (CALABARZON with 30 percent).

Table 15. GVA in AFF by sub-sector from 2010 to 2019, at constant 2018 prices

Industry	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Avg
Palay	329,425	348,097	373,962	382,785	389,264	370,914	358,273	385,740	380,311	357,982	367,675
Corn	80,732	88,309	93,831	94,011	98,206	94,456	90,186	98,358	96,904	100,085	93,508
Coconut including	88,639	86,896	90,063	87,746	82,914	83,131	78,361	79,151	83,528	84,403	84,483
Sugarcane	21,230	33,908	30,903	28,759	29,259	27,103	26,336	33,557	27,988	25,484	28,453
Banana	139,469	140,028	140,574	131,258	134,439	137,071	133,719	135,806	138,215	135,355	136,593
Mango	37,471	35,838	34,976	37,208	40,322	41,567	37,460	34,023	33,050	34,456	36,637
Pineapple	22,317	22,968	24,529	25,164	25,649	26,282	26,530	27,106	27,599	27,788	25,593
Coffee	9,512	8,864	8,988	7,943	7,613	7,216	6,864	6,175	5,956	5,855	7,499
Cassava	15,794	16,638	16,846	17,935	19,332	20,735	21,079	21,517	20,932	20,216	19,102
Rubber	9,098	9,761	10,102	10,097	10,235	9,033	8,213	9,160	9,499	9,740	9,494
Cacao	1,614	1,565	1,583	1,587	1,598	1,604	1,605	1,577	1,581	1,646	1,596
Abaca	1,937	1,865	1,872	1,863	1,862	1,854	1,841	1,795	1,784	1,858	1,853
Tobacco	1,719	1,627	1,604	1,568	1,537	1,500	1,459	1,393	1,354	1,410	1,517
Other agricultural	88,864	86,612	88,557	89,313	90,566	91,886	92,808	90,639	90,842	94,510	90,460
Livestock	**179,750**	**184,491**	**187,370**	**204,578**	**205,076**	**212,454**	**218,745**	**226,226**	**234,504**	**232,534**	**208,573**
Poultry and egg	**119,264**	**124,276**	**128,938**	**138,534**	**138,846**	**150,972**	**153,681**	**161,433**	**169,999**	**179,875**	**146,582**
Other animal	33,658	36,377	37,260	41,208	42,432	43,955	46,297	49,238	53,810	70,909	45,514
Forestry and	1,399	1,994	2,124	3,088	3,289	2,488	2,380	2,346	2,884	3,028	2,502
Fishing and	204,295	199,921	200,992	209,558	216,271	219,361	217,257	221,883	220,599	226,140	213,628
Support activities	113,614	120,521	123,238	130,988	137,296	144,763	148,990	156,013	161,278	170,583	140,729
Gross Value Added in AFF	**1,499,801**	**1,550,555**	**1,598,312**	**1,645,192**	**1,676,006**	**1,688,344**	**1,672,085**	**1,743,134**	**1,762,616**	**1,783,855**	**1,661,990**

Source: Philippine Statistics Authority (PSA)

Table 16. GVA growth rates in AFF by sub-sector from 2010 to 2019

Industry	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Avg
Palay	22.0	22.4	23.4	23.3	23.2	22.0	21.4	22.1	21.6	20.1	22.1
Corn	5.4	5.7	5.9	5.7	5.9	5.6	5.4	5.6	5.5	5.6	5.6
Coconut including copra	5.9	5.6	5.6	5.3	4.9	4.9	4.7	4.5	4.7	4.7	5.1
Sugarcane including muscovado sugar-making in the farm	1.4	2.2	1.9	1.7	1.7	1.6	1.6	1.9	1.6	1.4	1.7
Banana	9.3	9.0	8.8	8.0	8.0	8.1	8.0	7.8	7.8	7.6	8.2
Mango	2.5	2.3	2.2	2.3	2.4	2.5	2.2	2.0	1.9	1.9	2.2
Pineapple	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.5
Coffee	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.5
Cassava	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.2	1.2	1.1	1.1
Rubber	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.6
Cacao	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Abaca	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Tobacco	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other agricultural crops, n.e.c.	5.9	5.6	5.5	5.4	5.4	5.4	5.6	5.2	5.2	5.3	5.5
Livestock	**12.0**	**11.9**	**11.7**	**12.4**	**12.2**	**12.6**	**13.1**	**13.0**	**13.3**	**13.0**	**12.5**
Poultry and egg production	**8.0**	**8.0**	**8.1**	**8.4**	**8.3**	**8.9**	**9.2**	**9.3**	**9.6**	**10.1**	**8.8**
Other animal production	2.2	2.3	2.3	2.5	2.5	2.6	2.8	2.8	3.1	4.0	2.7
Forestry and logging	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.1
Fishing and aquaculture	13.6	12.9	12.6	12.7	12.9	13.0	13.0	12.7	12.5	12.7	12.9
Support activities to agriculture, forestry and fishing	7.6	7.8	7.7	8.0	8.2	8.6	8.9	9.0	9.1	9.6	8.4
Gross Value Added in AFF	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Table 15

Table 17. Livestock and poultry inventory and production from 2000 to 2019

Year	Inventory (in thousand heads)					Production (in metric tons)							
	Carabao	Cattle	Goat	Swine	Chicken	Carabao	Cattle	Hog	Goat	Chicken	Duck	Chicken eggs	Duck eggs
2000	3,037,830	2,476,821	3,168,283	10,904,660	118,567,222	123,972	271,556	1,517,943	75,185	999,316	51,490	243,381	53,465
2001	3,083,406	2,519,673	3,225,242	11,437,553	121,824,328	125,295	261,183	1,584,516	74,606	1,098,793	53,520	246,700	53,913
2002	3,135,891	2,547,450	3,278,669	12,209,106	126,517,508	132,560	261,058	1,667,763	74,793	1,175,238	54,107	260,980	53,783
2003	3,206,559	2,562,893	3,280,280	12,767,618	126,913,967	132,534	258,465	1,733,087	73,826	1,188,738	53,903	274,813	54,044
2004	3,286,650	2,581,098	3,404,843	12,517,138	127,823,170	138,063	255,981	1,709,404	74,976	1,231,794	53,195	296,576	56,743
2005	3,332,726	2,535,803	3,601,728	12,773,293	134,722,179	133,522	246,749	1,771,282	77,281	1,215,674	49,530	320,322	53,232
2006	3,375,967	2,526,444	3,864,270	13,604,188	137,982,510	130,412	238,274	1,836,136	74,824	1,205,951	45,987	330,288	50,027
2007	3,371,239	2,563,647	4,073,267	13,950,788	145,725,792	136,959	236,871	1,886,004	76,558	1,211,622	42,455	335,104	46,990
2008	3,333,700	2,573,282	4,151,989	13,667,018	156,402,304	140,423	239,156	1,855,726	78,009	1,281,343	39,206	350,939	42,559
2009	3,319,609	2,593,375	4,223,226	13,685,414	162,468,517	140,910	245,100	1,877,339	77,379	1,300,898	35,928	368,464	39,617
2010	3,201,707	2,558,899	4,057,159	12,966,825	162,525,415	148,022	251,743	1,898,158	78,451	1,353,127	32,978	387,335	36,676
2011	3,039,424	2,507,333	3,813,594	12,233,396	164,552,374	147,516	256,258	1,940,347	78,200	1,414,289	33,153	403,433	37,678
2012	2,947,799	2,492,690	3,716,383	11,933,093	168,680,687	142,727	253,983	1,973,617	75,665	1,479,435	33,847	421,057	39,747
2013	2,899,261	2,494,973	3,685,243	11,955,676	174,023,375	141,478	258,454	2,012,173	75,416	1,555,070	34,455	427,686	41,071
2014	2,852,103	2,515,836	3,702,051	11,998,283	170,983,362	143,034	261,319	2,032,303	76,102	1,571,762	34,613	415,652	41,510
2015	2,864,723	2,537,189	3,676,062	12,356,246	176,828,208	142,042	266,897	2,120,333	77,480	1,660,813	33,940	444,550	42,404
2016	2,882,662	2,554,637	3,687,028	12,603,312	175,297,228	144,685	270,415	2,231,660	77,454	1,674,505	32,216	461,719	44,160
2017	2,882,608	2,554,442	3,738,260	12,625,738	179,300,670	144,409	266,301	2,265,015	77,338	1,745,888	31,091	492,406	45,432
2018	2,880,568	2,552,826	3,748,903	12,816,526	185,305,675	143,143	263,310	2,319,764	76,953	1,836,664	30,806	533,905	46,611
2019	2,871,095	2,548,136	3,790,876	12,788,024	188,933,078	140,661	260,624	2,296,651	76,358	1,927,414	30,104	583,234	49,569
Average	**3,090,276**	**2,539,872**	**3,694,368**	**12,589,695**	**155,268,878**	**138,618**	**256,185**	**1,926,461**	**76,343**	**1,406,417**	**40,326**	**379,927**	**46,462**

Source: PSA

Table 18. Production by animal type, by Region from 2010 to 2019 (in mt)

	Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Hog	**PHILIPPINES**	1,898,158	1,940,347	1,973,617	2,012,173	2,032,303	2,120,333	2,231,660	2,265,015	2,319,764	2,296,651	2,109,002.10
	CAR	35,865	33,350	31,589	30,533	28,771	26,747	26,361	25,833	26,655	26,647	29,235.10
	Ilocos Region	73,914	75,951	81,706	82,977	81,609	82,731	86,553	90,065	94,684	94,568	84,475.80
	Cagayan Valley	66,104	66,239	68,525	68,766	67,093	68,853	71,356	72,869	71,805	72,488	69,409.80
	Central Luzon	289,041	309,655	338,493	362,341	380,674	422,534	462,430	447,517	472,552	417,748	390,298.50
	CALABARZON	276,966	292,108	297,082	309,486	315,598	336,349	365,056	371,713	381,590	395,545	334,149.30
	MIMAROPA	66,360	68,292	70,607	73,105	74,222	77,666	79,585	83,047	80,840	79,381	75,310.50
	Bicol Region	118,279	118,945	113,293	114,258	121,359	123,611	121,543	126,603	130,063	133,246	122,120.00
	Western Visayas	181,041	182,483	184,504	182,597	178,524	178,334	188,758	186,600	187,105	191,899	184,184.50
	Central Visayas	148,336	152,832	155,745	156,328	156,769	163,531	175,105	192,199	194,472	192,758	168,807.50
	Eastern Visayas	104,061	101,228	89,240	85,959	76,607	76,502	76,390	76,448	77,972	77,522	84,192.90
	Zamboanga Peninsula	94,072	89,420	83,994	82,237	80,176	81,321	80,051	82,199	82,084	82,135	83,768.90
	Northern Mindanao	136,518	144,473	153,082	159,747	163,978	170,011	177,672	188,448	196,623	200,965	169,151.70
	Davao Region	127,702	132,103	134,605	133,847	136,239	143,308	149,157	151,599	154,784	155,894	141,923.80
	SOCCSKSARGEN	119,193	117,849	118,056	118,252	119,811	118,371	119,047	117,741	117,291	124,594	119,020.50
	Caraga	48,734	41,853	40,650	40,316	39,825	39,589	42,388	42,188	40,689	40,495	41,672.70
	ARMM	11,972	13,566	12,446	11,424	11,048	10,875	10,208	9,946	10,555	10,767	11,280.70
Chicken	**PHILIPPINES**	1,353,127	1,414,289	1,479,435	1,555,070	1,571,762	1,660,813	1,674,505	1,745,888	1,836,664	1,927,414	1,621,896.70
	CAR	7,748	7,698	7,255	7,359	7,181	7,736	7,602	7,924	7,278	6,622	7,440.30
	Ilocos Region	74,921	75,369	81,395	83,259	82,462	82,829	78,760	78,079	84,933	84,231	80,623.80
	Cagayan Valley	39,409	46,969	51,757	55,525	57,696	59,319	60,644	58,777	57,894	55,372	54,336.20
	Central Luzon	458,322	474,733	505,166	549,845	570,126	609,509	590,993	624,686	658,909	699,655	574,194.40
	CALABARZON	279,502	285,024	298,358	302,569	298,542	321,670	328,430	328,646	330,940	343,265	311,694.60
	MIMAROPA	9,528	10,004	10,866	10,397	10,340	10,643	10,301	10,154	10,868	11,174	10,427.50
	Bicol Region	25,492	26,968	27,532	34,467	36,444	40,042	42,241	43,967	47,178	54,884	37,921.40
	Western Visayas	79,616	85,635	90,821	94,827	84,336	89,910	95,835	103,818	110,012	117,439	95,224.90
	Central Visayas	78,507	84,258	87,414	88,333	92,214	97,616	99,743	104,845	115,114	118,628	96,667.20

	Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
	Eastern Visayas	43,279	41,676	40,326	35,460	30,422	28,347	36,294	49,319	55,000	62,322	42,244.50
	Zamboanga Peninsula	25,474	28,228	25,395	26,700	26,492	27,826	30,204	31,986	34,236	36,476	29,301.70
	Northern Mindanao	118,789	127,930	130,084	135,957	140,522	146,029	152,802	159,086	164,672	170,021	144,589.00
	Davao Region	60,741	62,677	64,227	67,381	68,424	73,582	72,007	71,758	76,341	81,090	69,822.80
	SOCCSKSARGEN	33,747	39,398	43,003	45,239	47,970	47,142	49,844	53,403	61,916	65,563	48,722.50
	Caraga	11,604	11,258	10,019	11,901	13,164	13,253	13,864	14,591	16,277	15,513	13,144.40
	ARMM	6,448	6,464	5,817	5,851	5,427	5,359	4,943	4,848	5,096	5,161	5,541.40
Chicken egg	**PHILIPPINES**	387,335	403,433	421,057	427,686	415,652	444,550	461,719	492,406	533,905	583,234	457,097.60
	CAR	2,883	2,831	2,879	3,198	3,292	3,606	3,505	3,397	3,936	4,072	3,359.90
	Ilocos Region	16,775	16,462	16,236	13,867	12,785	14,087	14,081	16,265	18,588	19,578	15,872.40
	Cagayan Valley	8,496	8,192	8,884	10,243	11,821	11,951	12,305	12,987	14,331	14,787	11,399.70
	Central Luzon	75,523	77,110	80,886	86,429	88,303	91,125	93,564	102,159	105,238	118,182	91,851.80
	CALABARZON	112,096	120,876	129,777	128,707	120,642	133,962	140,274	145,017	156,317	174,939	136,260.70
	MIMAROPA	4,264	4,344	4,370	4,332	4,737	5,608	5,401	5,631	6,612	6,942	5,224.10
	Bicol Region	16,194	16,654	17,520	18,847	16,877	13,836	13,381	12,790	13,434	14,836	15,436.90
	Western Visayas	27,841	30,098	31,376	33,558	31,188	32,175	31,771	30,955	34,351	35,939	31,925.20
	Central Visayas	39,119	40,155	41,631	38,600	33,413	41,648	46,304	48,568	52,139	53,863	43,544.00
	Eastern Visayas	3,373	3,578	3,100	2,849	2,215	2,378	2,509	3,114	4,253	4,547	3,191.60
	Zamboanga Peninsula	9,684	9,452	8,600	8,081	8,976	10,530	11,055	12,481	13,519	16,185	10,856.30
	Northern Mindanao	34,534	36,632	37,897	39,830	40,805	41,841	43,084	45,713	47,788	49,204	41,732.80
	Davao Region	21,464	22,255	22,833	23,309	24,063	24,819	25,495	26,407	26,123	31,651	24,841.90
	SOCCSKSARGEN	8,974	9,324	9,193	9,109	9,007	8,469	10,861	18,789	25,846	27,145	13,671.70
	Caraga	2,325	2,307	2,501	3,222	4,052	4,815	4,758	4,834	8,174	8,017	4,500.50
	ARMM	3,790	3,163	3,373	3,505	3,476	3,700	3,371	3,299	3,256	3,347	3,428.00

Source: PSA

5.2.2. Poultry (broiler and layer) and livestock producers

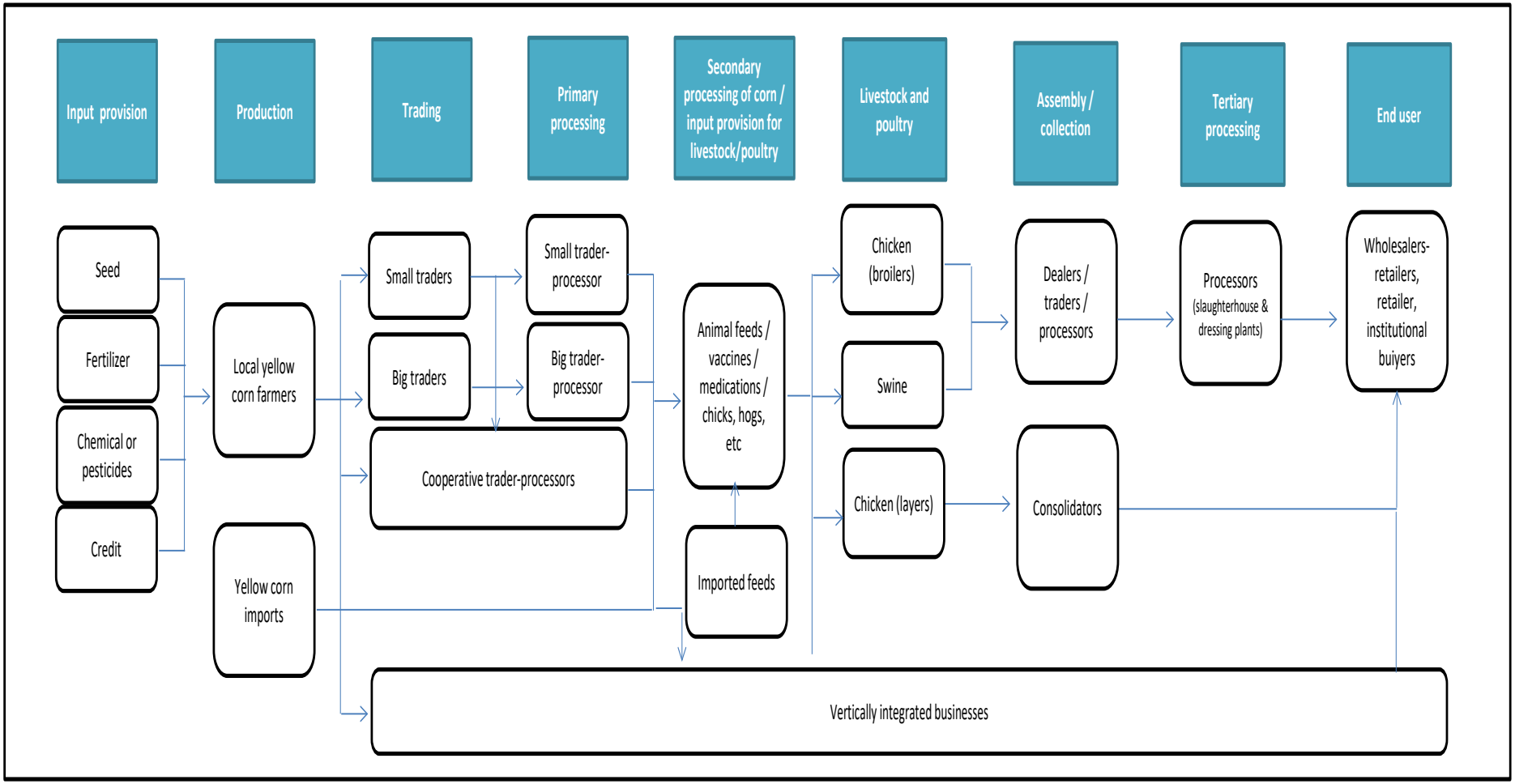
The end consumers of the animal feeds are the livestock, poultry, and chicken egg production industries (see **Figure 20**). As seen in **Figure 20**, the livestock and poultry (broiler and layer) industries require inputs such as vaccines, medications, chicks, hogs, and animal feeds. According to the papers of Gordoncillo et al. (2019) and Briones et al. (2021), feeds are the primary input utilized in the production of broiler chicken, chicken eggs, and hogs wherein it accounts for a substantial share to the total operating expense of these industries. The findings of the studies of Gordoncillo et al. (2019) and Briones et al. (2021) are summarized below:

(i) For backyard and commercial producers of chicken meat, feeds account for approximately 52 percent and 64 percent of the total operating costs, respectively (see **Table 19,** Gordoncillo et al.);
(ii) For commercial egg producers, the cost of feeds constitutes around 91 percent of the total production expenses (see **Table 20,** Gordoncillo et al.);
(iii) For backyard hog producers, feeds account for around 51 percent of the total operating costs, while for the commercial producers, it comprises approximately 67 percent (see **Table 21,** Gordoncillo et al.);
(iv) For large broilers farms, the share of feeds to total production cost is 65 percent (**Figure 21**, Briones et al.); and
(v) For large swine farms, the contribution of feeds to overall production is approximately 58 percent (**Figure 22**, Briones et al.).

In addition to this, **Tables 19, 20,** and **21** list the operating and investment costs of the chicken broilers, chicken layers, and hogs for the surveyed backyard and commercial farms, respectively. As discussed above, feed expense has the highest share to the total operating expenses. The other notable input requirement expense is the cost of the animal breeders (such as chicks, hogs, etc.) wherein its average share to total operating expense is 23 percent for broilers, 3 percent for chicken egg producers, and 25 percent for hogs (see **Tables 19, 20,** and **21**). Moreover, labor, electricity and water, and veterinary and medical supplies, on average, account for 4.8 percent, 2.1 percent, and 1.7 percent of the total operating expenses of the broiler, layers, and swine production (see **Tables 19, 20,** and **21**)**.**

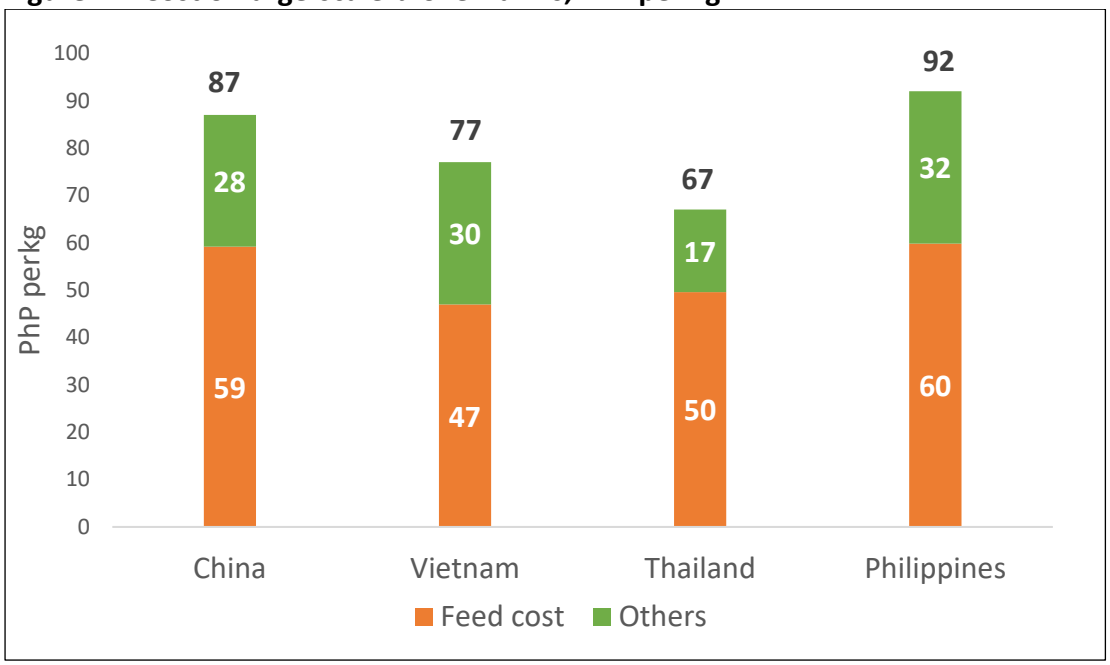
With regard to return on investment (ROI), commercial and backyard producers of broilers earn roughly 17.3 percent and 14.6 percent for every peso invested, respectively (see **Table 19**). These figures imply that economies of scale in the poultry broiler industry is minimal. In contrast, the ROI on commercial producers of swine is almost three times larger than backyard farms. More specifically, the returns of commercial swine farm for each peso invested is approximately 34.6 percent, while backyard producer only has a ROI of 12 percent (see **Table 21**). This indicates that commercial farms are more efficient producers than backyard farms in the swine industry. Lastly, commercial chicken egg producers have the highest ROI out of the three sub-industries. As seen in **Table 20**, approximately PhP 0.65 is earned for each peso invested in the commercial egg production business.

Figure 20. Value chain of yellow corn-livestock-poultry in the Philippines



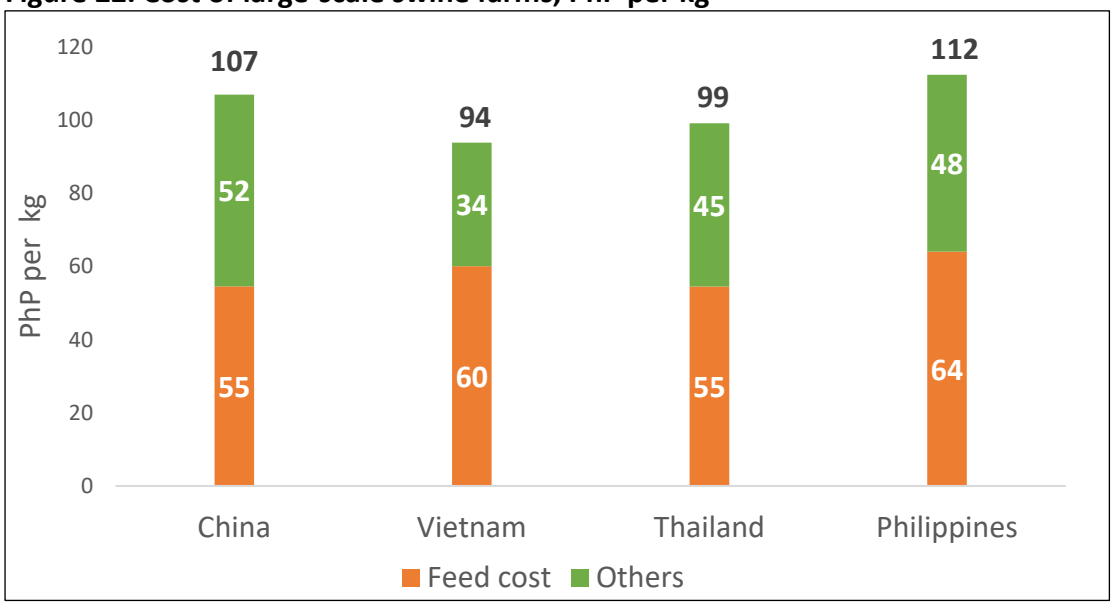
Source: ASPSI (2020), Gerpacio et al. (2004), and Gordoncillo et al. (2019)

Figure 21. Cost of large-scale broiler farms, PhP per kg



Source: Briones et al. (2021)

Figure 22. Cost of large-scale swine farms, PhP per kg



Source: Briones et al. (2021)

Table 19. Cost and returns of broiler chicken production by type of producer in Pampanga, 2017

ITEM	TYPE OF PRODUCER			
	Backyard Broiler Producer	Share to total cost (%)	Commercial Broiler Producer	Share to total cost (%)
INVESTMENT COST	30,700.00		3,950,000.00	
Land	3,600.00	11.73%	750,000.00	18.99%
Housing and other related costs	2,600.00	8.47%	2,500,000.00	63.29%
Vehicle	24,500.00	79.80%	700,000.00	17.72%
Generator	-		-	
RETURNS				
Sales of Live Broiler Chicken	-		9,556,620.00	
Sales of Dressed Chicken	35,985.60		-	
OPERATING COSTS				
Cost of Day-old Chicks	5,120.00	16.25%	2,640,000.00	29.75%
Cost of Feeds	16,500.00	52.36%	5,700,000.00	64.24%
Cost of Veterinary Supplies	608.00	1.93%	252,000.00	2.84%
Electricity, Fuel and Water	1,200.00	3.81%	58,500.00	0.66%
Labor	2,216.16	7.03%	94,500.00	1.07%
Depreciation	4,522.67	14.35%	128,000.00	1.44%
Dressing Cost	1,344.00	4.27%	-	-
NUMBER OF CYCLES/ YEAR	2		6	
VOLUME SOLD/per year, kg live	-		115,140.00	
VOLUME SOLD/per year, kg dressed	257.04		-	
TOTAL RETURNS /YEAR (PhP)	35,985.60		9,556,620.00	
TOTAL COSTS/ YEAR (Php)	31,510.83		8,873,000.00	
NET RETURNS/ YEAR (Php)	4,474.77		683,620.00	
RETURN ON INVESTMENT (%)	14.58		17.31	
Cost per kg, dressed	122.59		-	
Cost per kg, live	-		77.06	
Net income per kg, dressed	17.41		-	
	-			
Net Income per kg, live	-		5.94	
Mortality Rate: 8.18%				

Source: Gordoncillo et al. 2019

Table 20. Costs and returns of chicken egg production of commercial producers in Pampanga, 2017

ITEM	TYPE OF PRODUCER Commercial egg producer	Share to total cost (%)
INVESTMENT COST	40,895,000.00	
Land	13,500,000.00	33.01%
Buildings	25,795,000.00	63.08%
Vehicles	1,600,000.00	3.91%
RETURNS		
Sales of Chicken Egg	75,590,666.67	
OPERATING COSTS		
Cost of Layers	1,365,000.00	2.79%
Cost of Feeds	44,572,438.40	91.07%
Cost of Veterinary Supplies	551,880.00	1.13%
Electricity, Fuel and Water	435,600.00	0.89%
Labor	752,400.00	1.54%
Veterinary and other professional cost	108,000.00	0.22%
Depreciation	1,159,800.00	2.37%
TOTAL COSTS	48,945,118.40	
NET INCOME	26,645,548.27	
NUMBER OF CYCLES/ YEAR	0.5	
VOLUME SOLD/ YEAR, Trays	581,466.67	
RETURN ON INVESTMENT (%)	65.16	
Cost per tray (Php)	84.18	
Net Income per tray (Php)	45.82	
Cost per egg (Php)	2.81	
Net income per egg (Php)	1.53	

Source: Gordoncillo et al. 2019

Table 21. Costs and returns of hog production by type of producer in Iloilo, 2018

ITEM	TYPE OF PRODUCER			
	Backyard Hog Producer	Share to total cost (%)	Commercial Hog Producer	Share to total cost (%)
INVESTMENT COST	1,308,000.00		18,450,000.00	
Land	1,160,000.00	88.69%	15,000,000.00	81.30%
Building	68,000.00	5.20%	3,350,000.00	18.16%
Vehicle	80,000.00	6.12%	100,000.00	0.54%
RETURNS				
Sales of Live Hogs	424,800.00		14,952,960.00	
OPERATING COSTS				
Cost of Stocks	64,000.00	23.90%	2,252,800.00	26.28%
Cost of Feeds	137,691.84	51.41%	5,724,007.11	66.77%
Cost of Veterinary Supplies	4,320.00	1.61%	114,480.14	1.34%
Electricity and Water	15,600.00	5.82%	26,697.79	0.31%
Labor	36,000.00	13.44%	352,410.89	4.11%
Depreciation	10,220.00	3.82%	101,748.26	1.19%
TOTAL COSTS	267,831.84		8,572,144.19	
NET INCOME	156,968.16		6,380,815.80	
NUMBER OF CYCLES/YEAR	2		2	
VOLUME PRODUCED/YEAR (kg, live)	3,600.00		63,360.00	
RETURN ON INVESTMENT	12		34.58	
Cost per kg, live	74.4		67.65	
Net Income per kg, live	43.6		50.35	

Source: Gordoncillo et al. 2019

As mentioned in the previous section, the hog or swine industry is mostly dominated by the backyard producers (small players) wherein its share in the total production of swine is roughly 60 to 70 percent (Gordoncillo et al. 2019). This type of producers is characterized as transitioning value chain wherein there are many small farmers that sell their goods to traders or middlemen. On the other hand, the top commercial farm producer in the country is San Miguel Foods Inc. It has a market share of approximately 3 percent to the total supply of pork in 2014 (see **Table 22**). It is then followed by Universal Robina Corporation, Foremost Farms, and Cavite Pig City with market shares of 1.4 percent, 1.1 percent, and 0.6 percent given the same period, respectively (see **Table 22**). These large players are vertically integrated from animal feed production to supermarket retail of the livestock and poultry commodities – an attribute of a modernized value chain. This type of companies typically operates as "integrators" wherein it engages in contract growing operations with hog producers. As seen in **Table 22**, the sum of the market shares of the top four major commercial producers of pork is only roughly 6 percent in 2014. Thus, the market for pork in the country is relatively competitive given that there is no single or few players in the market which has/have a significant influence in the production or supply of pork.

In contrast, the production side of the chicken meat industry (broilers) is dominated by few major players. **Table 23** shows the list of the top four producers of broiler chicken in the country. As seen in **Table 23,** these are San Miguel Foods Inc, Bountry Fresh Group of Companies, Swift Foods, and Foster foods with market shares of 40.1 percent, 12.1 percent, 0.06 percent, and 0.06 percent in 2014, respectively. This is equivalent to an aggregate market

share of approximately 52.8 percent. Similar to large hog players, these companies are greatly vertically integrated wherein they produce their own animal feeds to engaging contract growers in the production of broilers to supermarket retails where chicken meat are sold for household consumption and institutional buyers (such as hotels, restaurants, etc). However, it is important to note that the two major producers have a combined market share of more than 50 percent. Thus, unlike the swine industry, the chicken broiler industry in the country can be characterized as an oligopolistic market[19].

Lastly, the chicken egg production has a relatively low market concentration similar to the swine industry. As seen in **Table 24**, the top four producers of chicken eggs are Bounty Farms Inc, Universal Robina Corporation, Everest Farm Inc, and Venvi Agro-Industrial Ventures Corp with market shares of 5 percent, 2.6 percent, 2.5 percent, and 0.4 percent in 2013, respectively. This translates to an aggregate market share of only 10.5 percent in the same period. Therefore, similar to the hog sector, the chicken egg industry in the country is relatively competitive.

Table 22. Market concentration of the major pork producers in the Philippines in 2014

Company	Market share (in %)
San Miguel Foods, Inc.	2.9
Universal Robina Corp.	1.4
Foremost Farms	1.1
Cavite Pig City	0.6
Total	**6**

Source: Security Exchange Commission (SEC) and WATTAgnet.com

Table 23. Market concentration of the major broiler chicken producers in the Philippines in 2014

Company	Market share (in %)
San Miguel Foods, Inc.	40.6
Bounty Fresh Grouop of Companies	12.1
Swift Foods, Inc.	0.06
Foster Foods, Inc.	0.06
Total	**52.82**

Source: SEC

Table 24. Market concentration of the major chicken egg producers in the Philippines in 2013

Company	Market share (in %)
Bounty Farms, Inc.	5
Universal Robina Corporation	2.6
Everest Farm, Inc.	2.5
Venvi Agro- Industrial Ventures Corp.	0.4
Total	**10.5**

Source: SEC and WATTAgnet.com

[19] An oligopoly is characterized by two major players having significant power or influence on the market.

5.2.3. Assembly and tertiary processing

Once the chickens have laid eggs, the eggs are collected by consolidators from the commercial farms (see **Figure 20**). Subsequently, the consolidators will perform postharvest processing such as cleaning, packaging, marketing, and transportation (to wholesalers and retailers) (Gordoncillo et al. 2019). Moreover, the consolidators classify the eggs by weight or size. The egg categories are extra-small, small, medium, large, and extra-large (Gordoncillo et al. 2019) wherein the smaller (larger) the weight or size of the egg, the lower (higher) the market price. For instance, extra-small eggs are sold for PhP 1,296 per case[20], while extra-large eggs are retailed at PhP 1,620 per case (Gordoncillo et al. 2019).

Conversely, live broiler chicken and live hogs are purchased and collected by dealers, traders, or processors at the end of each production cycle (see **Figure 20).** Subsequently, the chicken or swine is transported to dressing plants and slaughterhouse for further processing, respectively. The former involves activities such as ante-mortem inspection of chicken, stunning, sticking, scalding, dehairing, evisceration, cleaning, post-mortem inspection and cleaning, chilling, and delivery to wholesalers and retailers. While the latter includes processing such as ante-mortem inspection of swine, stunning, sticking and bleeding, scalding, dehairing, evisceration, carcass splitting, weighing, post-mortem inspection and cleaning, and delivery (to wholesalers and retailers).

There are two types of chicken dressing plants. The first one is dressing plants accredited by the National Meat Inspection Service (NMIS), while the other is accredited by the Local Government Units (LGU). The main difference between the two plants is that the accredited NMIS dressing plants has a larger capacity than the LGU counterpart. In particular, NMIS accredited facilities has a capacity of 10,000 to 50,000 chicken per day. In contrast, LGU accredited plants has a maximum volume of 2,500 chicken per day (Gordoncillo et al. 2019).

Similarly, there are two major categories of slaughterhouse for swine: (1) NMIS accredited, and (2) Locally Registered Meat Establishments (LRMEs), which is accredited by the LGUs. Compared to the number of accredited NMIS dressing plants, NMIS slaughterhouses are relatively few in the country. However, institutional buyers of pork such as hotels, restaurants, supermarkets, etc. require meat carcasses slaughtered from NMIS accredited facilities (Gordoncillo et al. 2019). As such, due to the limited number of accredited NMIS slaughterhouses, dealers, traders, or processors have to occasionally transport their goods to NMIS accredited slaughterhouses of other provinces. This entails unnecessary additional transaction costs to dealers, traders, or processors. In contrast, meat originating from LRME accredited slaughterhouses are generally sold only to wet markets (Gordoncillo et al. 2019).

5.2.4. End users of poultry and livestock products

Once the processors have performed their processing activities, the chicken meat, pork, and chicken eggs are delivered and sold to wholesalers-retailers and retailers. They will then sell the meat and eggs to end-users that include but not limited to consumers, wet markets, supermarkets, food chains, institutional buyers, and meat processors (Gordoncillo et al. 2019).

Tables 25 to **33** describe the consumer peso breakdown in the value chain of chicken meat, chicken egg, and pork. In terms of the contribution of the producer to the final consumer price,

[20] One case contains 360 eggs.

chicken egg farmers have the highest share with an average of approximately 80 percent, out of the three commodities. It is followed by pork and chicken meat manufacturers with average shares of percent 68 percent and 68 percent, respectively (see **Tables 25** to **33**). In contrast, the dealers or traders have relatively low share to the final consumer price. More specifically, dealers or traders, on average, only account for 4 percent to the final market price of goods (see **Tables 25** to **33**).

Moreover, the contribution of wholesalers of pork to the final consumer price is relatively high. As seen in **Tables 32 and 33**, their average share is approximately 21 percent. In comparison, wholesalers of chicken meat, on average, account for 13 percent of the final consumer price of chicken, while wholesalers of chicken eggs contribute only around 5 percent (see **Tables 25** to **31**). Finally, retailers of chicken eggs and chicken meat have relatively large shares to the final market price of commodities. In particular, retailers of chicken eggs, on average, account for approximately 15 percent of the final consumer price, while chicken meat retailers, on average, contribute 14 percent (see **Tables 25** to **31**). Conversely, the average share of retailers to final price of pork is only 5 percent (see **Tables 32** and **33**). As such, depending on the good, certain stakeholders in the value chain have relatively higher influence or power over the final market price of the commodity.

Table 25. Breakdown of consumer peso in the value chain of chicken meat (dealer-wholesaler-retailer)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	94.86			0.68
Dealer		94.86	102	0.05
Wholesaler		102	120	0.13
Retailer		120	140	0.14

Unit: kg dressed meat
Conversion: 1 kg live weight = 0.857 kg dressed weight
Source: Gordoncillo et al. (2019)

Table 26. Breakdown of consumer peso in the value chain of chicken meat (dealer-retailer)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	94.86			0.68
Dealer		94.86	120	0.18
Retailer		120	140	0.14

Unit: kg dressed meat
Conversion: 1 kg live weight = 0.857 kg dressed weight
Source: Gordoncillo et al. (2019)

Table 27. Breakdown of consumer peso in the value chain of chicken eggs (egg size = XL)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	1,620			0.77
Wholesaler		1,620	1,728	0.05
Retailer		1,728	2,100	0.18

Unit: case (360 eggs per case)
Source: Gordoncillo et al. (2019)

Table 28. Breakdown of consumer peso in the value chain of chicken eggs (egg size = L)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	1,512			0.76
Wholesaler		1,512	1,628	0.06
Retailer		1,628	1,980	0.18

Unit: case (360 eggs per case)
Source: Gordoncillo et al. (2019)

Table 29. Breakdown of consumer peso in the value chain of chicken eggs (egg size = M)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	1,404			0.78
Wholesaler		1,404	1,476	0.04
Retailer		1,476	1,800	0.18

Unit: case (360 eggs per case)
Source: Gordoncillo et al. (2019)

Table 30. Breakdown of consumer peso in the value chain of chicken eggs (egg size = S)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	1,332			0.82
Wholesaler		1,332	1,404	0.04
Retailer		1,404	1,620	0.13

Unit: case (360 eggs per case)
Source: Gordoncillo et al. (2019)

Table 31. Breakdown of consumer peso in the value chain of chicken eggs (egg size = XS)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	1,296			0.86
Wholesaler		1,296	1,368	0.05
Retailer		1,368	1,500	0.09

Unit: case (360 eggs per case)
Source: Gordoncillo et al. (2019)

Table 32. Breakdown of consumer peso in the value chain of backyard pork (trader-wholesaler-retailer)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Backyard producer	153			0.71
Trader		153	160	0.03
Wholesaler		160	205	0.21
Retailer		205	215	0.05

Unit: kg carcass
Conversion: 1kg live weight = 0.85 kg dressed weight
Source: Gordoncillo et al. (2019)

Table 33. Breakdown of consumer peso in the value chain of commercial pork (trader-wholesaler-retailer)

Key player	Farm price	Buying price	Selling price	Consumer peso breakdown
Commercial producer	139			0.65
Trader		139	160	0.1
Wholesaler		160	205	0.21
Retailer		205	215	0.05

Unit: kg carcass
Conversion: 1kg live weight = 0.85 kg dressed weight
Source: Gordoncillo et al. (2019)

5.2.5. Summary of animal-feed and livestock and poultry value chain

The livestock and poultry subsectors were not just the major contributors to the GVA of the AFF sector but were also the main drivers of growth in AFF despite the relatively low budget support and attention of the government from 2015 to 2019 (see **Table 16**, **Figures 11 and 23**). As seen in **Figure 23**, the two industries contributed for more than half of the 1.27 percent average growth in AFF during the same period. More specifically, of the total 1.27 percentage points growth in AFF from 2015 to 2019, the livestock and poultry subsectors accounted approximately 0.80 percentage points (see **Figure 23**). This is equivalent to around 63 percent of the total average growth of AFF given the same reference period. On the other hand, the average share of the livestock banner program to the total program expenditure of the DA is only 7.1 percent from 2015 to 2019 (see **Figure 11**). This figure is approximately 6 times, 3.1 times, and 1.7 times smaller than the budget contributions of rice, fish, and corn given the same

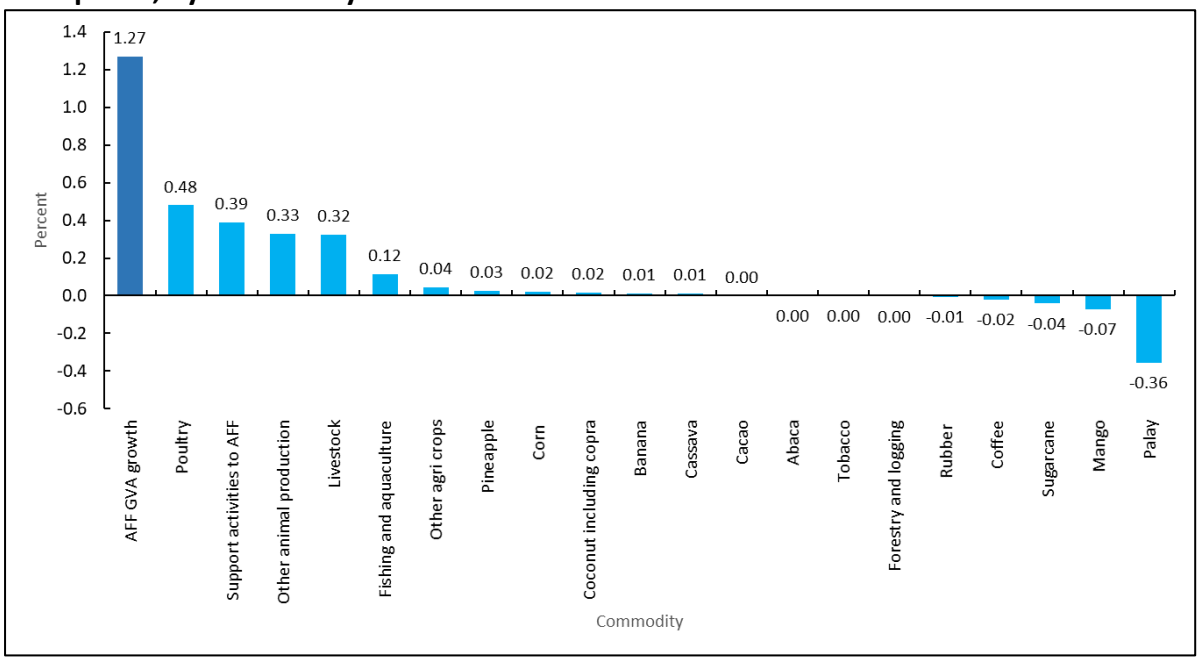
reference period, respectively (see **Figure 11**). These findings coincide with the conclusion of Briones et al (2021) that the pre-COVID development and growth in the livestock and poultry sectors mostly relied on private sector investments.

Due to this lack of government support, the full integration of the corn sector with the livestock and poultry industries has not materialized. As mentioned in the previous sections, although there are some commercial livestock and poultry raisers that are fully vertically integrated from animal feed production up to the wholesale and retail of livestock and poultry meat and by products, there is a glaring absence of existing contract agreements or integration between corn farmers and the feed industry and/or livestock and poultry producers. Furthermore, this inadequacy of government funding to the livestock and poultry sectors has contributed to the dominance of backyard production wherein there is limited economies of scale for both sectors. In particular, backyard raisers accounts for approximately 66 percent and 45 percent of total swine and poultry inventory (PSA). As such, the livestock and poultry value chain are mostly characterized as transitioning value chains.

Moreover, apart from the limited support from the government contributing to the underdevelopment of the livestock and poultry sectors, government policies typically lack a holistic value chain approach for the corn-animal feed-livestock/poultry industries. As discussed in the previous section, the availability and affordability of yellow corn in the country significantly impacts not just the operation of the animal feed industry, but also the production cost and ultimately the growth and competitiveness of the livestock and poultry subsectors. Unfortunately, from 2015 to 2021, there was a supply shortage of yellow corn for feeds in the country. As seen in **Figures 25** and 26, there was a supply deficit of approximately 3.8 million metric tons (mt) from 2015 to 2021. This shortfall of supply in yellow corn could have been remedied by importation. However, the current policy of the government on corn importation (Minimum Access Volume (MAV) system) significantly restricts the entry of cheap non-ASEAN corn.

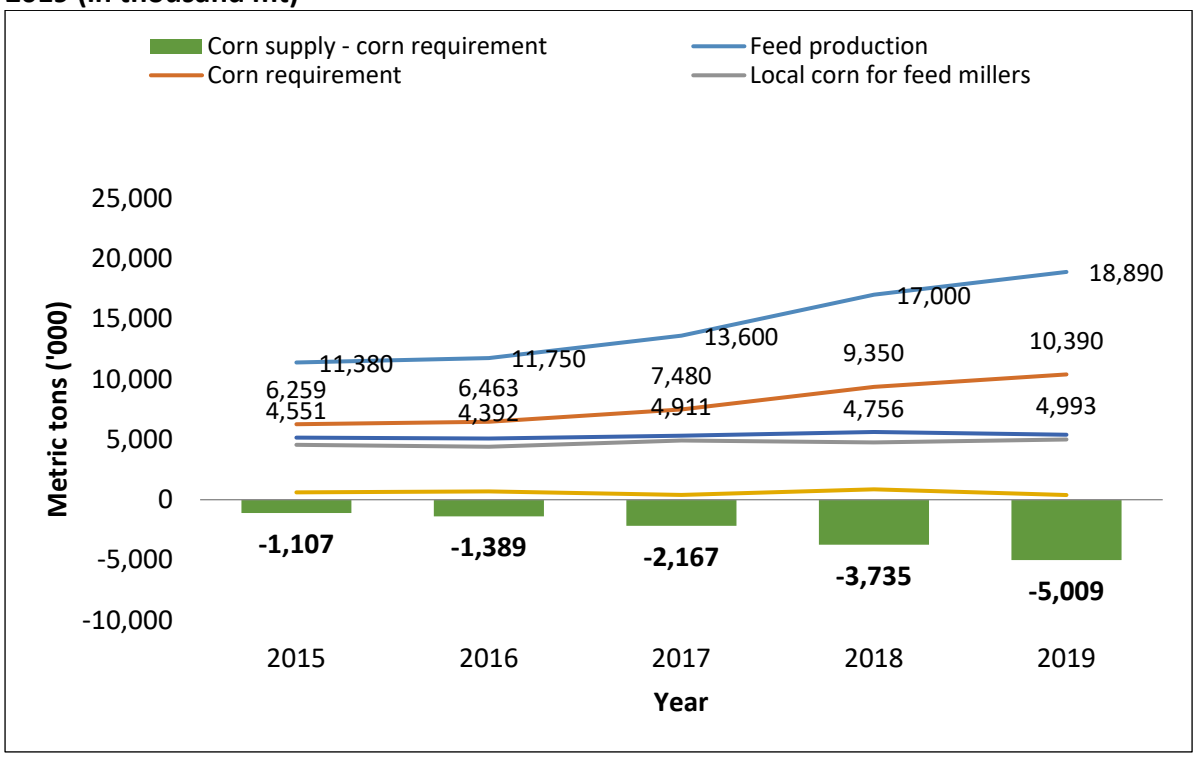
Consequently, according to Briones (2021), the cost per unit in commercial farms in the Philippines is among the highest out of the four countries observed in the study and this is mostly due to greater cost of feed. More specifically, the cost per unit in commercial swine production in the Philippines is approximately 16.5 percent, 11.8 percent, and 4.8 percent higher than Vietnam, Thailand, and China, respectively (see **Figure 22**). Similarly, the cost per unit for commercial scale broiler farms is the greatest in Philippines. As seen in **Figure 21**, the unit cost of commercial broilers in the Philippines is around 27.6 percent, 17.1 percent, and 6.2 percent higher than Thailand, Vietnam, and China, respectively.

Figure 23. Average annual contribution to growth in AFF from 2015 to 2019 at constant 2018 prices, by commodity



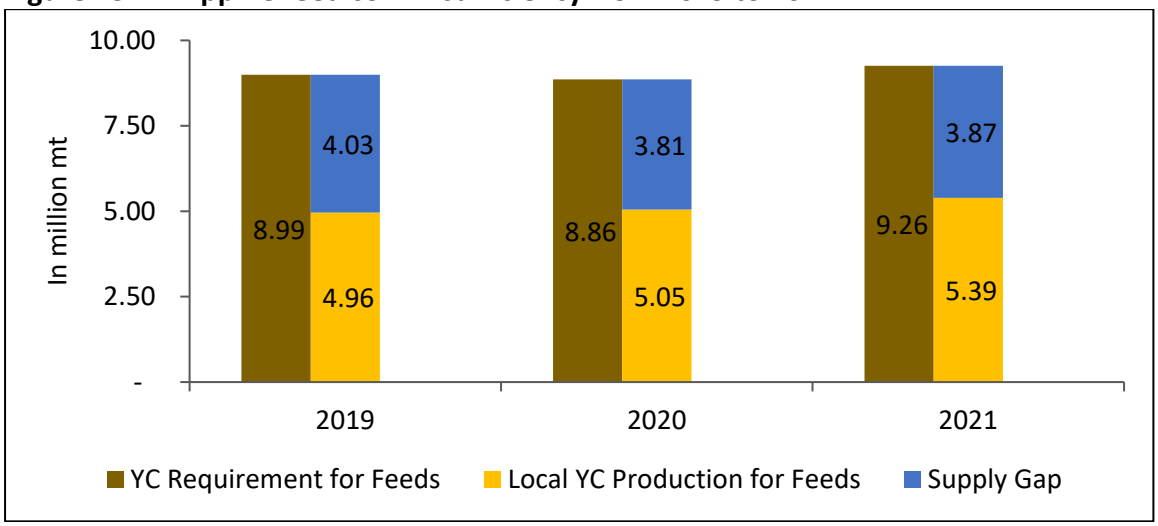
Source: PSA and authors' computation

Figure 24. Philippine feed production, corn requirement, and supply of corn from 2015 to 2019 (in thousand mt)



Source: PSA, USDA Grains and Feed Annual, the Alltech Global Feed Survey, PAFMI, and authors' computation

Figure 25. Philippine feed corn insufficiency from 2019 to 2021



Source: DA National Corn Program (from the second roundtable discussion on poultry, livestock, and yellow corn) and authors' computation

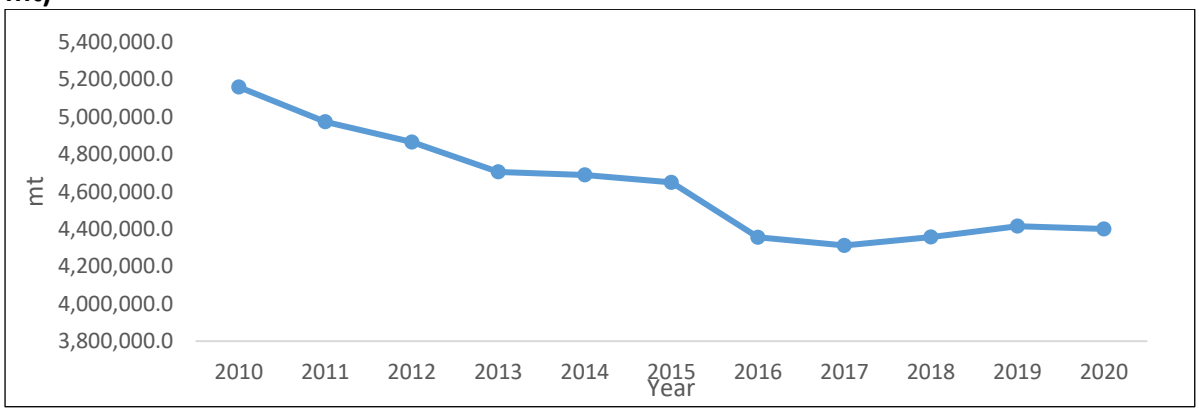
5.3. Milkfish and tuna value chain

5.3.1. Overview of the fishery and aquaculture industry

Figure 27 shows the total production of the fishery sector from 2010 to 2020. As seen in **Figure 27**, the average total production of the industry is approximately 4.6 million mt for the same reference period. Although the Philippines is considered as one of the top producers of fish in the world, the output of the sector is diminishing. In particular, the country's fishery production decreases by around 14.7 percent from 2010 to 2020. This translates to an average annual decline of around 1.6 percent for the same reference period (see **Figures 27 and Table 34**).

Out of all the fishery or aquatic species being captured or cultivated (65 in total based on PSA data), seaweed dominates the sector in terms of volume of production. As seen in **Table 35**, the average production of seaweed is 1,575 thousand mt from 2010 to 2020, which is almost quadruple in terms of volume of the second highest specie (milkfish) as seen in **Table 35**. This is equivalent to an average share to total fishery production of 34 percent for the same reference period (see **Table 35 and Figure 28**). The seaweed commodity is followed by milkfish, tilapia, bali sardinella (tamban), skipjack (gulyasan), roundscad (galunggong), others (marine fisheries), frigate tuna (tulingan), yellowfin tuna, and big-eyed scad (matangbaka) with average productions of 398, 310, 269, 233, 223, 213, 128, 119, and 114 thousand metric tons from 2010 to 2020, respectively (see **Table 35**). In total, the top 5 species (out of the 65), on average, account for approximately 60 percent of the total volume of production in the fishery sector for the same period (see **Figure 28**).

Figure 26. Fishing and aquaculture sector's volume of production from 2010 to 2020 (in mt)



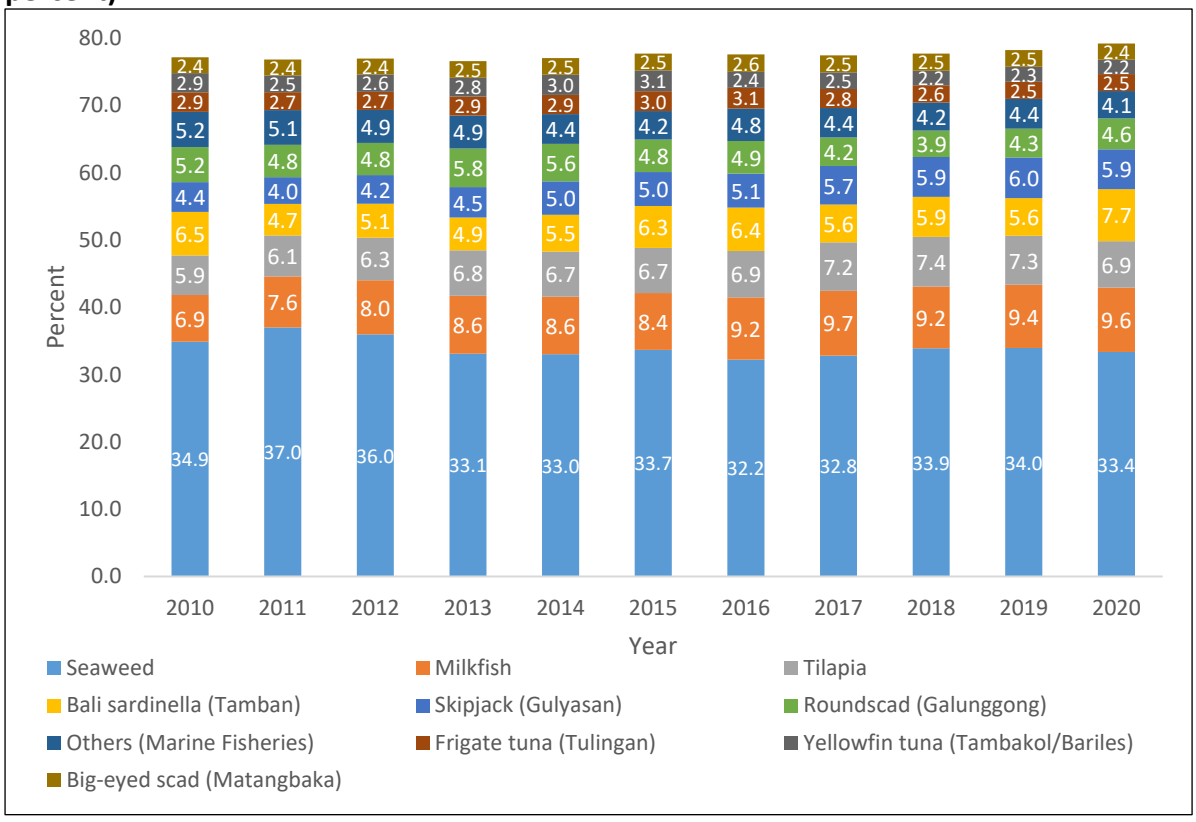
Source: PSA

Table 34. Growth rate of the volume of production of the Fishery sector by category from 2010 to 2020 (in percent)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Municipal	-2.8	-3.9	-1.3	-1.6	-2.2	-6.5	-1.0	-1.8	1.7	-2.0
Commercial	-16.8	0.9	2.4	3.7	-2.0	-6.2	-6.8	-0.2	-1.6	4.7
Aquaculture	2.4	-2.5	-6.6	-1.5	0.5	-6.3	1.7	3.0	2.3	-1.5
Total	-3.6	-2.2	-3.3	-0.3	-0.8	-6.3	-1.0	1.0	1.3	-0.3

Source: PSA

Figure 27. Share of top species to total volume of production from 2010 to 2020 (in percent)



Source: PSA

Table 35. Top species by volume of production from 2010 to 2020 (in '000 mt)

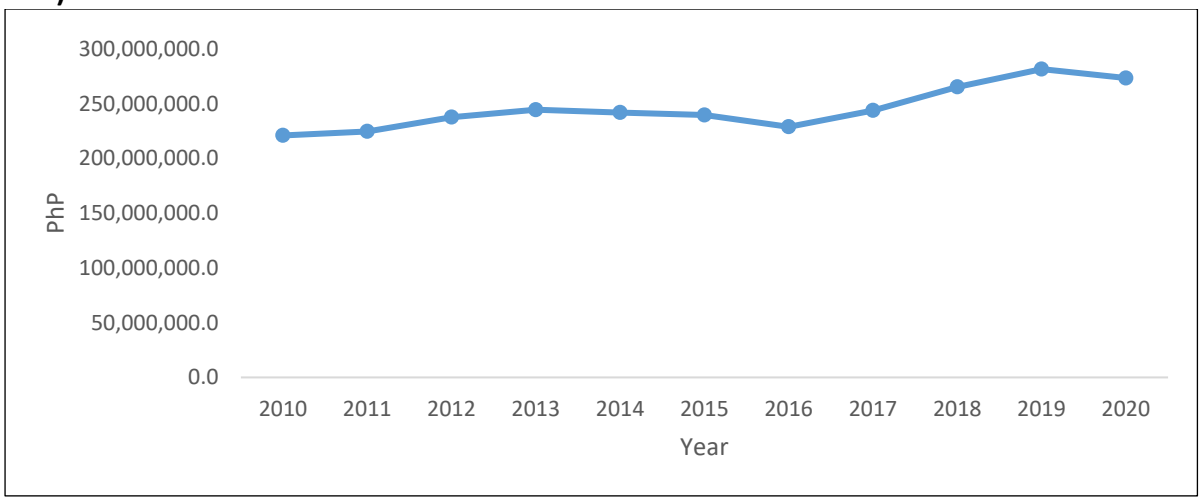
Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Seaweed	1,801.3	1,840.8	1,751.1	1,558.4	1,549.6	1,566.4	1,404.5	1,415.3	1,478.3	1,500.0	1,468.7
Milkfish	357.9	378.3	391.3	405.8	402.0	392.7	402.7	416.4	400.1	414.9	421.0
Tilapia	303.7	303.2	308.0	317.8	313.4	311.7	300.7	311.0	321.1	321.2	304.3
Bali sardinella (Tamban)	334.0	232.9	246.1	229.2	256.1	290.7	280.5	241.5	259.1	247.5	339.9
Skipjack (Gulyasan)	228.2	197.4	206.5	212.2	233.9	233.5	220.1	247.6	258.4	266.4	260.6
Roundscad (Galunggong)	268.2	239.6	233.5	270.8	260.6	225.1	211.8	183.1	171.3	189.0	202.0
Others (Marine Fisheries)	270.3	255.8	237.6	229.8	207.8	196.3	210.3	188.0	181.7	196.1	179.2
Frigate tuna (Tulingan)	149.6	132.6	131.7	134.2	134.1	137.7	133.9	122.1	111.9	111.5	110.5
Yellowfin tuna (Tambakol/Bariles)	147.3	123.0	125.3	130.1	139.9	143.4	103.0	106.9	94.4	99.4	94.9
Big-eyed scad (Matangbaka)	121.5	119.2	114.9	117.1	116.4	116.7	112.8	109.2	110.9	109.4	105.2
TOTAL	**5,159.5**	**4,973.6**	**4,865.1**	**4,705.4**	**4,689.1**	**4,649.3**	**4,355.8**	**4,312.1**	**4,356.9**	**4,415.0**	**4,400.4**

Source: PSA

Moreover, the top three fishing or aquatic species in terms of average volume of production from 2010 to 2020 are all predominantly cultivated and harvested from the aquaculture sub-sector. These aquaculture commodities, in particular, are seaweed, milkfish, and tilapia (see **Table 35** and **Figure 28**). The rest of the top fishing goods (from rank 4 to rank 10) in terms of average volume of production given the same reference period are all marine capture (both municipal and commercial). As seen in **Table 35** and **Figure 28,** these are bali sardinella, skipjack, roundscad, others (marine fisheries), frigate tuna, yellowfin tuna, and big-eyed scad.

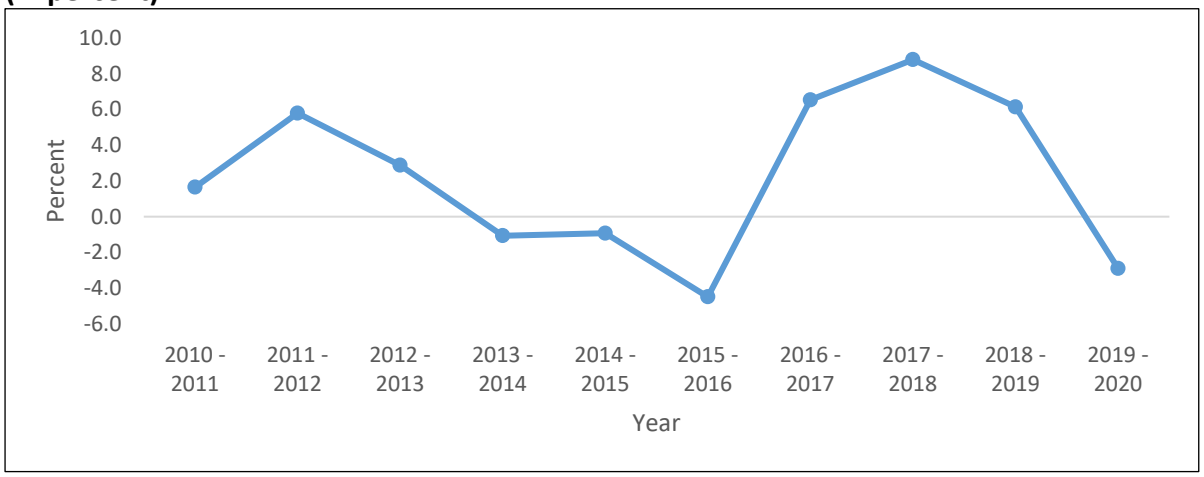
In contrast, **Figure 29** shows the value of production of the fishing and aquaculture sector from 2010 to 2020. As seen in **Figure 29,** the average value of production of the industry is estimated to be at PhP 245,725 million for the same reference period. Although the sector's total volume of output diminished, as discussed above, its aggregate value of production rose from 2010 to 2020. In particular, the value of the output of the fishery sector increased by approximately 23.7 percent for the same reference period, or from PhP 221,051 million in 2010 to PhP 273,488 milion in 2020 (see **Figure 29**). This translates to an average annual growth rate of 2.2 percent during this period (see **Figure 30**).

Figure 28. Fishing and aquaculture sector's value of production from 2010 to 2020 (in '000 PhP)



Source: PSA

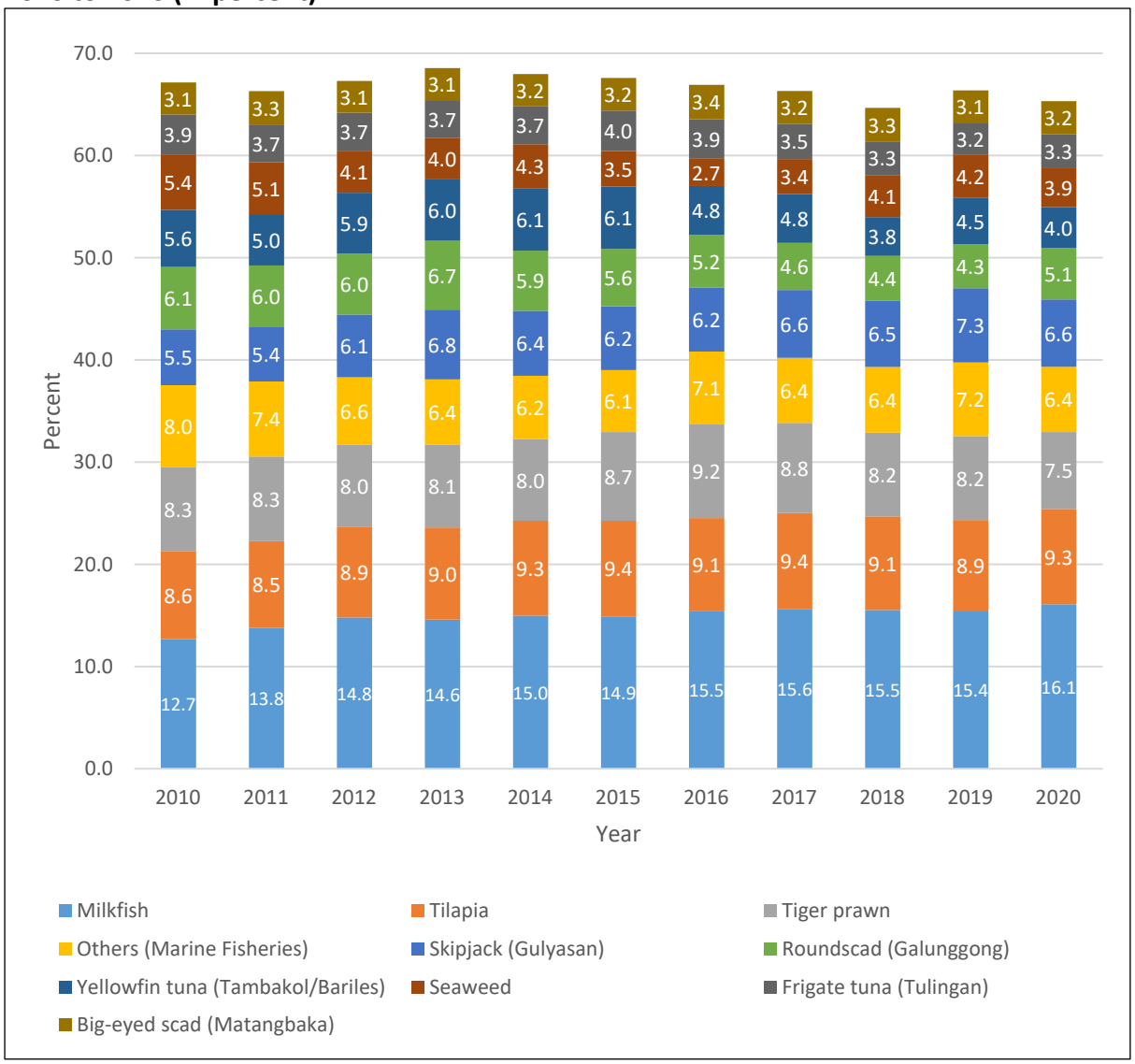
Figure 29. Growth rates of the value of production of the Fishery sector from 2010 to 2020 (in percent)



Source: PSA

Although seaweed dominates the fishing and aquaculture sector in terms of volume produced (as seen in **Table 35** and **Figure 28**), it only ranks eighth in terms of value of production out of all the fishery species (65 species in total based from PSA data) from 2010 to 2020 (see **Figure 31 and Table 36**). As seen in **Table 36**, the average value of seaweed production is PhP 9,969 million for the same reference period. In contrast, milkfish and tilapia, which ranks second and third in terms of volume of production respectively (see **Table 35 and Figure 28)**, generate the highest value of production out of all the 65 fishery species or goods. More specifically, the average value of milkfish and tilapia were PhP 36,713 and PhP 22,247 million from 2010 to 2020, respectively (see **Table 36** and **Figure 31**). These translate to average shares to the total value of fishery of 15 percent and 9 percent from 2010 to 2020 (see **Figure 31**).

Figure 30. Share of the top species to total value of production of the fishery sector from 2010 to 2020 (in percent)



Source: PSA

Table 36. Top species of the fishery sector by value of production from 2010 to 2020 (in million PhP)

Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Milkfish	28,059.0	30,957.3	35,168.3	35,698.8	36,243.9	35,712.4	35,386.9	38,041.5	41,225.4	43,352.8	44,004.2
Tilapia	18,934.4	19,069.7	21,135.4	22,019.9	22,443.7	22,420.5	20,770.1	22,993.7	24,253.2	25,179.6	25,504.6
Tiger prawn	18,269.1	18,593.5	19,010.7	19,763.1	19,347.2	20,828.5	20,967.5	21,494.3	21,785.3	23,118.8	20,597.6
Others (Marine Fisheries)	17,687.8	16,533.1	15,734.8	15,695.8	14,994.2	14,541.8	16,329.4	15,523.2	17,039.2	20,296.2	17,446.7
Skipjack (Gulyasan)	12,076.4	12,056.2	14,596.6	16,658.7	15,380.8	14,956.3	14,279.5	16,200.4	17,246.3	20,454.1	18,015.5
Roundscad (Galunggong)	13,477.7	13,410.2	14,186.8	16,475.2	14,229.0	13,455.0	11,811.6	11,242.5	11,608.3	12,179.4	13,832.9
Yellowfin tuna (Tambakol/Bariles)	12,389.4	11,294.3	14,117.5	14,688.0	14,671.4	14,636.0	10,980.3	11,670.4	10,044.0	12,678.7	10,871.4
Seaweed	11,974.7	11,391.1	9,776.3	9,903.2	10,517.7	8,315.3	6,104.7	8,301.4	10,919.7	11,845.0	10,614.1
Frigate tuna (Tulingan)	8,637.8	8,317.7	8,839.4	9,085.7	8,953.7	9,484.3	8,852.8	8,462.8	8,750.3	8,972.0	8,933.8
Big-eyed scad (Matangbaka)	6,931.4	7,337.9	7,404.9	7,659.0	7,652.4	7,656.1	7,699.4	7,786.3	8,673.8	8,866.5	8,806.3
TOTAL	221,050.8	224,695.1	237,711.5	244,551.7	241,943.8	239,702.4	228,934.1	243,901.9	265,348.7	281,651.7	273,488.5

Source: PSA

With regards to trade, **Table 37** provides the volume of fish exports of the country. As seen in **Table 37,** tuna is the country's top export commodity with an average export volume of 142,326 mt as fresh/chilled/frozen, smoked, prepared/preserved, and dried from 2012 to 2020. It is followed by seaweeds, crabs, grouper, and shrimps or prawns with average volume of exports of 41,928 mt, 12,873 mt, 10,387 mt, and 7,561 mt for the same reference period (see **Table 37**). The top five leading exports goods, on average, accounted for around 65 percent (215,074 mt) of the total export volume of the fishing and aquaculture sector (330, 892 mt) from 2012 to 2020 (see **Figure 32**). Other major export commodities such as ornamental fish, squid and cuttlefish, octopus, sea cucumber, and roundscad, on average, constituted only around 5 percent (16,251 mt) of the total export volume during the same period (see **Figure 32**).

Similarly, tuna is the country's top export commodity in terms of export value. As seen in **Table 38**, the average value of tuna exports is PhP 21,143,673 thousand from 2012 to 2019. This translates to an average share to total value of exports of 36.3 percent for the same reference period (see **Figure 33**). Tuna is followed by seaweeds, crabs, shrimps or prawns, and grouper with average Free on Board (FOB) values of PhP 9,599,544 thousand, PhP 5,239,948 thousand, PhP 2,754,863 thousand, and PhP 1,666,727 thousand from 2012 to 2020 (see **Table 38**). The top 5 leading export commodities, on average, accounted for approximately 69 percent (PhP 40,404,755 thousand) of the total export value of PhP 59,321,716 thousand for the same period (see **Figure 33**). On the other hand, the other major export commodities such as octopus, squid and cuttlefish, ornamental fish, sea cucumber, and roundscad, on average, constituted only around 4 percent (PhP 2,594,882 thousand) of the total export volume from 2012 to 2019 (see **Figure 33**).

Table 37. Fishery volume of exports by species from 2012 to 2019 (in mt)

Species	2012	2013	2014	2015	2016	2017	2018	2019
Tuna	56,708	165,757	117,909	97,815	103,542	305,466	171,452	119,955
Seaweeds	34,128	55,810	42,469	38,968	39,874	35,491	40,661	48,026
Crabs/crabs fat & crab meat	6,915	13,886	11,914	11,464	14,160	18,265	15,770	10,607
Grouper	8,709	11	13,441	16,178	17,345	12,351	8,632	6,431
Shrimps/Prawns	2,985	9,563	8,917	5,475	8,969	11,010	7,021	6,544
Ornamental Fish, Live	6,049	5,895	5,988	5,900	6,876	5,929	5,351	5,086
Squid and Cuttlefish	4,131	3,999	9,085	3,357	4,231	5,389	5,237	5,108
Octopus	4,586	1,946	4,132	2,041	3,442	7,709	7,896	6,573
Sea Cucumber, Dried	435	149	171	164	408	590	311	429
Roundscad	461	191	191	226	130	103	53	61
Total of other commodities	40,217	76,256	102,645	45,233	198,977	75,903	201,864	55,434
TOTAL	**165,324**	**333,463**	**316,862**	**226,821**	**397,954**	**478,206**	**464,248**	**264,254**

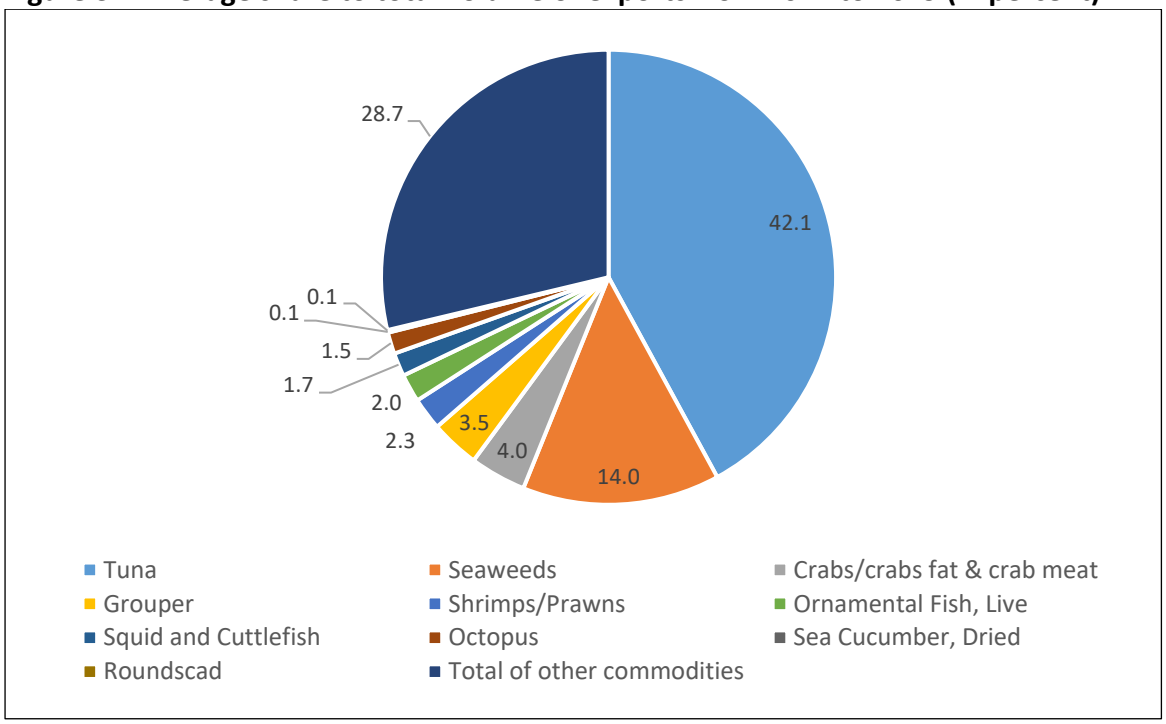
Source: BFAR

Table 38. Fishery value of exports by species from 2012 to 2019 (in thousand PhP)

Species	2012	2013	2014	2015	2016	2017	2018	2019
Tuna	17,370,199	28,914,254	19,597,882	13,521,026	13,556,374	25,558,935	26,071,069	24,559,646
Seaweeds	7,781,989	9,275,227	11,687,900	9,245,232	9,444,811	8,836,591	7,658,610	12,865,990
Crabs/crabs fat & crab meat	2,890,306	3,646,225	5,881,136	5,070,842	4,991,822	7,202,037	7,134,028	5,103,190
Shrimps/Prawns	1,566,124	2,863,185	5,313,847	1,606,011	2,437,562	3,643,288	2,431,065	2,177,823
Grouper	1,395,667	1,611	2,051,377	2,094,233	2,723,334	2,424,828	1,665,903	976,862
Octopus	902,102	356,231	1,124,110	410,654	638,300	1,659,063	2,000,698	1,559,012
Squid and Cuttlefish	980,353	759,671	842,811	614,726	945,541	1,328,924	1,328,880	911,282
Ornamental Fish, Live	299,958	260,950	266,928	260,568	284,089	283,187	297,310	313,706
Sea Cucumber, Dried	238,289	78,444	116666	179,039	326,613	300,634	355,394	355,023
Roundscad	61,366	33,523	13205	30,967	15,464	13,422	6,312	5,641
Total of other commodities	8,883,416	12,611,476	9,453,412	8,667,863	35,372,910	11,603,912	34,957,617	9,026,023
TOTAL	**42,369,769**	**58,800,797**	**56,349,274**	**41,701,161**	**70,736,820**	**62,854,821**	**83,906,886**	**57,854,198**

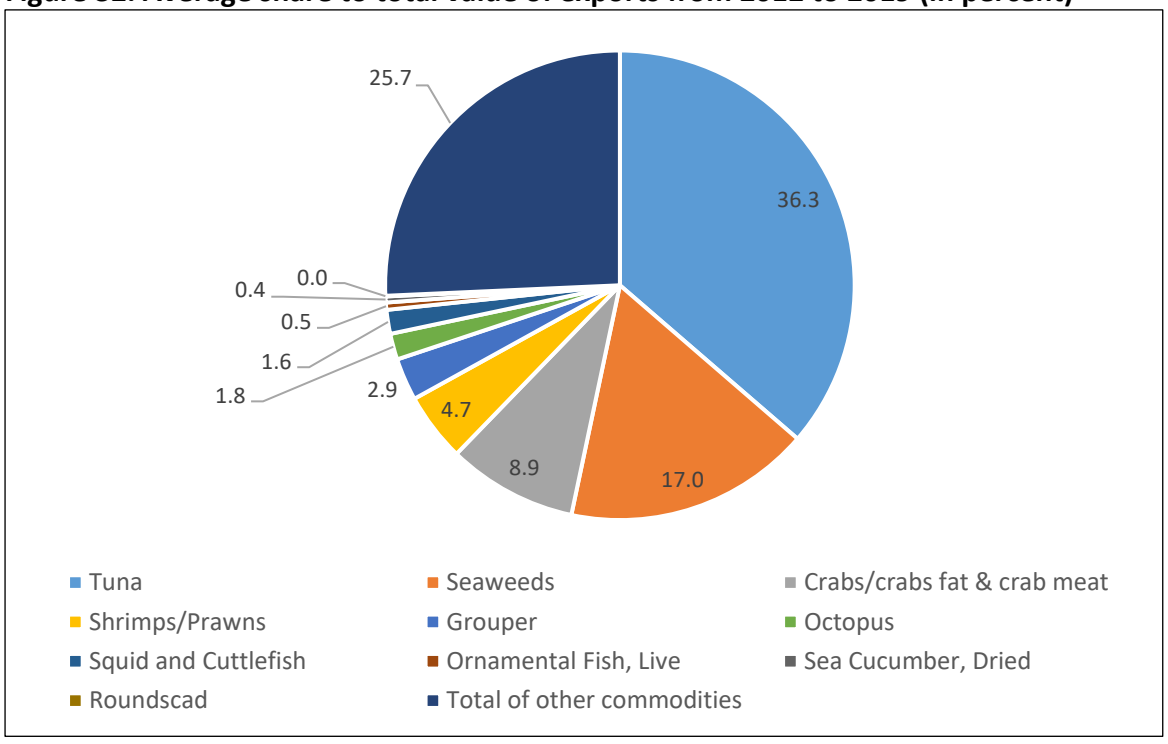
Source: BFAR

Figure 31. Average share to total volume of exports from 2012 to 2019 (in percent)



Source: BFAR

Figure 32. Average share to total value of exports from 2012 to 2019 (in percent)



Source: BFAR

Given discussions of the fishery sector's production and trade trends, the paper will focus on the value chain analysis of milkfish and tuna. This is because: (1) milkfish is consistently the country's top local fish commodity in terms of value and volume of production (the author excludes seaweed given that it is not really a "fish" product) from 2010 to 2020, and (2) tuna is the highest contributor to the country's fish exports both in terms of value and volume from

2012 to 2019. While galunggong is a politically important fish commodity in the country given that it is described as the fish of the poor, it undergoes little processing (i.e., after being caught or imported, it is directly sold to the wet markets) and hence, was not included in the value chain analysis. Similarly, tilapia, another popular fish species in the country, undergoes little to no processing like galunggong, and thus, a value chain analysis of tilapia was not rendered.

5.3.2. Input provision of milkfish

Figure 34 illustrates a schematic diagram of a typical value chain of the milkfish industry in the Philippines. Given that majority of the local milkfish output is originating from aquaculture (wherein, on average, approximately 98.8 percent of the annual milkfish supply in the Philippines came from aquaculture [Salayo et al. 2021]), the main inputs for producing are: (1) fingerlings and/or fry, (2) commercial fish feeds, (3) supplemental feeds such as rice bran or bread crumbs for eutrophic lakes, (4) credit, (5) net pens, cages, and ponds, and (6) other equipment and tools used for production such as boats, water pumps, scuba gear, harvest containers (i.e. chillers) (see **Figure 34**).

According to the studies of Yap et.al. (2007) and Salayo et al. (2021), the major upstream bottlenecks in the production of milkfish in the country are (1) the high prices of commercial formulated feeds and (2) the insufficient local fry and/or fingerlings supply. As seen in **Table 39**, fish feed is a major cost contributor in the production of milkfish (Yap et al. 2007; Salayo et al. 2021). In particular, in the study of Yap et al. (2007), they found out that, on average, feeds constitute around 60 percent of the total operating costs of a typical pen or cage culture system (see **Table 39**).

On the other hand, the country has been heavily dependent on the importation of fry, which are mainly originating from Indonesia and Taiwan, to augment the fry requirements of the local milkfish industry (Ahmed et al. 2001; Sugama 2007; Ferrer et al. 2017; Salayo et al. 2021). Unfortunately, there is no agency (whether private or government) which documents data regarding the country's local milkfish fry production, importation, and requirements (Yap et al. 2007; Salayo et al. 2021). The last known estimates regarding the country's demand of fry are: (1) around 20 million fry was imported from Taiwan in 1994, (2) 360 million fry was imported during peak season (BFAR 2010), and (3) approximately 1.65 billion milkfish fry is required annually based on the country's milkfish production (Ahmed et al. 2001).

Consequently, Salayo et al. (2021) conducted a study to estimate and forecast the required number of integrated breeding and hatchery (IBH) facilities for the country to be self-sufficient in its supply of milkfish juveniles. The summary of the findings of the paper is as follows:

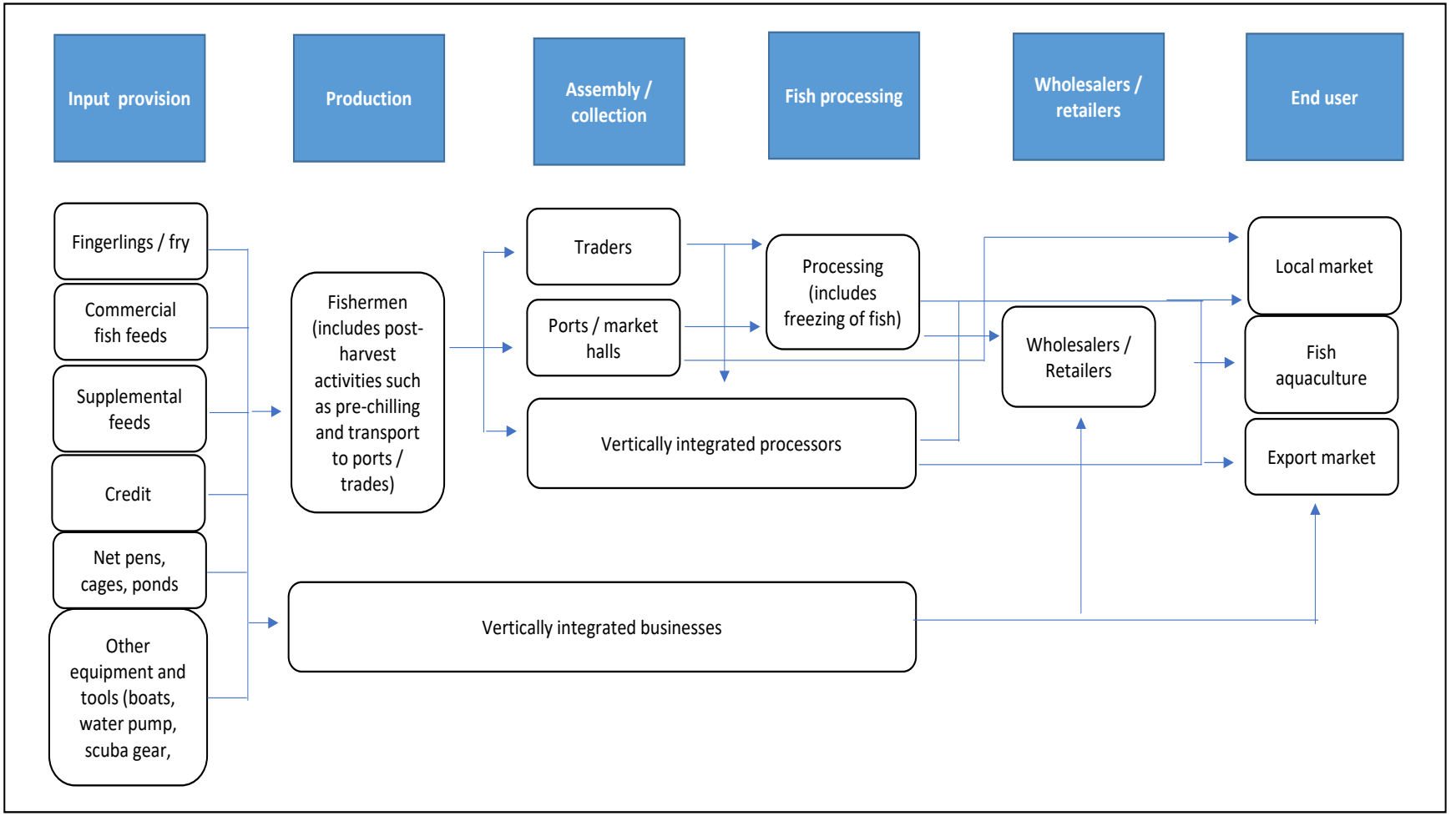
(i) In 2019, the country has 43 IBH facilities wherein 19 are private and 24 are government-owned/operated;
(ii) the Philippines needs around 54 units of IBH in 2020 to become self-sufficient in juvenile milkfish;
(iii) the country needs 60 units of IBH in 2030 to produce 6.75 trillion eggs that will subsequently transform into 448 thousand mt of milkfish valued at PhP 61 billion for its 128 million projected population;
(iv) IBH investments have a high capital requirement (due to the sophisticated technological requirement and high depreciation cost of IBH) but with relatively low returns and hence, private-public partnership is recommended to fund IBH; and
(v) An IBH facility generates considerable direct and indirect employment.

Table 39. Cost and returns of typical pen and cage culture systems

Item	Pen Lagoon	Pen River	Pen Freshwater	Cage
Production	5,667	11,333	6,993	32,725
Sales	424,996	849,992	349,650	2,454,357
Less:				
Variable Costs				
Milkfish fingerlings	36,000	72,000	54,000	198,000
Supplemental Feed	237,998	475,995	73,427	1,374,450
Direct Labor			1,500	3,000
Gasoline & oil	7,000		5,000	20,000
Caretaker			6,000	12,000
Repairs & maintenance	2,000	2,000	2,500	2,000
Harvesting cost	3,400	34,000	20,979	98,175
Caretaker's incentive	38,440	85,919	16,615	34,934
Subtotal	324,838	669,914	180,020	1,742,559
Fixed costs				
Depreciation	15,100	15,100	49,000	68,000
Pond rental			1,000	500
Subtotal	15,100	15,100	50,000	68,500
Total Costs	339,938	685,014	230,020	1,811,059
Net income before tax	85,058	164,978	119,630	643,316
Undiscounted Economic Indicators				
Unit cost of production	59.99	60.44	32.89	55.34
Return on investment	36%	45%	29%	54%
Payback period	3	2	3.5	2

Source: Yap et al. (2007)

Figure 33. Value chain of milkfish in the Philippines



Source: Yap et al. (2007), Idemne et al. (2013), and Salayo et al. (2020)

5.3.3. Production, assembly, collection, and end-users of milkfish

Once the milkfish is harvested, the commodity is immediately chilled. This is because fish, in general, is an extremely perishable commodity such that the process of decomposition starts almost as soon as the fish is taken out of the water (Yap et al. 2007). As such, cold storage and/or freezing techniques are vital to the fishing industry in order to maximize the freshness of the raw material or to minimize the quality loss of the fish (Yap et al. 2007; Montejo et al. 2020; Mopera 2016).

Subsequently, the fish is either transported to the shore which can be directly sold to traders or to be packed for transfer to fish ports where market halls can be found. It is important to note that more chilling process is required if the travel time from farm to fish port is relatively long. Upon arrival at the fishing ports, the milkfish products are then sold to processors or to final consumers.

Processing. Milkfish can be processed into various products utilizing traditional, non-traditional, and modern techniques. Below list the different milkfish processing technology and/or products (Yap et al. 2007):

1. *Preservation by curing**:***
    a. Drying – it is the oldest preservation technique wherein the fish is dried by lowering the water content of the commodity to a level at which microorganisms cannot grow and reproduce. In the Philippines, natural sun drying is the most common way of drying. Examples of dried milkfish products are: (i) dried in the round or whole fish that utilizes small-sized fish, and (ii) split salted dried fish for medium sized fish (locally known as daing)

    b. Fermentation – it is a chemical change that takes place in the fish that has been properly salted to induce the action of proteolytic enzymes and microorganisms (Legaspi et al. 1986b). Example of fermented milkfish commodity is fermented fish with rice (or locally known as buro)

    c. Smoking – there are three types of smoked milkfish or commonly referred as tinapa: c.1. smoked drawn milkfish – which is the conventional smoked bangus. In this process of smoking, it is estimated that some 30 percent of the fish maybe wasted due to the singling out of the flesh bones (Anon 1973; Yap et al. 2007);

    c.2. smoked soft-boned bangus – it makes the milkfish product 98 percent edible and hence, minimizing wastage. In this process of smoking, the bones can be eaten as they have softened due to being subjecting to high pressure (Legaspi et al. 1986b; Yap et al. 2007); and

    c.3. smoked deboned milkfish – the bones are already removed which makes it more convenient to consume.

2. *Boneless bangus* – this process can be considered as a unique Philippine milkfish processing wherein the bones of the bangus are removed. This makes milkfish more acceptable to a wider range of consumers (Yap et al. 2007)

3. *Freezing* – frozen milkfish which can be whole (excluding livers and roes) or deboned. Frozen milkfish is also available in prime cuts, bellies, backs, heads, and tails

4. *Others:*
   a. Use of cans or glass jars – examples are bangus sardine style, bangus salmon style, bangus reliano, paksiw na bangus, smoked bangus in oil, bangus escabeche, and curried bangus

   b. Surimi (minced fish) processing – milkfish has been considered as raw materials for surimi as it has white flesh and it is meaty (Peralta 1998). The milkfish "waste" during deboning process or of trimmings are utilized as materials for surimi. Examples of surimi processing using bangus as raw materials are: (i) fish patties (Peralta 1995), fish burger (Peralta 1998), fish sausage, fish ball, and fish nuggets (Mendoza et al. 2002)

   c. Milkfish by products (offal – viscera, heads, fins, tails)
   c.1. food products – milkfish offals are utilized as an ingredient for making fish kropek, a form of rice cracker (Sulit et al. 1957). Furthermore, Calmorin (1999) successfully incorporated the use of powdered milkfish bones in making polvoron;

   c.2. Animal feed material – milkfish offals are used to produce (i) fish meals, and (ii) fish silage.

   d. Bangus sausages, ready to heat bangus products, and flavor fillets.

End users. As seen in **Figure 34**, the final users in the value chain of milkfish are households (for domestic consumption), institutional buyers, exporters, and fish breeders (aquaculture).

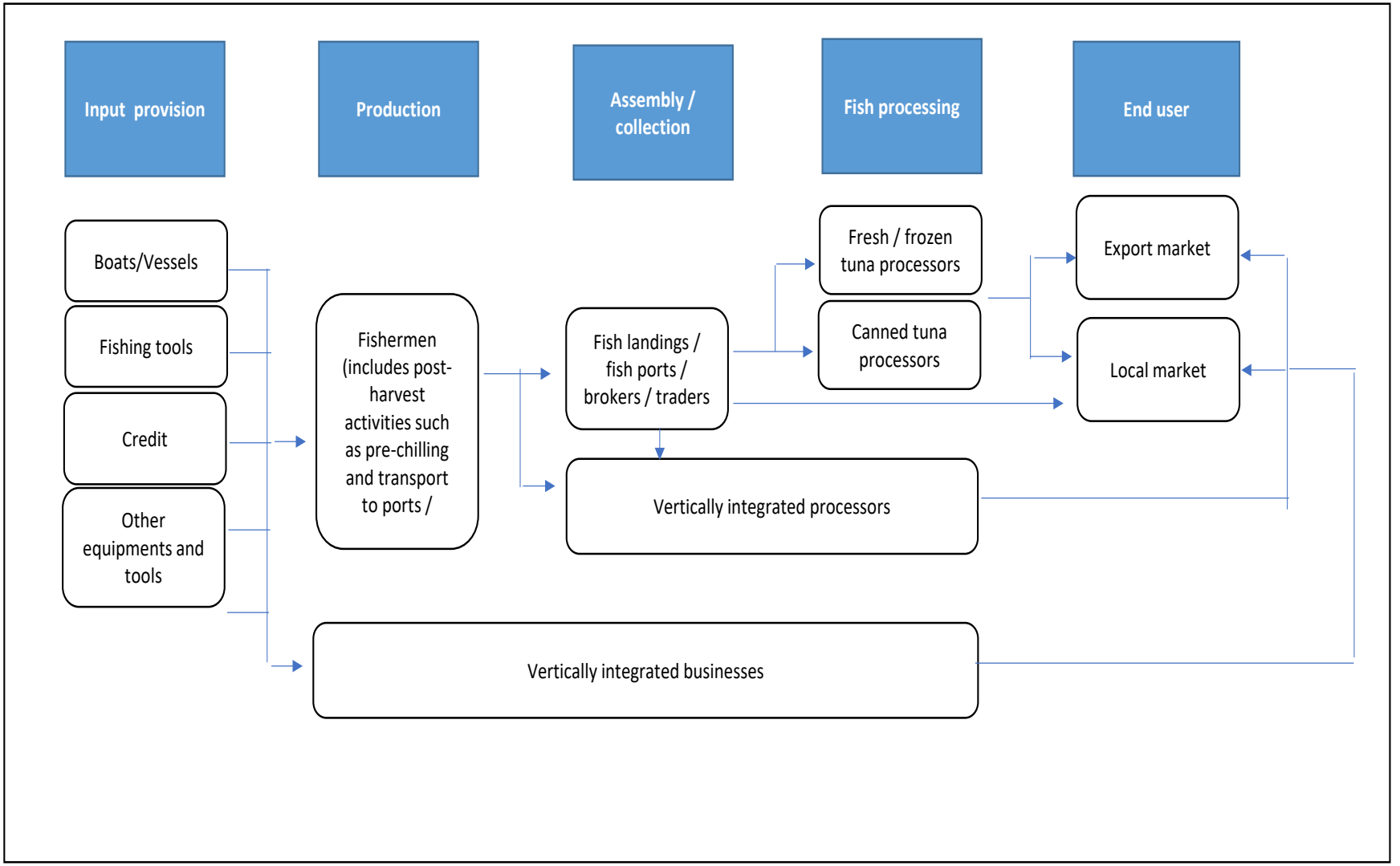
5.3.4. Input provision of tuna

Figure 35 provides a diagram of the value chain of the tuna industry in the Philippines. Given that local supply of tuna is mainly sourced through marine capture, the primary inputs in the production of tuna are the boats or vessels, labor, and fishing tools and equipment. According to the study of Sheppard (2017) and Van Duijin et al. (2012), there are three main catching methods of the Philippine tuna fishing fleet: (1) handline fisheries (mainly company operated handline motherships and a declining number of traditional bancas), (2) small and medium purse seiners, and (3) large purse seiners.

Handline fisheries mainly catch yellow fin tuna. Traditional bancas (municipal fishers) ranging from 3 gross registered tons (GRT) to 8 GRT with around 350 hp have average fishing trips of approximately 7 to 15 days, of which 5 to 10 days is utilized for fishing and around 2 days for transportation. These small vessels mostly used ice-chilling techniques[21] and the bulk of the capture are sold in the local market (Llanto et al. 2017). On the other hand, larger vessels, or sometimes called mother vessels (around 20 to 35 GRT), typically fish in the Philippine EEZ. However, due to the declining catch in the Philippine EEZ, these hardline fishing vessels are

[21] Ice-chilling is defined as lowering of temperature close or just below the initial freezing point typically between -1.10 degree Celsius to 2.20 degree Celsius (Espejo-Hermes 2004).

Figure 34. Value chain of tuna in the Philippines



Source: USAID (2017) and Van Duijin et al. (2012)

sometimes forced to fish farther such as in the High Seas Pocket 1 (HSP-1)[22]. As a result, average fishing duration of these vessels are further increased (more than 15 days). In contrast to the "traditional" bancas, the larger handline vessels supply fresh and frozen tuna to both the international and local markets (Van Duijin et al., 2012).

It is important to note that these "handline" mothership boats are also only equipped with ice-chilling technology. Unfortunately, according to Johnston et al. (1994), storage of fish utilizing ice-chilling techniques can only preserve the aquatic product for a maximum period of two weeks. Consequently, several studies found that catch from HSP-1 are of lower quality (Sheppard 2017; Montojo et al. 2020) and hence, reducing expected profits of fishermen.

On the other hand, small and medium purse seiners (< 250 GT) typically catch skipjack, yellowfin, and small pelagic species. These fleets usually fish inside the Philippine EEZ. According to Van Duijin et al. (2012), around 50 percent of the catch of the small and medium purse seiners is sold to the domestic market while the other half is for the canneries. In contrast, large purse seiners (> 250 GT) predominantly fish outside the Philippine EEZ. These vessels typically fish in the HSP-1 area targeting skipjack and yellowfin tuna (Sheppard 2017; Van Van Duijin et al. 2012; Montojo et al. 2020). According to Montojo et al. (2020), majority of the catch of large purse seiners are sold as raw materials for canning (49.5%) and local markets (38%).

Similar to large handline vessels, these large purse seine operations are constrained by the current preservation technology in the country (ice-chilling) given the long distances and transit time involved in operating in HSP-1. In a recent study of Sheppard (2017), it calculated that approximately 20 percent of the catch from large purse seine operation in HSP-1 in 2014 was spoiled and hence, only useable for smoking and drying of fishmeal. Sheppard (2017) further estimated that over PhP 380 million of financial loss was incurred by large purse fishermen from the periods 2012 to 2014. Moreover, in another paper by Montojo et al. (2020), they found out that large purse seine operators fishing in HSP-1 incur a loss of around PhP 223 million primarily due to quality loss of the fish caused by spoilage and presence of defects such as skin loss, laceration, and burst belly. This translates to around 17 percent of the total volume of capture by large purse seine vessels (or 2,194.29 mt out of the total 12,725.33 mt catch; Montojo et al. 2020).

5.3.6. Assembly, collection, processing, and end users of tilapia

Once the tuna has been harvested and preserved (ice-chilled as discussed above), the catch is landed in fish landing sites or fish ports where the handling and distribution of fishery products are performed. In case of tuna, majority of the catches are landed in the General Santos Fish Port Complex (Llanto et al. 2017). Subsequently, landed tuna is categorized as Grades A, B, or C. More specifically, Grades A or B are categorized as export-quality fish wherein the former is entirely sold to the international market and usually exported as whole or with heads and entrails removed (Sheppard 2017). On the other hand, the later type of tuna is also exported but in contrast to Grade A tuna, prime meat is only exported for Grade B. Furthermore, Grade B tuna is sold to the local market particularly the institutional buyers such as restaurants and hotels (Sheppard 2017). Lastly, Grade C tuna is entirely sold to the domestic market, tuna

[22] According to Montojo et al. (2020: p. 88), HSP-1 is "the areas of high seas bounded by EEZ of the Federated States of Micronesia to the north and east, Republic of Palau to the west, and Indonesia and Papua New Guina to the south".

canneries and processors (Sheppard 2017). Typically, brokers, traders, or middlemen act as a middleperson between the tuna producers and processors, canners, and domestic buyers.

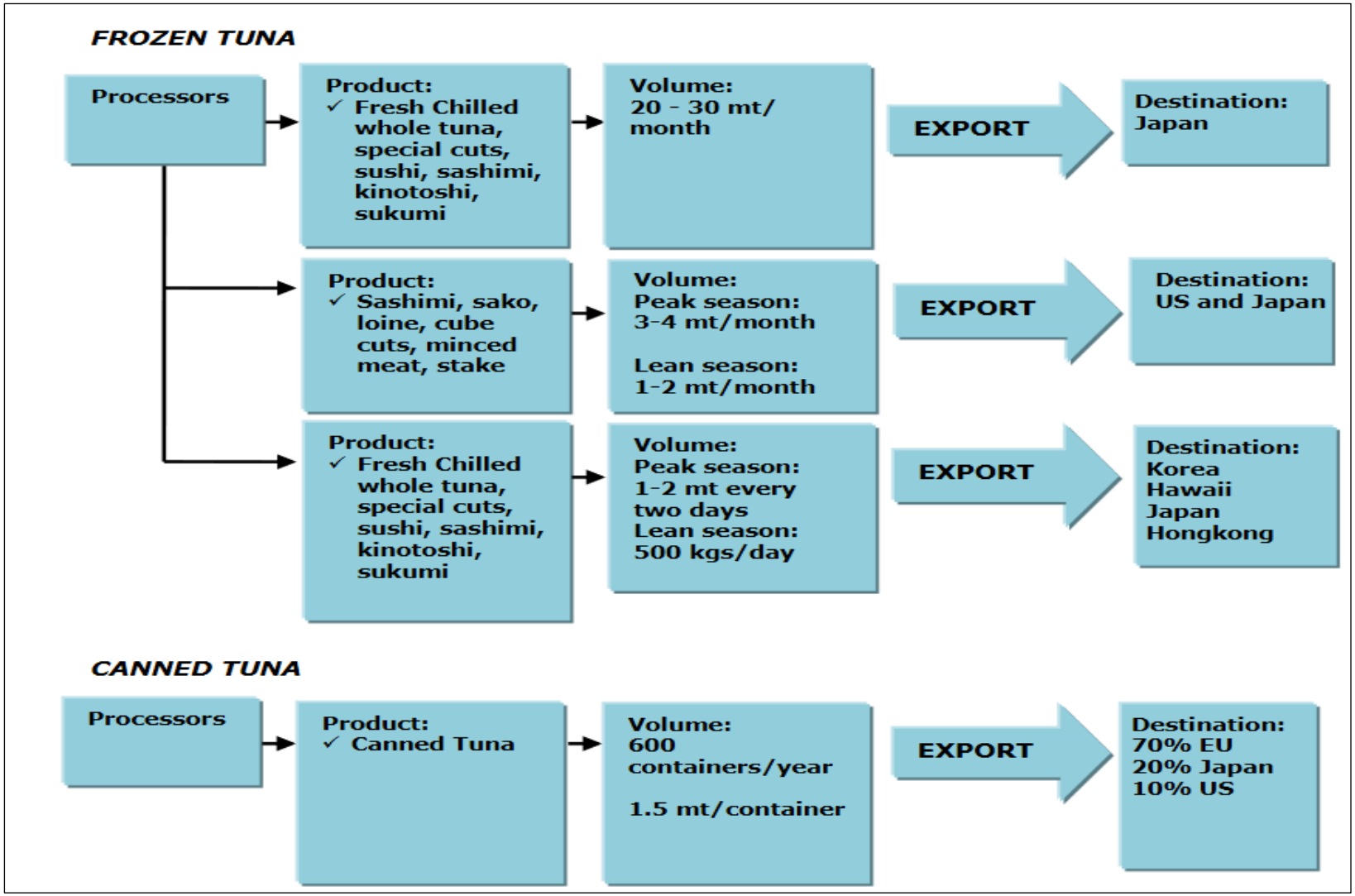
As seen in **Figure 35**, there are two major ways of processing tuna: (1) fresh / frozen tuna and (2) canned tuna. Fresh and frozen tuna include various forms such as whole tuna, head on and head off, cubes, sashimi, pellets, sak, minced meat lions, and steak (Van Duijin et al. 2012). In 2010, there are a total of 36 companies processing tuna in the country. Out of the 36 tuna processing companies, 28 specialize in fresh and frozen tuna while the remaining 6 produce canned tuna (Van Duijin et al. 2012; Sheppard 2017; Llanto et al. 2017). Moreover, majority of the processors of fresh and frozen tuna are located around Manila and in the southern part of the Philippines while all of the 6 canned tuna processors are concentrated in General Santos and Zamboanga (Van Duijin et al. 2012). It is important to note that according to Llanto et al. (2017), there are 7 operating tuna canneries as of 2016 wherein one is located in Zamboanga and the rest is in General Santos City.

Figure 36 shows the estimated export volumes of frozen and canned tuna. As seen in the figure, majority of the tuna export of the country is originating from canned tuna. In fact, according to Hamilton et. al. (2011), the Philippines is the second largest canned tuna producer in the Western and Central Pacific Ocean following Thailand. In addition, utilizing BFAR export data from 2015 to 2019, the average share of preserved or canned tuna to total export volume of tuna is approximately 73.5 percent while the contribution of fresh/frozen/chilled tuna to total export volume is only 26.5 percent.

However, although the country's volume of canned tuna exports is significant, the study of Sheppard (2017) noted that the six tuna canneries in General Santos were running under capacity. As seen in **Table 40,** the total daily output of the six canneries is 317 mt a day while the total capacity is approximately 720 mt a day. This translates to a deficit of around 403 mt a day to maximize the potential production capacity of the six canneries (see **Table 40**). What makes the figures worse is that according to Sheppard (2017), the majority of the raw materials utilized in the canning of tuna are already heavily augmented by frozen tuna imports due to the availability problem and low quality of the local tuna catch.

Finally, the end-users in the value chain of tuna are households, institutional buyers, and the international market (see **Figure 35**).

Figure 35. Philippine export volume for frozen and canned tuna



Source: Van Duijin et al. (2012)

Table 40. Canneries in General Santos daily output and capacity

Company	Daily Output (mt/day)	Capacity (mt/day)	Production (mt/year)	Markets (%)				
				PH	US	EU	Japan	Other
Alliance Tuna International, Inc.	50	100	14,750	0	1	90	0	5
Celebes Canning Corp.	75	100	10,000	0	48	48	2	2
PhilBest Canning Corporation	180	140	45,000	0	30	40	10	20
General Tuna Corporation	200	200	85,000	40	Data not provided			
Ocean Canning Corporation	45-80	100	15,000	0	Data not provided			
Seatrade Development	80	80	15,000	0	Data not provided			
TOTAL	**317**	**720**	**72,750**	**0**	**39**	**37**	**16**	**5**

Source: USAID (2017)

5.3.7. Summary of milkfish value chain

In summary, the milkfish industry is currently being hindered by upstream bottlenecks (fingerlings and feeds). As noted by Salayo et al. (2021), the country needs an additional 54 IBH in 2020 to become self-sufficient in juvenile milkfish. On the other hand, the high feed cost can be attributed to the high price of yellow corn for feeds (as discussed in the corn-livestock/poultry value chain section) wherein its share to fish feed formulation is approximately 25 percent.

Furthermore, there is an issue of relatively low value-addition in the processing of the majority milkfish products due to lack of substantial private investment in the sector. Although there are few large companies that focus on milkfish processing and exportation (more specifically, deboned milkfish), milkfish's value chain is mainly transitioning which is characterized by the dominance of small- to medium- fisherfolks or producers with a relatively long chain.

On the other hand, the tuna industry is characterized as a mixed of transitioning and modern value chains. The main bottlenecks of small- and medium- fisherfolks are the cold chain technology (ice-chilling), the declining catch, and the limited access to international market. As discussed in the previous section, the small- to medium- tuna operators only sell their catch to the domestic or local market (Llanto et al. 2017; and Van Duijin et al. 2012). In contrast, the large-scale tuna operators are fully vertically integrated from production/catch, processing, up to the exportation of frozen and/or canned tuna. Similar to the small- and medium- tuna producers, large-scale tuna operators are constrained by the cold chain technology and the waning fish catch. Consequently, due to the large post-harvest losses and declining fish catch, majority of the tuna canning processors are underutilized by as much as 47 percent (Sheppard 2017).

Given this, it seems that the AFMA interventions of the government that are highly concentrated in the provision of inputs are insufficient and have limited impact to the ascension of the milkfish and tuna value chains. In particular, the milkfish industry is still plagued with upstream bottlenecks, such as supply of fingerlings and cost of feeds, and the dominance of

small value-addition processing (such as dried or smoked) of the commodity. In contrast, the tuna industry is constrained by cold chain technology, resulting to considerable post-harvest losses, and non-compliance of small- and medium- operators to international safety standards.

Although the large or commercial tuna operators are fully vertically integrated and are involved in the sizeable exportation (wherein the Philippine is considered as one of the top exporters of tuna) of high value-added processed tuna and by products, the small- and medium- tuna fisherfolks are still limited with selling all of their produce to the domestic market (Llanto et al. 2017; and Van Duijin et al. 2012). This is due to non-adoption to food safety standards of importing countries. Although AFMA espoused the need to enhance value-addition and competitiveness of agri-food products through food safety and quality compliance, there is still a great number of small- to medium- agricultural producers, in general, who are not convinced on the merits of international standard compliance (DAP 2021). Major reasons for their non-adoption are the additional costs (such as transportation) entailed and the cumbersome and long processing time required in acquiring the certification for these practices. Additionally, the costs for applying for recertification are so prohibitive for small rural producers and MSMEs discouraging them to continue their adoption of the protocols.

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