Innovative Institutions to Accelerate Agroindustry Development in Asia

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INNOVATIVE INSTITUTIONS TO ACCELERATE AGROINDUSTRY DEVELOPMENT IN ASIA

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FOREWORD

Agribusiness has huge economic, social, and environmental impacts on the overall agriculture sector. Opportunities in agribusiness are expanding substantially in the Asia-Pacific due to increasing populations, growing economies, and globalizing of trade. Disruptive agricultural technologies could raise productivity even under difficult conditions, and innovative business management strategies could help meet total food demand. In order to encourage innovations in the sector, different models should be examined by institutions offering specialized education, mentorship, and financing options to agribusinesses.

The Asian Productivity Organization (APO) resource paper Innovative Institutions to Accelerate Agroindustry Development in Asia draws from the institutional approach to economic development to analyze existing innovation institutions supporting Asian agroindustries. Robust institutions undergird entrepreneurial opportunity and activities and are therefore vital to economic development. This paper provides an inventory of innovative institutions operating in APO member countries compiled from publicly available material; considers holistic approaches to agroindustry which are competitive, sustainable, and inclusive; and offers a starting point for discussion among experts, policymakers, and thought leaders on how to promote sustainability in the sector in Asia.

Completed in August 2019, this paper continues the eight-year collaboration between the APO and Cornell University's Emerging Markets Program. Both institutions recognize the need to support agribusinesses and agroindustry in the Asia-Pacific region through tailored research and education. During 2012–2019, the collaboration resulted 10 workshops involving agribusiness representatives and policymakers in discussions on the major forces shaping the supply of, demand for, and distribution of food.

The role of private-sector actors in the global economy is indispensable in meeting national food security and safety policy objectives. The mission of the APO and Cornell University is to contribute to greater efficiency, higher productivity, enhanced food safety, and a more environment-friendly approach to sustainable agriculture and agribusiness.

Portions of this resource paper were previewed during two agribusiness-focused workshops organized by the APO and Cornell in Indonesia, where they sparked interesting, thoughtful debate. It is my hope that the release of the full paper to a wider audience will facilitate discussions on the transformations occurring in terms of value addition, mega trends, and enabling environment among Asian agroindustries.

I would like to thank Ralph D. Christy, Lin Fu, and their team at The Dyson School of Applied Economics and Management, Cornell College of Business for developing this report and the Secretariat staff who worked with them on this project.

Dr. AKP Mochtan
Secretary-General

INTRODUCTION

Context and Rationale

Agroindustries have the potential to be major drivers of economic development. However, fulfilling this potential requires a fundamental break from the history of agricultural development policies that focus solely on subsistence farming and smallholder farmers to the exclusion of other forms of agricultural activity, e.g., commercial farming and agroindustries.

Agroindustries are uniquely situated between raw and natural sources of supply, and food and fiber demand. As such, development of agroenterprises can lead to positive impacts on employment in both rural and urban areas; offer market access to smallholder farmers; create business linkages with small and medium enterprises (SMEs); and enhance food security by reducing post-harvest losses. From the perspective of national governments in Asia, the combined effects of employment gains and food security through improved agroindustry competitiveness can be an important strategy for reducing overall poverty.

Given rising incomes and population dynamics in Asia, the region's agribusinesses must position themselves for demographic shifts, consumer lifestyle and preference changes, and other megatrends to meet the growing urban demand for food and food services. Megatrends, i.e., the global forces that have profound impacts on and implications for the economy and the society, provide both the context and the rationale for an examination of innovative institutions supporting agroindustry development. Like agribusiness owners, policymakers and institutions charged with supporting agroindustry development, must position themselves to adapt and respond to megatrends that will impact all agribusinesses in the coming years. Developing an understanding of the forces that drive change is critical to the formation of successful public policies and private strategies.

Underpinned by an institutional approach to economic development, and relatedly, to agroindustry development, this resource paper provides an overview of existing institutions in support of agroindustry development in the Asia-Pacific region. It also examines selected innovative institutions that are at the forefront of accelerating agroindustry development in the light of industry-relevant megatrends. This paper's focus on agroindustry marks a departure from the traditional foci of past development efforts, which emphasized incremental changes and smallholder self-sufficiencies. Instead, the emphasis here is on holistic approaches to agroindustry that are competitive, sustainable, and inclusive. As such, this paper serves as a policy agenda as well as a compilation of best-in-class initiatives as a starting point for experts, policymakers, and thought leaders to revisit and reformulate strategies for promoting sustainable agroindustry in Asia.

Objectives

The central purpose of this resource paper is to evaluate selected exemplars of innovative institutions in Asia that target agroindustry development. Each selected example belongs to a different category of innovative institutions, i.e., business development services, incubators,

science and technology parks, and mechanisms to promote agricultural value chain. This is illustrative of the ways in which the contemporary innovative institutions are adapting to trends and the drivers that are impacting the entire agroindustry landscape. Periodic consideration of best-in-class innovative institutions that pertain directly to agroeconomic development is necessary for gathering information on best practices, identifying challenges and the resulting learning opportunities, and continuing discussions on how to best support agroeconomic development, given the demographic shifts, environmental changes, and technological advancements.

This resource paper is organized around the following objectives:

1. Provide an overview of key analytical concepts (institutional approach in economic development, institutional voids, and institutional innovations) and explain their relevance for accelerating agribusiness and agroindustry development.

2. Identify the main forces shaping agribusiness and agroindustries in Asia.

3. Highlight various institutional arrangements in different APO member countries and identify the successes and challenges of these public, private, and public-private programmatic initiatives.

4. Aggregate the lessons learned from the highlighted innovative initiatives that can facilitate transformation, accelerate economic growth, reduce rural poverty, and promote food safety.

The next four chapters of this paper correspond to the above objectives. Chapter 2 highlights concepts from the development economics and business management literatures that inform this resource paper's institutional approach to economic and agroindustry development. Chapter 3 discusses the megatrends shaping agroindustries, policymakers promoting agroindustry growth, and policy tools supporting agroindustry development.

Chapter 4 evaluates selected innovative institutions across the Asia-Pacific region and presents their successes and challenges. The selection and discussion of these examples is based on extensive interviews with entrepreneurs, policymakers, and experts from various APO member countries as well as review of relevant primary and secondary sources, e.g., government websites and academic literature and policy reports, respectively. Chapter 5 concludes with a summary of the lessons learned about the implementation of different innovative initiatives and ways to facilitate transformation, accelerate economic growth, reduce rural poverty, and promote food safety in Asia's agroindustries.

The authors of this paper are indebted to the many entrepreneurs, policymakers, and experts who generously and candidly shared with us their context-specific knowledge of agroindustry development practices and challenges.

CONCEPTUAL UNDERPINNINGS

The literature on the roles of institutions in economic development offers several important concepts that are applicable to a wide range of industries and settings, including the food and agriculture sector in the Asia-Pacific. This chapter reviews selected key concepts that are relevant to any discussion of accelerating agroindustry development, e.g., institutions, institutional voids, and innovative institutions.

Institutions and Economic Development

Over the past several decades, the evolution of economic development theory has seen a realization among academics and policymakers that the goal of development is not just increasing GDP but achieving sustainable development. This evolution is captured in Figure 1, which summarizes what economists considered to be the major constraints to economic development through the years, from market failures to nonmarket, new market, and institutional failures [33].

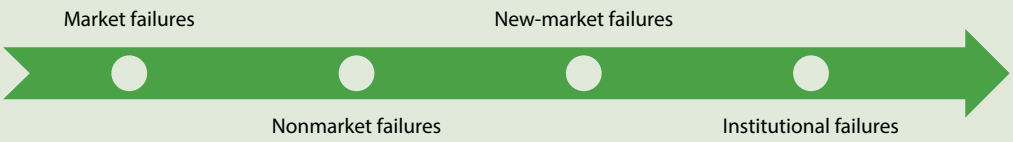
These insights into the nature and causes of economic problems imply and are associated with certain policy options for addressing them. In the 1950s and 1960s, when development problems were thought to be caused by market failures, policymakers turned to market-led strategies. In the 1980s, when nonmarket failures, e.g., inefficient government policies, were seen as the problem, there was a resurgence of interest in and implementation of laissez faire capitalism with a diminished role for the state. In the 1990s, when the idea of new market failures, e.g., imperfect and costly information, incomplete markets, and transaction costs arose, one corrective espoused was a greater role for government intervention. Nonetheless, the 1990s still saw more of an emphasis on government failures than on market failures. Today, institutional failures have been identified as the critical problem to solve if economic development goals are to be attained [33].

Although views vary on the relative importance of different types of institutions and institutional arrangements in determining economic performance [6, 10, 19, 43, 45], the development economics literature has come to acknowledge the importance of institutions in economic development. Institutions are "the humanly devised constraints that structure political, economic, and social interaction" [38]. Institutions can be both formal, e.g., laws and rules; and informal, e.g., norms and conventions. North [38] and others have argued that institutions matter greatly for economic development because they "create order and reduce uncertainty in exchange," or in other words, reduce transactions costs.

In the agriculture sector, land and property rights are the institutions that incentivize farmers and producers to invest and make improvements to the land by ensuring that they can retain any returns on investment. A legal system that enforces contracts is an institution that enables transactions by lowering counterparty risks. The banking system is an institution that through rural banking services and loan programs for small and medium enterprises (SMEs) can help small-scale producers start and stay in business. When institutions are missing or weak (e.g., laws are not enforced), the costs and risks of economic transactions will become higher, thereby hampering the economic activities and economic growth.

FIGURE 1

EVOLUTION OF DEVELOPMENT THOUGHT.



Note: Adapted from Meier and Stiglitz [33], Christy, et al. [11].

Institutional Voids

Institutional voids, common in many emerging markets, refer to situations where there is a dearth of institutions that facilitate market transactions. Businesses operating in an environment with few (or none) specialized intermediaries that provide information, signal credibility, and facilitate transactions, face numerous operational obstacles [18, 28]. Asian agribusinesses, particularly smaller-scale operations, face various institutional voids. For Asian SMEs in general, access to credit remains a problem [55]. At the farm level, access to information is still an issue. According to an estimate, in Sri Lanka, the "cost of information" constitutes 11% of farmers' total cost of production [12].

Missing and weak institutions like unclear or unenforced property-right protections are detrimental to achieving and maintaining economic growth. Specific to agroindustry value chains, Table 1 highlights overarching policies that have proven critical in addressing common institutional weaknesses. Addressing issues such as insufficient investment in agricultural research and development or a lack of standards would facilitate trade and transactions along agroindustry value chains [15, 32].

While some businesses in emerging markets can, on their own, overcome the institutional voids they face [18, 28], it is widely recognized among governments and international donors that institutional voids must be addressed to facilitate market transactions and spur economic growth. In the realm of food and agriculture, many existing public, private, and public-private initiatives across the Asia-Pacific region are already aimed at addressing different institutional voids.

Appendix A provides a list of more than 1,000 programs across the APO's 20 member economies aimed at supporting agribusiness SMEs.

The list includes various policy tools and initiatives, including innovative institutions, for which there is publicly available information. The list was populated through extensive research of government websites in APO's 20 member economies (e.g., Ministry of Agriculture, Ministry of Science and Technology, Ministry of Trade, Ministry of Labor, and equivalents), policy reports, and relevant academic literature on policies and interventions to support agroindustry growth and development.

It is evident from this list that support for agribusinesses may come in many different forms, including but not limited to technical assistance, tax incentives, capital loans, training programs, and innovation programs. The many and varied initiatives on the list represent efforts by governments, the private sector, and civil societies to address certain institutional voids. Innovative institutions are a subset of this larger category of initiatives aimed at supporting agribusiness and agroindustry growth and development.

TABLE 1

POLICES TO FACILITATE TRANSACTIONS ALONG THE AGROINDUSTRY VALUE CHAIN.

Activities	Outputs (possible examples)	Expected outcomes
Public investment in agricultural research and development	• Increased release of locally adapted crop and tree varieties from public research institutions • Increased access to food processing technologies from national food science research centers • Increased use of processing machinery	• Increased productivity of key crops and trees • Increased productivity and reduced mortality of farm animals • Appropriate solutions to agroenterprises that maximize output and minimize costs of production
Public investment in infrastructure and education that serves agribusiness and agroindustries	• Improved roads and railways services • Wider coverage and consistent supply of electricity to agroindustries • Enhanced water management and investments in public water systems	• Reduction in post-harvest losses • More agribusiness and agroindustries located closer to source of raw materials (i.e., reduced urban bias for agroindustries) • Improved market efficiency
Public investment in market information systems for key agricultural commodities	• Daily or weekly broadcast of agricultural commodity prices in various markets • Periodic assessment of local, regional, and international markets • Provision of value-chain information	• Improved market integration between local, regional, and international markets • Reduced seasonality in prices of agricultural products • Reduced information asymmetry
Develop and enforce grades and standards for agricultural products	• Consistent use of grades and standard across, geography, seasons, and traders • Comprehensive food safety policies and regulations • Institutional capacity to test and enforce food safety standards	• Effective communication of market information based on specific grates and standards • Increased premium for high-quality products • Increased consumer confidence in value-added foods • Improved access to international food markets
Enhance business climate to improve ease of doing business for agroindustries	• Comprehensive strategy by governments to improve the ease of doing business • Improved rankings on commonly used business climate indices	• Reduction in barriers to entry and exit • Increased FDI flow to agroindustries • More SMEs shifting from informal sector to formally registered private enterprises
Develop and enforce legal framework for property rights	• Comprehensive property rights • Willingness and ability to enforce property rights	• Increased investment in research and development by private agroenterprises • Increased FDI flows
Develop and implement trade policy that minimizes distortions and harmonizes regional trade	• Trade policy that is focused on achieving specific development goals such as the achievement of the MDGs • Harmonization of trade policies within regional trading blocs	• Increased specialization on commodities in which countries have a comparative advantage • Increased regional and international trade

Source: Adapted from Market Matters [32].

Innovative Institutions

What makes an institution innovative? An innovative institution is defined here as one that offers a novel, useful, and scalable approach to a persistent problem. It fills an institutional void that

hinders market transactions and consequently sustainable economic development. Such innovative institutions entail changes to existing law, norms, and conventions, or at least provide a push in that direction. Over time, as an innovative institution demonstrates effectiveness, gains traction, and becomes more mainstream, it nonetheless remains 'innovative' if it still represents a useful and scalable approach to supplant, supplement, or improve upon an existing institution that is supposed to enable and encourage market transactions.

Innovative institutions that seek to fill institutional voids and enable market transactions generally fall into three categories. Some may even belong to more than one category. First, institutions that facilitate are those that enable transactions in some way, e.g., information or insurance services. Agricultural extension services that provide farmers with weather forecasts, pricing information, and plant disease alerts are some examples. The information provided to farmers facilitates economic transactions by lowering their production costs. Such information is also available in some countries as mobile phone subscription services.

Second, institutions can serve a function by providing a needed service, e.g., finance, transportation, or storage. Rural lending programs would be an example of an institution that serves a 'function.' By providing credit to farmers and rural businesses, rural finance can smooth out cashflow shortages between growing seasons or between the times when accounts payables are due and accounts receivables are paid. Rural finance can also enable the borrower to make investments in land and machinery, which would have longer-term benefits.

Third, institutions can also have a structural purpose, e.g., cooperatives that give members more bargaining power than they previously had as individuals. Agricultural cooperatives are a form of collective action in which members not only pool resources for production and marketing, but also negotiate pricing and sales contracts together. Farmer cooperatives, typically organized around a specific crop, are commonly employed across Asia.

Table 2 identifies specific categories of innovative institutions that strengthen SME linkages and smallholder access to national, regional, and global agroindustry supply chains. These are, business development services for farmers and agroenterprises, agribusiness incubators, research and technology parks, clusters and networks, warehouse receipt systems, mechanisms to link farmers to a value chain, commodity exchanges, and certification programs. These are no longer new ideas, but they still represent useful and scalable methods of addressing institutional voids and of encouraging and supporting the growth and development of agribusiness SMEs.

Chapter 4 will present and examine illustrative examples from four of the eight categories of innovative institutions identified in Table 2, namely business development services targeting farmer-entrepreneurs and agroenterprises, agribusiness incubators, research and technology parks, and mechanisms to integrate farmers into the agricultural value chain. The selected innovative institutions stand out in their respective categories as well as among other institutions seeking to support agroindustry development listed in Appendix A. The examples selected can be considered representative of a 'new wave' of innovative institutions that are actively seeking to address the megatrends that will shape the food and agriculture sector in the coming years. The forces of urbanization, climate change, and technological innovation are driving shifts in consumer preferences as well as in agroindustry constraints and opportunities. Agribusinesses as well as institutions whose goal it is to support agroindustry development must adapt to the new realities brought on by the megatrends.

TABLE 2

INNOVATIVE INSTITUTIONS THAT STRENGTHEN SME LINKAGES AND SMALLHOLDER ACCESS TO NATIONAL, REGIONAL, AND GLOBAL AGROINDUSTRY SUPPLY CHAINS.

Activities	Outputs (possible examples)	Expected outcomes
Develop business development services that are targeted at farmers and agroenterprises	• Management training workshops that are specific to the needs of agroindustries • Modules, case studies, and other training materials that are specific to the context of agroindustries	• Improved performance of agroenterprises as measured by increased sales revenue, profitability, market share, and range of products and services offered
Promote business incubators for agroenterprises.	• Programs designed to accelerate the successful development of startup and early-stage agroenterprises	• Increased likelihood that a startup agroenterprise will stay in business for the long term
Establish agroindustry research and technology parks	• Investment in research and technology parks that house established agroenterprises and government or university labs	• Increased production efficiency and improved technology transfer • More agribusiness and agroindustries located closer to the source of raw materials
Promote agroindustry clusters and networks	• Vertical linkages along value chains for specific commodities • Horizontal linkages across agroenterprises on the same level of the value chain but dealing in different commodities	• Improved transfer of technology among members of the same network or cluster (learning from peers) • Improved efficiency in agroindustry supply chains (from farmer to consumer)
Build warehouse receipts systems for agricultural commodities	• Facilities that guarantee the quantity and quality of the agricultural commodity being stored within an approved facility	• High income for farmers as they capitalize on higher off-season prices • Decrease in seasonality of agricultural prices
Promote mechanisms that integrate farmers into the agricultural value chain (e.g., collective action, contract farming, and outgrower schemes)	• Increased use of contract farming to coordinate linkages between farmers and agroindustry firms • Agroenterprises providing services to smallholder farmers, e.g., input credits, tillage, spraying, and harvesting	• Tighter coordination of supply chains • Increased participation of smallholder farmers in formal markets • Higher incomes for smallholder farmers
Develop commodity exchanges for agricultural commodities	• Exchanges where various agricultural commodities and derivatives products are traded • Contracts can include spot prices, forwards, futures, and options on futures	• Efficient trade of agricultural commodities • Linkages between domestic, regional, and international markets
Create and support certification agencies for agricultural products	• Institutional mechanisms to ensure traceability and certification of agricultural products	• Increased premiums for high-quality products • Increased consumer confidence in value-added agricultural products

Source: Adapted from Market Matters [32]

The new-wave innovative institutions selected for further examination in chapter 4 are standouts in their respective categories because of their efforts in adapting to the new realities brought on by agroindustry-relevant megatrends. These new-wave innovative institutions share common

emphases in their agroindustry development approach, i.e., branding, consumer-oriented product development, and technology-driven applications. The shared emphases acknowledge changing consumer demands as well as new agroindustry constraints and opportunities as a result of urbanization, climate change, and technological innovation. While the selected examples in chapter 4 are 'best in class,' they are not without their challenges. In fact, it is the challenges in creating, implementing, and maintaining these institutional innovations and the considerations of those issues that provide learning opportunities for both the public and private sectors as well as for public-private partnerships.

Upgrading, Branding, and Innovation

Innovative institutions may be created by governments, international organizations, for-profit and not-for profit groups, or a combination thereof. In addition to bringing scalable changes aimed at addressing longstanding institutional challenges in the food and agriculture space faced by farmers and agribusinesses, what distinguishes the new generation of innovative institutions is their focus on upgrading, branding, and innovation itself. This emphasis on upgrading, branding, and innovation reflects the reality of all value chains, but especially that of agricultural value chains. Whether the sequence of value-added activities takes place domestically, regionally, or globally, profits are higher further along the value chain as each successive step along an agricultural good's path from farm to consumer represents added value. Upgrading along a value chain and moving to higher value-added activities has become the economic development strategy and policy in many countries [22].

If supplying a raw material is least profitable, processing the raw material is more profitable, and selling a packaged product is most profitable, then upgrading along a value chain typically brings greater economic benefits to both companies and countries. This reality is reflected in the emphasis on value addition and upgrading in the development assistance programs of international donors and in the domestic economic development agendas of national governments.

The upgrading process brings companies closer to consumers. This means that greater attention and effort are needed for branding and innovation as companies are now selling differentiated products to consumers rather than commodities to a processor. Small agribusinesses face a multitude of challenges when trying to enter an industry at a point of higher value added. For example, to become a cocoa processor and branded chocolate producer in a country that counts cocoa as one of its major commodity exports but has virtually no domestic chocolate manufacturers, is very difficult. To illustrate the challenges associated with upgrading along a value chain, Appendix B provides a case study of the emerging domestic chocolate industry in Indonesia, the world's third-largest cocoa producer. The case study highlights the difficulties small Indonesian chocolate producers face, from country-specific institutional voids to issues that all fledgling companies must think through, e.g., growth and marketing strategies.

Recognizing that branding and innovation are critical to upgrading the value chain and that both activities may require access to more information and investment than the typical small agribusiness can afford on its own, innovative institutions are stepping in to assist in both types of activities, thereby addressing specific institutional voids. Their focus on upgrading, branding, and innovation is an integral component of enabling and encouraging agroindustry development.

AGROENTERPRISE MEGATRENDS SHAPING AGROINDUSTRY IN ASIA

The backdrop to any discussion of agroindustry growth and the innovative institutions that seek to support its development are the megatrends that will impact individuals, companies, industries, whole regions, and even the entire world. Megatrends are global forces that have profound impacts on and implications for the economy and the society. Adapted from the introductory chapter of Asian Agribusiness Management [16, 17], this chapter provides an overview of the key trends and drivers that will shape Asian agribusinesses in the coming years. Urbanization, climate change, and technological innovations will influence food production, processing, and marketing, thus presenting both challenges and opportunities for the region's agroindustry. Policymakers and institutions charged with supporting agroindustry development must position themselves to adapt and respond to megatrends that will impact all agribusinesses in the coming years.

Urbanization

Urbanization in Asia is occurring rapidly as a result of rural-to-urban migration. As elsewhere, the reasons for internal migration center around the search for economic and social opportunities. The world's urban population is currently around 3.9 billion and will reach 6.3 billion by 2050. Asia is already home to 53% of the urban population in the world. Over the next four decades, the Asian continent will see a steady increase in its urban population and will continue to be home to more than half of the urban population of the world (52%) in 2050 [52, 53].

Increased urbanization brings changes in consumption patterns. The process of urbanization leads to lifestyle changes and diet diversification as income growth leads to shifts in demand for different types of food. Urban consumers typically consume less cereals and starchy food commodities, which are still common staples in rural areas, and gravitate toward more high-value foods, e.g., horticultural and livestock products, and processed foods. As the demand for high-value food such as livestock products increases, the demand for feed grain also rises. Animal protein consumption in Asia is highly diverse with particularly high overall consumption in Malaysia, Republic of Korea (ROK), PR China, and Vietnam. Additionally, there is an emerging preference for organic products as food safety is a growing concern for Asia's rising middle class, which is wary of residual pesticides and other contaminants in the produce. Rising per capita incomes mean that middle-class consumers have the financial means to pay more for that peace of mind. A growing number of consumers are willing to do so, and organic farming has already started to take off across the region.

Due to urban migration, rural households now commonly lease out their farmlands as young people prefer to seek jobs in urban areas and are not available to work on family plots. As the remaining rural households are acquiring land released by their neighbors, smallholder farm sizes are shrinking, which means that the average farm size in Asia will likely increase. Farmland consolidation in Asia, combined with an increased proximity to urban markets, will likely lead to higher average outputs per farm in Asia.

Climate Change

Existing climate change studies vary in their models and scenarios, but most have average temperatures increasing globally by at least 1° C by 2050 and by anywhere between 2° C and 4° C by 2100. The effects of climate change in the Asia-Pacific region will vary, depending on the country. As a whole, the region is expected to become warmer, but higher latitude areas will experience greater temperature increases than lower latitude areas. Pacific Island nations will likely see smaller changes in temperature and annual rainfall, but will be significantly impacted by rising sea levels to the point where some of the smaller islands may no longer be livable. The coastal areas of south and southeast Asia, as well as parts of PR China, will be threatened by changing precipitation, higher temperatures, and rising sea levels [7, 8, 9, 36].

As agriculture is dependent on climate and weather, the entire agricultural sector is particularly vulnerable to climate change. Changes in temperature and precipitation threaten agricultural productivity, and consequently, the food supply. Extremes ranging from desertification and droughts to typhoons and flooding will most likely have a devastating impact on farmers' livelihoods and regional food security.

The Asian Development Bank (ADB) forecasts a decrease in crop yields across the Asia-Pacific region. Climate change is expected to reduce both maize and wheat yields, but the rice yields will particularly be affected. Without any adaptation or technological improvements, rice yields my decline by up to 50% by 2100 from the 1990 levels in Indonesia, the Philippines, Thailand, and Vietnam. In south Asia, the estimated average decrease in yield of all crops is about 8% by 2050, with potential reductions in yields of maize and sorghum by 16% and 11%, respectively [7, 8].

The projected negative effects of climate change on crop productivity could lead to higher food prices, and as a result, a decline in total demand for cereal and other crops and a reduction in calorie availability across the Asian region. Central Asia will likely be the most heavily impacted, with projected declines in calorie availability ranging from 15% to 18%. Since childhood malnutrition levels are directly linked to calorie availability, the number of malnourished children is also projected to increase dramatically due to a climate change. From a geopolitical standpoint, population displacement and conflict as a result of these socioenvironmental changes will present the region, and indeed the world, with a new set of challenges [8, 36].

Technological Innovations

Internet connectivity in the developing world has increased dramatically in the last two decades. Mobile broadband is particularly popular. In 2010, the Asia-Pacific region accounted for over half of the world's mobile cellular subscriptions. Sixty percent of the expected global mobile connectivity growth during 2015–20 will come from just six Asian countries, with India contributing the largest increase in numbers, followed by PR China, and rounded out by the fast-growth markets of Indonesia, Pakistan, Bangladesh, and Myanmar [20, 27]. In east and southeast Asia, the internet has overtaken traditional media outlets such as TV, radio, and print, which presents new opportunities for customer engagement. According to the 2011 Nielsen Southeast Asia Digital Consumer Report, Singaporeans spend more than 25 hours online each week, followed by Filipinos and Malaysians, who spend 21.5 hours and 19.8 hours a week online, respectively. Like in North America and Europe, social networking sites have become an important conduit between companies and consumers in Asia. Sixty-five percent of Filipinos, 60% of Malaysians, and 56% of Singaporeans interact with brands, products, and companies via social media. Most consumers in Malaysia, the

Philippines, Singapore, and Thailand read and post product reviews online. Given that companies in the region still spend relatively little on online advertising, this is an area that marketers will need to explore in the coming years in order to keep up with the increasing amount of time consumers spend online.

Moreover, Asian consumers, like elsewhere, are increasingly using their phones to access the internet. In 2014, about 30% of the population of Asia, or 1.3 billion people, were mobile internet subscribers. By 2020, the number of mobile internet subscribers in Asia is expected to increase to 2 billion, which would account for over 50% of the total worldwide subscribers. As most people in the region access the internet using mobile devices, successful online marketing strategies need to include mobile phone-specific plans [20, 21, 37].

On the primary producer side, internet connectivity can also help mitigate many of the problems associated with poor communication infrastructure. Having accurate and timely market information, especially as it pertains to perishable items, greatly reduces transaction and travel costs. With internet connectivity, farmers can also more easily share relevant information. They can use SMS to send critical local agricultural information like incidences of pests or crop yields, or information that was previously difficult to obtain without expensive research surveys [12, 53]. By leveraging mobile technology, farmers can overcome the barrier of imperfect information. The expansion of open-access software has enabled grassroot community organizations to share information such as extension and advisory services via publicly and privately provided mobile services. Farmers can tap into collective knowledge through crowdsourced data using mobile phones.

Beyond mobile technology, many other technological advances can be applied to agriculture to improve quantity, quality, and efficiency at various points along the supply chain. The past couple of years has seen a surge in interest in the agricultural technology (agtech) space. In 2014, the agtech sector experienced a 'breakout year,' receiving over $2.36 billion of investment across 264 deals globally [1, 30].

Prior to 2013, the conversation (and the investment) in agtech was predominantly about biotechnology and seed genetics. Though agricultural biotechnology remains controversial in many parts of the world since the anti-GMO movement has not abated, it is still considered by many governments to be a valuable technological innovation, given the expectations of declining yields and extreme weather conditions. The research on high-yield, drought-resistant, and flood-resistant crop varieties could prove very useful in future. In fact, the governments of PR China and Brazil [14] have spent significant resources on creating their own domestically researched and developed ag-biotech crop varieties.

Agtech, however, is more than just ag biotech; it encompasses many other technologies, including farm management software, sensors, and internet of things (IoT); robotics, mechanization, and equipment; novel farming systems; supply chain technologies; bioenergy and biomaterials; innovative food, and food marketplace/e-commerce (see Table 3).

In 2016, total investment in agtech was $3.2 billion globally. The USA accounts for a large number of those deals, but of the top 10 non-USA deals, six were in PR China. The growing food-tech startup scene in PR China is focused on food delivery, supply chain logistics, and alternative proteins. Singapore is also home to many new agtech ventures. Temasek Trust, the philanthropic arm of the city-state's sovereign wealth fund, has developed a new variety of high-yield rice that

can withstand extreme weather conditions using marker-assisted selection technology. Temasek Rice, as the product is called, is currently being grown in Indonesia. Garuda Robotics, a Singaporean startup, is using drone and sensor technology to map and capture more accurate data on southeast Asian farms to help these plantations tailor their land management plans to account for variations in weather, rainfall, soil quality, fertilizer, etc. [1, 54].

Many opportunities are emerging at the intersection of agriculture and big data. This trend is just starting in Asia and the prospects for 'smart agriculture' in the region look bright, given the ingenuity of local entrepreneurs and the exigencies of ensuring a steady food supply in the face of population growth and environmental degradation. To address the negative impact of climate change on agriculture, technological innovation is more important than ever.

TABLE 3

AGTECH CATEGORIES.

Category	Examples
Farm management software, sensors, and internet of things	• Ag data capturing devices • Decision support software • Big data analytics
Robotics, mechanization, and equipment	• On-farm machinery • Automation • Drones • Grow equipment
Novel farming systems	• Indoor farms • Insects, algae, and microbe production
Supply chain technologies	• Food safety and traceability tech • Logistics and transport • Food processing
Bioenergy and biomaterial	• Non-food extraction and processing • Feedstock technology
Innovative food	• Innovative food, e.g., alternative proteins, novel ingredients, and supplements
Food marketplace/e-commerce	• Online farm-to-consumer • Meal kits • Specialist consumer food delivery

INNOVATIVE INITIATIVES TO SUPPORT AGROINDUSTRY IN ASIA

Innovative institutions, as defined in this research paper, are those that offer novel, useful, and scalable approaches to a persistent problem. In other words, innovative institutions fill an institutional void that hinders market transactions and consequently sustainable economic development. While there are several categories of innovative institutions that strengthen SME linkages and smallholder access to national, regional, and global agroindustry supply chains, this chapter will specifically examine four in particular: business development services for agroentrepreneurs and agroenterprises, agribusiness incubators, science and technology parks, and mechanisms to link farmers to the agricultural value chain.

Business Development Services

Business development services can contribute greatly to the success of SMEs, regardless of the industry. Whether an entrepreneur already has prior experience of setting up and running a company or not, there are advantages to being paired with appropriate management assistance. These include financing, accounting, marketing, and legal benefits; introductions to value-added business networks; and access to structured mentoring and/or informal consultation with more seasoned professionals. Such business development services are invaluable resources for SME owners, particularly as they look to upgrade to higher value-added activities and/or expand their businesses.

Business development services may be offered by any number of organizations, e.g., government agencies, academic institutions, and local community groups. Agroindustry-specific business development services are available in all APO member economies, but sometimes such services may not be easily accessible or may not address the specific challenges faced by agribusiness entrepreneurs trying to upgrade along the value chain.

Branding and Consumer Value

Business development services encompass a wide range of advisory services that a typical SME owner may need. The earlier agricultural development interventions focused mainly on subsistence farming and the poorest of smallholder farmers. As such, the emphasis was on providing market and pricing information to individual farmers. An agricultural development policy that acknowledges and prioritizes agroindustry growth and development, however, requires business development services that include branding advisory. Facilitating access to credit, market information, and technical expertise remain important components of business development services for SMEs. Moreover, increasing market transactions also require strategies for selling products, particularly higher value-added products that are higher priced, have higher margins, and are at least somewhat, if not highly, differentiated.

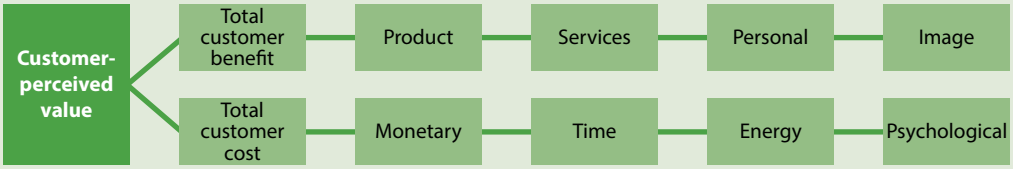
Kotler and Keller [29] define customer-perceived value as "the difference between customer's evaluation of all the benefits and all the costs of an offering and the perceived alternatives." Figure 2 illustrates their idea of customer-perceived value as the difference between customers' perception

of benefits they believe they will derive from a purchase (a bundle of economic, functional, and psychological benefits such as product, services, personnel, and image value) and the costs they will have to pay (monetary, time, energy, and psychic costs). Some experts have argued for even more detailed distinctions within those categories [3, 49, 51].

What is important to keep in mind here is that a product's benefits to a consumer include more than just the product's functional characteristics. Conveying consumer benefits that are personal and emotional requires not just market information but marketing strategies, i.e., whom the product can appeal to and how can/does the product fit into the current zeitgeist. Branding and marketing strategists can be of great help to SMEs in formulating effective branding and marketing strategies that convey a desired consumer benefit and inform customer perceived value. It is especially important for agribusinesses moving into higher value-added market segments (such as the artisanal chocolate niche mentioned in Appendix B) to highlight personal and image benefits associated with their products. Thus, branding advisory constitutes an important element of business development services for agroindustry development.

FIGURE 2

CONSUMER-PERCEIVED VALUE.



Source: Adapted from Kotler and Keller [29].

Taiwan Agricultural Technology Research Center

The Taiwan Agricultural Technology Research Institute (ATRI) was created by the Republic of China (ROC)'s Council of Agriculture in 2014 to strengthen the commercialization and industrialization of agricultural research results. ATRI [2] is home to several different laboratories and research centers, namely the Department of Animal Technology Laboratories, Department of Plant Technology Laboratories, Department of Aquatic Technology Laboratories, Agricultural Policy Research Center, and Industrial Development Center. ATRI's Industrial Development Center, in particular, its division of IPR Utilization and Business Development, provides marketing and branding support to small-scale agroentrepreneurs.

In terms of public provisioning of business development services, depending on the division of portfolios between different government agencies within a country, different types of business development services will be offered by different agencies. While it is more than reasonable for a department within a Ministry of Trade to provide regulatory advice on exporting products abroad and for a department within a Ministry of Science to offer technical assistance on formulating new products, it does take more work for entrepreneurs to find the appropriate place to seek advice if, for example, their objective is to formulate a new product for export.

Moreover, certain bureaucratic portfolio divisions may negatively impact agribusiness entrepreneurs more than entrepreneurs in other industries. For example, for a farmer seeking to upgrade from producing a commodity to producing a processed food item, piecing together the appropriate

support is more difficult when there is a ministry that overseas agriculture and a ministry that oversee value-added activities. Given that there are political and organizational reasons for the way ministerial (and local too) portfolios are distributed, it makes more sense to look at ways around that problem.

ATRI offers a useful model for addressing the problem by aggregating relevant expertise without changing the existing ways in which expertise is organized. The ATRI framework to promote agricultural entrepreneurship (see Figure 3) gathers different expertise that might be useful for agricultural entrepreneurship under one institute and also designates the institute as the bridge to other relevant expertise within other institutions. From the perspective of an agribusiness, this serves to streamline the process of seeking technical support, marketing advice, or another business development service.

FIGURE 3

ATRI FRAMEWORK TO PROMOTE AGRICULTURAL ENTREPRENEURSHIP.

Source: ATRI website.

Clear organizational divisions and mandate notwithstanding, ATRI faces challenges in the reach and accessibility of its business development services. ATRI's business development services for agribusinesses are available to all agribusinesses, regardless of size. However, its 'success stories' are typically companies that are closer to large rather than small enterprises on the SME continuum. Any individual farmer or a small farmer group can seek assistance from ATRI and access the institute's full suite of business development services as appropriate, but some might receive more attention than others. Sometimes an agribusiness will be 'recommended' to ATRI by a government agency. These recommendations are usually well-established companies or have already seen some success in transitioning into higher value-added products lines. As one ATRI researcher admitted,

in such cases, companies that have already seen some success receive even more support and attention from ATRI and other government agencies. While ATRI can still contribute to further growth of such companies through product innovation and branding advisory services, such success stories are low-hanging fruits for ATRI and other government agencies to claim as achievements for their organizations.

Incubators and Science and Technology Parks

Clustering, Networking, and Innovation

Is there a formula for innovation? How can it be replicated? These are the questions that motivate the pursuits of both incubators and research-and-technology parks as policy instruments to promote innovation that can lead to economic growth. Incubators and research-and-technology parks are two distinct categories of innovative institutions (see Figure 3), but they are grouped together here because it is now common to see research-and-technology parks including incubators as is the case with the Thailand Science and Technology Park, which will be discussed later in this chapter. Incubators and research-and-technology parks are also similar in their approach to innovation, though at different scales. Both cluster individuals or companies in one place so that they may benefit from physical proximity to a business network, share ideas and information, and access shared resources.

Business incubators generally take a cohort of 20–25 startup companies and offer them shared working space, business and legal advice, and sometimes a financial investment. Incubators are meant to be a nurturing environment for the selected small companies so that they can try out and demonstrate the viability of their business plans, i.e., take an innovative idea from proof of concept to a functioning business. A study of incubators in developing countries by The World Bank notes that the "success of incubators depends on several factors, and many lessons have been learned so far. Many of them can be applied to incubators in developing countries. Some aspects, however, require specific attention, depending on the status of the private sector development in each country" [47].

Similarly, the success of a science and technology park (STP) depends on adapting the lessons learned from successful examples to new contexts. An STP is a designated physical location, affiliated with a university or other research organization, that houses and fosters the growth of tenant companies. The idea behind STPs is that clustering companies around research capability promotes innovation by encouraging knowledge sharing and facilitating the commercialization of research. The physical location and infrastructure of an STP is an important component of its effectiveness as a policy tool to promote innovative activities, However, physical proximity to research institutes and organizations does not automatically increase R&D collaborations [40, 46, 50]. For STPs to be "more than a form of glorified property development" [40] requires moving beyond a conceptualizing innovation in spatial terms or as a linear model that assumes that scientific knowledge can be easily transferred from research institutes to companies in an adjacent STP for commercialization. Innovation is a complex nonlinear process that involves feedback loops and synergies through a diverse range of information networks, as well as interaction and networking not only between STP tenant companies and nearby research institutes, but also among tenant companies themselves [39, 44].

Thailand Science and Technology Park

The Thailand Science and Technology Park (TSP) is Thailand's first science and technology park. It was conceived in 1989 by the Sixth National Economic and Social Development Plan with support from the Ministry of Science, Technology, and Energy; the Ministry of University Affairs;

and the Ministry of Education, but was not established until 2002. Its mission is to promote innovation and foster a collaborative R&D ecosystem between the public and private sectors. TSP is strategically located near Thammasat University, the Asian Institute of Technology, and Sirindhorn International Institute of Technology. It is also connected with eight other universities, major cities, airports, and other industrial parks through expressways and mass transit systems. Currently, 25% of TSP tenants belong to the agrofood industry.

At TSP, tenant companies can design their space to suit specific R&D activities or move into a fully furnished space. TSP tenant companies have access to shared wet and dry lab spaces, office spaces, common area spaces, meeting rooms, a plaza with retail stores, and a 'garden of innovation' for business incubation activities. TSP also has several other facilities, including a pilot plant for scaling up before commercialization, greenhouses, a design service center, training centers, and a convention center. TSP tenant companies benefit from financial incentives such as a 300% tax deduction for R&D expenses, a low-interest loan program, and a joint investment program. TSP tenant companies also have access to a variety of testing services performed by other TSP-tenant companies, National Science and Technology Development Agency (NSTDA) members, and Thammasat University.

From a services perspective, TSP offers a number of legal, financial, business, and testing services that can help small companies with the innovation process. There is also a Science and Technology Knowledge Services (STKS) center, open to tenant companies as well as the general public. STKS is a digital hub for the latest information, offering online academic databases, electronic journals, Thai thesis database, IP database, patent mapping, and ThemeScape mapping.

Aside from STKS, TSP also houses the Intellectual Design Group Co., Ltd (IDG), which offers brand building, patent trademark registration services, product and packaging design, IP drafting, registration for invention or industrial design products in local and international markets, and industrial technology analysis services. IDG's Technology Licensing Office and Innovation Promotion Program support IP activity by facilitating technology transfer, licensing, and promotion from lab to market. As is now the norm in many STPs, TSP also houses a business incubator. TSP's Business Incubation Center offers six types of services to support startups: business diagnosis, advanced training, consulting, business networking, marketing assistance, and financial linkage. It also offers programs for young technopreneurs and business incubatee alumni.

In terms of agroindustry relevant innovation, TSP has the potential to be at the forefront, given that roughly one-quarter of TSP's tenant companies are in the agrofood industry, which is higher than the 9% average across all STPs [2a]. TSP lists six universities and institutes under its food network system, which offers many different services, e.g., research, food quality assurance, food sample analysis, nutrition labeling, equipment rental, and consultation [51a]. The goal of such a food network system is to have more collaborations that result in commercializable products such as the joint project between Betagro, one of Thailand's largest agroindustrial companies and a TSP tenant company, and the National Metal and Materials Technology Center (MTEC) that resulted in the creation of low-fat sausages.

For smaller companies at TSP, however, physical proximity to centers of research-and-technology does not necessarily make accessing and utilizing that research easier. The CEO of an SME that is a tenant company at TSP acknowledges that locating his company at TSP has enabled him to have greater access to the professors at the nearby universities whom he can query about various

scientific and technical issues and advancements. However, his company has not licensed any research or technology from the universities surrounding the TSP or from the government research agencies having presence at the TSP, because the licensing fees are too high for a company the size of his. Instead, this CEO asks TSP-affiliated professors to recommend colleagues at universities farther from the TSP. Typically, these other universities have lower licensing fees, so he might be able to pursue technology licensing agreements with them at lower rates.

Although the above SME does not directly utilize R&D from TSP-adjacent universities, the company still benefits from its TSP address because it can more easily access the network of TSP-affiliated professors and researchers. This network is a source of information, advice, and further connections, all of which are especially valuable for smaller companies, which, without the TSP affiliation, might not have enough clout to access the same information, advice, and introductions to relevant connections. Moreover, smaller companies located at the TSP also have their own, unofficial LINE chat group through which they share information and advice on matters like the availability and pricing of different testing equipment and materials on the TSP campus. Such information is not always available or updated on official websites because some services are ad hoc and not publicized.

Although the physical location and infrastructure of the TSP are well thought out, challenges remain to its capacity to foster innovation. As studies of STPs in other countries have found [39, 40, 44], the colocation of companies and research institutes does not in itself enable R&D collaboration and innovation. In case of the TSP, smaller tenant companies find it more difficult to license relevant research and technology from TSP-affiliated research institutes from a purely financial perspective. However, their TSP membership still affords them access and thus benefits from a diverse range of information networks as well as the opportunity to interact and network with nearby research institutes and other TSP tenant companies.

Malaysia's Publicly Funded Agribusiness Incubators

Just like STPs run the risk of becoming a form of glorified property development if policymakers emulate the physical infrastructure of successful STPs without considering the networks and interactions that foster innovative activity, incubators run the risk of becoming a form of glorified office space if policymakers focus on creating incubators rather than considering and measuring how incubators may lead to actual innovative outcomes. As Mitra [35] puts it, "For incubators to live up to their full economic potential, they need to overcome two pitfalls: they need to provide real value, not just office space, and they need to measure success in more than just outside funding."

Considering and measuring how incubators may lead to actual innovative outcomes, however, is a difficult task. First, no consensus exists on how best to measure the effectiveness of business incubation for incubated businesses or the economy [5, 48]. Moreover, just as most new businesses fail, most incubators fail. This stark reality does not negate the utility of incubators in nurturing innovative new businesses, especially when policymakers and incubator creators move beyond incubator form to incubator function. Many of today's highly successful young companies in various industries have spent time in a business incubation program. Meaningful program content must include business counseling and management assistance [26, 35].

Second, policymakers face a series of difficult questions when it comes to publicly funded incubators that directly impact the effectiveness of the incubator. In a study of 205 publicly funded Czech incubators, Dvouletý et al. [13] found that these publicly funded incubators were not successful in supporting the growth of incubated firms, due at least in part to, insufficient experience

with managing business incubators and selecting incubatees. The study also suggested that policymakers should exercise stricter control over financial expenditures on incubators and over effectiveness evaluations of incubators [13]. The Czech experience with publicly funded incubators points to several difficult questions that all incubators must consider, though publicly funded incubators have more difficulty in considering these on account of being publicly funded: Who selects incubator participants? Should all applicants be allowed to participate, given that the incubator is publicly funded? How long is the incubation period? How should the effectiveness of an incubator be measured? Based on performance, is there a point at which public funding for an incubator should be terminated?

Malaysia's Ministry of Agriculture (MOA) currently has 177 agribusiness incubators under its purview. Since these agribusiness incubators were created by different agencies under the MOA and at different administrative levels (i.e., national, state, territory, or municipal), until recently, there has not been a single repository of information about these agribusiness incubators. Only a few of these 177 incubators appear in Appendix A because scant public information exists for most of them.

While Malaysia's MOA has begun gathering administrative information about the many incubators under its umbrella and collecting survey data about incubation program participants and outcomes, challenges remain to evaluating incubator effectiveness. According to an MOA official, there is not enough discussion and certainly no internal consensus about certain critical questions: Should all applicants be allowed to participate given that the incubator is publicly funded? If most new businesses fail, then how should the effectiveness of an incubator be measured? Is there a point at which public funding for an incubator should be terminated?

Technology for Value-chain Integration

Blockchain for Food Safety, Supply-chain Management, and Value-chain Integration

An emerging area of innovation in and around agroindustry is the application of blockchain technology to food-safety challenges. A blockchain is a tamper-resistant ledger of records maintained by a set of connected computers that reach agreement over shared data. Rather than relying on a central entity to maintain a single database, computers in a network can instead communicate directly with one another using rules embedded in software to agree on the state of a shared database. The tamper-resistant nature of the ledger is achieved via cryptographic tools that allow computers to easily verify data consistency and correctness such that any attempt to maliciously modify current or past data can be quickly detected and rejected.

Blockchains originally attracted attention as the foundational technology powering Bitcoin, a decentralized peer-to-peer cryptocurrency with a monetary policy defined by rules embedded in software run by computers in an open and permissionless network rather than by a central government. While Bitcoin enabled decentralized digital value transfer, other blockchain networks that (e.g., Ethereum) focused on enabling developers to programmatically control digital value transfer via conditions and clauses like those found in traditional financial contracts.

Technologists have explored additional use cases for blockchains, usually focused either on public blockchain networks that allow for open and permissionless participation from anyone who runs the required software or on private blockchain networks that restrict participation to a curated set of known entities.

Public blockchain networks such as Bitcoin and Ethereum have appeal for technologists interested in building decentralized applications that are not subject to the control of a single centralized entity. These applications include computational resource marketplaces (e.g., file storage, video processing, and machine learning), digital asset-powered video games, prediction markets, and user-owned social media platforms. The primary goals with these types of applications include: reduced platform risk, since a single company would be unable to withhold services from an application; censorship resistance, since no entity can unilaterally prevent users from interacting with the application; decentralized power distribution among users who serve as stakeholders and can influence the future development of an application; improved user experience resulting from increased competition among service providers; and interoperability to allow users to take their data with them if they choose to use a different application.

Private blockchain networks are appealing to traditional corporations such as banks interested in leveraging shared computing and data infrastructure to reduce the costs of tracking and authenticating information flows with internal organizations as well as external business partners. Due to certain customer and regulatory requirements, many of these corporations are wary of public blockchain networks in which they cannot exercise tight controls over network usage. However, these corporations still desire the digital infrastructure that eliminates the manual data reconciliation and paper document-based authentication processes typically present in their workflows. Traditionally, a corporation's data might be split across a disparate set of silos that correspond to various internal teams or external business partners. Whenever new data is introduced, multiple teams might have to append it to their respective databases. This data might need to be deduplicated in future, or worse, reconciled with differing versions in a scenario where different teams use different formats or sources. Additionally, within many organizations, the movement of particular documents or assets need to be accurately tracked such that relevant parties can validate that they were properly handled by the correct parties in the past. For example, the failure of the Depository Trust Company to properly track ownership of Dole Food Inc. shares resulted in shareholders owning more shares than the total shares in existence [31]. Technologists at these corporations hope to use blockchains to help solve these types of problems.

While cryptocurrency is the blockchain application that has garnered the most press, applications in food and agriculture exist as well. There are three categories of agroindustry-relevant blockchain applications: food safety and traceability, supply-chain management, and value-chain integration. Food safety and traceability as well as supply-chain management are two obvious areas of blockchain applicability.

Blockchain technology could have a transformative impact on the supply chain and logistics industry, making the transactions and regulatory signoffs at each stage of the supply chain faster and more transparent. The decentralized recordkeeping and verification aspect of blockchain helps ensure supply-chain transparency, while rule-based smart contracts could speed up approval signoffs and transactions along the supply chain. All this would have positive implications for food safety and traceability. Currently, tracing how food goes through the supply chain can be extremely difficult and time-consuming. For example, four days of a farm's production of red- and green-leaf lettuce and cauliflower can generate more than 200 separate tracking numbers [24]. Greater transparency of data records from point to point along a supply chain would make it easier and faster to trace a contaminated food product back to the source of the problem, for example. Greater transparency of verifiable data records could also help increase consumer trust in the safety and quality of their food supply.

The decentralized recordkeeping functionality of blockchain could also be transformative for value-chain integration. Smart contracts and data exchange are the two other applications of blockchain that could have a wide-reaching impact on agroindustry development (see Figure 4). Automated rule-based smart contracts can speed up payment delivery, which not only helps improve supply-chain efficiency, but also benefits individual producers and small businesses by reducing cashflow problems that result from the mismatched timing of accounts receivable and accounts payable due dates. A potential upshot of a better cashflow situation could be greater capacity for business expansion, perhaps into even higher value-added activities that may require higher upfront costs. As a data exchange mechanism, blockchain can also have an important impact in that the secure sharing of production, market, and transaction data can relieve information asymmetries. While gathering and sharing such data does not depend on blockchain, the use of blockchain technology to record and store this data may help increase confidence in the veracity of the data since decentralized ledgers are immutable. Given the global supply chains for many fresh and packaged foods, greater confidence in food supply-chain data can be a boon for the industry as a whole. Smaller companies, in particular, can build a track record and trust through data transparency via blockchain.

FIGURE 4

BLOCKCHAIN APPLICATIONS FOR AGROINDUSTRY.

Supply chain traceability	• Convert physical components into digital data (encoding information about origin, certifications, etc.) from product origination to consumer
Smart contracts	• Since distributed ledgers are secure and immutable, they allow for automation of contracts/agreements when predefined conditions are met • Real-time approvals to improve efficiency of supply chain and payment delivery
Data exchange	• Secure decentralized storage to share data between different parties in the network • Secure sharing of production data, market information, and transaction data on crop to remove information asymmetry in agriculture markets

Source: Fu and Heng, 2019.

Pilot Programs

The use of blockchain for food safety and supply-chain management is still in the conceptual and pilot stages, but it is worth reviewing some of the current efforts in this space in Asia.

Provenance.org: This UK-based platform [41] conducted a pilot in Indonesia in early 2016 using blockchain, along with mobile and smart tags, to track tuna from catch to consumer. This pilot enabled Indonesian fishermen to convert physical tuna into codified assets linked to a digital identity that can be verified on an open registry. Supply-chain actors used a mobile application and a QR code on the product to trace its origin and movements along each step of the supply chain.

HARA: HARA [23] is a blockchain-based decentralized agriculture data exchange. Smallholder farmers, agricultural retailers, and other data providers are incentivized to share real-time, verifiable insights in order to improve inventory management, identify market opportunities, prevent excess stock, anticipate weather risks, reduce spoilage, and cut transport times. To date, HARA has collected agricultural data from roughly 10,000 farmers across Indonesia. The data collection itself

was made possible with the support of Indonesian regional governments and local government leaders. HARA is now partnering with a financial provider (BTPN) to offer micro loans to farmers and connecting with an agrodealer (Hexa Agro) to offer a fair price for farmers' yields.

IBM Blockchain Platform: IBM trialed an electronic bill of lading (e-BL) in January 2019 to track in real time a shipment of mandarin oranges from PR China to Singapore for Hupco, a major importer in Singapore of mandarin oranges. The bill of lading is a critical document in international trade, issued by a shipping carrier to document the title or ownership of goods. It also serves as a receipt of goods and a contract of the shipment. The administrative process of transferring the title deed usually takes five to seven days. The pilot of IBM Blockchain Platform's e-BL demonstrated a significant reduction in the time needed for transferring the title deed to just one second [25].

Nongshim Group: This ROK conglomerate, with a large food and beverage business, has embarked on several food-related blockchain projects through the group's IT affiliate, Nongshim Data System (NDS). NDS is partnering with Korean government ministries and the Korea Internet Development Agency (KISA) for the blockchain technology-powered issuance of HACCP certificates. NDS is also partnering with the Ministry of Agriculture Food and Rural Affairs to develop a blockchain platform for beef production, distribution, and sale [4].

Coffee Board of India: Coffee Board of India partnered with Bengaluru-headquartered digital commodity management platform, Eka Software, to launch a blockchain platform for coffee farmers in India in March 2019. It is India's first marketplace on blockchain. With the blockchain platform, Coffee Board aims to help farmers get better prices for their products and provide coffee roasters and exporters with data on crop quality and traceability of coffee origins. Plans for future functionality on the platform include links with payment gateways so that farmers can be paid faster. The platform started off with 14 farmers and six exporters and coffee roasters [34].

The above examples are just a few of the many pilot projects involving blockchain as applied to the food and agriculture sector. How successful agroindustry blockchain applications are when implemented on a larger scale remains to be seen. PwC's [42] 2018 cross-industry global survey of 600 executives whose companies have at least one blockchain-based project indicated that C-suites across the world still have many general concerns about the wider rollout of blockchain technology, namely, regulatory uncertainty, lack of trust among users, ability to bring the network together, separate blockchains not working together, inability to scale, intellectual property concerns, and audit/compliance concerns.

While blockchain's agroindustry applications form an exciting new area for development, they are still at very initial stages. Thus, it is too early to say when blockchain as a tool to improve food safety and supply-chain management and as a mechanism for value-chain integration and upgrading will live up to its potential.

CONCLUSION

This resource paper has offered a holistic consideration of evolving innovative institutions that shape agroindustry development in Asia. Through a comprehensive web search of publicly available data (e.g., government websites, policy reports, and academic literature) and backed by personal interviews of managers of new-wave innovative institutions, agribusiness owners, and policymakers, this report has identified over 1,000 institutional arrangements across the 20 APO member economies. Moreover, we have described the successes and challenges of these public, private, and public-private programmatic initiatives. In this conclusion, we offer the lessons learned from the highlighted innovative initiatives that can facilitate transformation, accelerate economic growth, reduce rural poverty, and promote food safety of Asia's agroindustries.

Innovative institutions for agroindustry development (see Table 2 in the second chapter) are categories of policy tools that aim to strengthen agribusiness linkages and smallholder access to national, regional, and global agroindustry supply chains. These include business development services for farmers and agroenterprises, agribusiness incubators, research and technology parks, clusters and networks, warehouse receipt systems, mechanisms to link farmers to a value chain, commodity exchanges, and certification programs. In this report, we focused on four of the categories and selected illustrative examples from APO member economies for further examination. From the evaluation of the illustrative examples of business development services, incubators and STPs, and mechanisms for value-chain integration, five common lessons emerged:

Do not let form overshadow function: Incubators and STPs run the risk of being glorified office spaces or glorified office parks, respectively, if the focus is only on the physical space and not on the interactions and networks that occur there. Moreover, innovation is complex and nonlinear, so it cannot be assumed that proximity between companies and research institutes will naturally result in R&D partnerships that yield innovations.

Ask and discuss difficult questions at the outset: Publicly funded incubators, STPs, and organizations that offer business development services are subject to the same set of hard questions that their private investor-backed counterparts face: Given high failure rates for new companies, what is an acceptable level of risk and failure? Given limited resources, how should companies be selected for support, for what kind of support, and for how long? Clear parameters need to be set and followed because publicly funded initiatives to support agribusinesses must be sustainable.

Monitor and evaluate to measure success and learn from setbacks: Despite the difficulty in measuring the impact of certain innovative institutions on company performance and overall national economic performance, it would be useful to regularly conduct surveys of administrators and tenant companies in order to begin collecting data. This not only ensures that comprehensive and up-to-date information is available on various programs, but also seeds opportunities for future analysis when there are enough data points collected over time.

Innovative institutions can be disruptive: Innovative institutions have the potential to be disruptive, i.e., supplementing, transforming, and superseding existing capacities of governments

and social organizations to impact economic activity. Not all innovative institutions, however, are disruptive; nor do they have to be in order to be effective.

Financial sustainability is a key element of performance: Institutions can have a positive impact, but their effect over time depends on their financial sustainability. Initiatives that support agroindustry development may initially be funded publicly, privately, or in some combination of the two in the short run. For institutions to be effective over time, however, they must successfully attract multiple and alternative revenue streams to become financially sustainable.

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APPENDIX A

BANGLADESH

Appendix A was prepared by Jenny Chan, Carina Chien, and Cynthia Istanto.

Initiative	Initiative type	Summary	Source
Online Fertilizer Recommendation System	Public	Automation of data processing and updating to develop fertilizer recommendations among farmers: Before this initiative, soil had to be tested in the Dhaka office. The initiative allows regional labs (total 22 across the country) to upload soil results	[1]
Krishoker Digital Thikana (Farmers Digital Home)	Public	A website/app where farmers can find all essential technologies and information on crop cultivation	[1]
Krishi Call Center (16123)	Public	Founded in 2014, the call center provides information and solutions to different agricultural problems On an average, the center receives around 500 daily calls from farmers	[2]
Establishment of Agriculture Information & Communication Center (AICC) at village-level	Public	Managed by registered farmers' cooperative organizations, each center is provided with desktop computer, laptop computer, digital camera, internet modem, multimedia projector, scanner, and other digital devices from Agricultural Information Service (AIS) to deliver information to farmers In 2017 there were 245 centers, with the aim to establish 87,000 by 2021	[3]
Establishment of Community Radio (Barguna)	Public	The radio airs programs during the hours 9–11 am and 3–5 pm. A news program, comprising local, national, and international news, is aired every day at 4 pm. The radio focuses on raising awareness, and agricultural (market prices) and recreational programs	[4]
Bangladesh Rice Knowledge Bank	Public	It is a source of knowledge on rice research. It publishes factsheets, training manuals, booklets, leaflets, brochures, posters, and videos prepared in Bangla, which is easily understood by farmers and extension workers	[5]
Establishment of Mobile Seed Testing Laboratory	Public	The agency is the only government-authorized body for the quality control of all kinds of seeds in Bangladesh It certifies and maintains the quality of seeds through field inspection, seed testing, and variety testing as per the decision of the National Seed Board (NSB)	[6]
Barind Tract (Trail)	Public	It covers greater Rajshahi, Dinajpur, Rangpur, Pabha, Joypurhat, Bogra, and Naogaon districts of Rajshahi division of Bangladesh and Malda district of West Bengal in India Before 1985, the potential for the agricultural development in Barind was considered nil and the area was not considered suitable for development. Today, agriculture is the main occupation in the region and 81% of people in Barind are farmers, as a result of Barind Multipurpose Development Authority (BMDA)'s financially self-sustaining underground pipe irrigation system	[7]
Establishment of Prepaid Meter in Deep Tubewell	Public	Prepaid card meters allow water allocations to be determined on a volumetric basis and ensure full and transparent payment and accounting	[8]

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Initiative	Initiative type	Summary	Source
Development of Mobile Apps for Agricultural Technology	Public	Agtech mobile apps	[9]
Bangladesh Hi-Tech Park Authority	Public	An objective was to establish up to 33 hi-tech, software, and IT parks in 2018. Some parks, such as Janata Tower Software Park in the capital and Sheikh Hasina Software Technology Park in Jessore, have already opened and are home to a large number of digital companies	[10]
Bangladesh Standards on Agricultural and Food Products	Public	List of sectional committees: Cereals, Pulses, and their Products Sectional Committee (62 standards); Oilseeds and their Products Sectional Committee (76 standards); Milk and Milk Products Sectional Committee (78 standards); Fish and Fisheries Products Sectional Committee (34 standards); Meat, Poultry, and their Products Sectional Committee (8 standards); Spices and Condiments Sectional Committee (37 standards); Tea and Coffee Sectional Committee (23 standards); Sugar and Sugar Industries Products Sectional Committee (8 standards); Animal Feeds Sectional Committee (11 standards); Fruits and Vegetables Products Sectional Committee (94 standards); Starch, Derivatives, and their By-products Sectional Committee (42 standards); Forest Products Sectional Committee (25 standards); Food Colour, Artificial Sweeteners and Additives Sectional Committee (19 standards); Pesticides Sectional Committee (27 standards); Tobacco and Tobacco Products Sectional Committee (4 standards); Soft Drinks and Beverages Sectional Committee (27 standards); Irradiated Food Products Sectional Committee (4 standards); and Miscellaneous (CAC/ISO Standards/Code/Guides and Others) (12 standards). The use of such a large number of laws for a single purpose like food safety is quite unusual and unprecedented in the world. A violation can result in criminalization. However, this multiplicity of laws creates confusion in the minds of manufacturers, processors, retailers, or even the enforcement authorities when ascertaining which law deals with a particular food safety issue	[11]
Restaurant Grading System	Public	Established in January 2019, the restaurant grading system helps consumers to determine the hygiene and quality of food at eateries The system has been implemented in the capital's Motijheel, Dilkhusha, and Paltan areas, and has officially awarded 57 restaurants, after intense scrutiny by the BFSA, with green and blue stickers	[12]

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Initiative	Initiative type	Summary	Source
Strengthen the Food Security Cluster	Public-private	A goal is to strengthen FSC in Bangladesh through improved cluster coordination, information management, needs assessment, and integrated phase classification	[13]
National Food Policy Capacity Strengthening Programme (NFPCSP)	Public-private	This works to increase the capacity of the Food Planning and Monitoring Unit and of the members of the inter-ministerial teams to perform their functions associated with the implementation of the National Food Policy It also serves to improve research and dialogue in and with civil society, e.g., private enterprises, universities, research centers, think tanks, NGOs, and the general public (non-state actors) to inform and enrich the implementation of the National Food Policy	[13]
Linking School Milk with Smallholder Dairy Development	Public-private	The goals are to (1) improve nutritional status of 2,000 primary school children through enhanced consumption of milk; (2) develop the dairy sector by increasing collection of milk from small-scale dairy farmers and industry processing capacity by establishing a pasteurizing center at Satkhira; and (3) document the lessons learnt and disseminate and present to the policy planners of the Government of Bangladesh and obtain their feedback for scaling up	[13]
Harmonization and Dissemination of Unified Agricultural Production Statistics in Bangladesh project	Public-private	The objective is to harmonize operations of national institutes (BBS, DAE, SPARSSO) for collection of agriculture production statistics by identifying and piloting a unique and harmonized crop-cutting methodology	[13]
Enhancing Food Security through Improved Crop Water Management Practices in the Southern Coastal Areas of Bangladesh	Public-private	The objective is to improve food security and increase agriculture production in the Southern Coastal Region of Bangladesh. The expected outcome of the project is that crop and water management practices are improved in 750 ha of farming land in the designated area	[13]
Strengthening the Environment, Forestry and Climate Change Capacities of the Ministry of Environment and Forests and its Agencies	Public-private	It strengthens human and organizational capacity in the country to deliver more effective, coordinated, sustainable, and country-driven investment programs in environmental protection, sustainable forest management, and climate-change adaptation and mitigation	[13]
Integrated Agricultural Productivity Project Technical Assistance and Capacity Development Component	Public-private	It initiates effective, inclusive, and country-owned agriculture, food security and nutrition investment programs through strengthened national capacities	[13]
Establishment of an Agricultural Planning Unit within the Hill District Councils of CHT	Public-private	It assists the Government of Bangladesh in enhancing its capacity in the Chittagong Hill Tracts (CHT), supporting the establishment of Agricultural Planning Units (APU) within the three Hill Districts of the CHT, and promoting sustainable agriculture development in CHT, through improvement of livelihoods and food and nutrition security and sustainable increases in production of crops, livestock, and fisheries	[13]

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Initiative	Initiative type	Summary	Source
Establishing Breeding and Post-Harvest Laboratory of Mushroom in National Mushroom Development and Extension Centre	Public-private	It conducts mushroom breeding and marketing development, contributing to increase in farmers' incomes and trade of high-value crops	[13]
Improving Food Safety in Bangladesh	Public-private	It serves as an efficient and well-functioning food safety control system in Bangladesh, which leads to improved public health and enhanced trade in food commodities	[13]
Strengthening Agricultural Market Information Systems (AMIS) globally and in selected countries (Bangladesh/India/ Nigeria) using innovative methods and digital methodology	Public-private	Support the globally accessible and transparent AMIS platform and build the capacities of Bangladesh, India, Nigeria, and other countries to produce, disseminate, and analyze quality agriculture market statistics using digital technologies	[13]
Building trade capacity of small-scale shrimp and prawn farmers in Bangladesh. Investing in the Bottom of the Pyramid Approach	Public-private	The goal is to increase international market access for shrimp and prawn products originating from small-scale farmers in Bangladesh	[13]
Support for Establishing Seed Multiplication Farm, Seed Processing Centre and Seed Testing Laboratory in the South-Western Coastal Region	Public-private	The goal is to increase sustainable crop diversification and intensification for greater household food and nutritional security, as well as decreased poverty, through greater farmer access to high-yield stress tolerant crops throughout the year and enhanced capacities for production, processing, preservation, and marketing technologies	[13]
Rainwater harvesting in Hilly creeks/ charas to restore sustainable Agriculture-Based Livelihoods in Hilly areas of Chittagong Hill Tracts	Public-private	This aims to contribute to the enhancement of agricultural productivity, diversification of food production, employment generation, women's empowerment, and increased resilience to food and agriculture threats and emergencies in Bangladesh through effective generation and dissemination of sustainable technical solutions in accordance with the Government of Bangladesh's Country Investment Programme for the agriculture sector	[13]
Bangladesh NATP-2: National Agricultural Technology Program	Public-private	The objective is to increase the agricultural productivity of smallholder farms and improve smallholder farmers' access to markets in selected districts. There are five components of the project, the first being enhancing agricultural technology generation	[14]
Livestock and Dairy Development Project	Public-private	The objective is to improve productivity, market access, and resilience of smallholder farmers and agroentrepreneurs operating in selected livestock value chains in targeted areas. There are four components of the project, the first being productivity improvement	[15]
Sustainable Enterprise Project	Public-private	The goal is to increase the adoption of environmentally sustainable practices by the targeted microenterprises	[16]

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Initiative	Initiative type	Summary	Source
Nuton Jibon Livelihood Improvement Project	Public-private	The objectives are to (1) mobilize poor and extreme poor in selected rural communities by building and strengthening beneficiary community institutions; (2) provide funding for small infrastructure and livelihood support for project beneficiaries; and (3) provide nutrition awareness and ag-production knowledge	[17]
Bangladesh Modern Food Storage Facilities Project	Public-private	The objectives are to (1) increase the grain reserve available to households to meet their post-disaster needs and improve the efficiency of grain storage management; (2) improve the storage capacity for grain at the country level by financing the construction of modern steel silos for rice and wheat; and (3) facilitate households' access to domestic silos for foodgrain-and-seed storage to improve household-level food security during and after natural disasters	[18]
Bangladesh Sustainable Coastal and Marine Fisheries	Public-private	The objective of the Sustainable Coastal and Marine Fisheries Project is to increase coastal and marine fisheries' contribution to the economy, poverty reduction, and environmental stability	[19]
Agriculture Value Chains (AVC) Program	Public-private	DAI is a private USA development company that applies a market systems approach to agricultural value chains in Bangladesh's Southern Delta It has forged partnerships with 25 private-sector companies and cooperatives to ensure sustainable supply of inputs, transfer of appropriate technologies and management practices to farmers, and enable market linkages for farmers' products	[20]
Chittagong Tea Auction (Commodity Exchange)	Private	It is the first tea auction center since 1949, and holds weekly auction throughout the year and exports tea to various countries. Participants are up to 250 tea traders and auctions are conducted by seven Chittagong-based brokers having agreements with tea growers	[21]
Tea Trader Association of Bangladesh	Private	It conducts auction (including online auctions), and disseminates information on the activities surrounding the tea auction, market trend, price movements related to supply and demand, tea production, trader's activity, etc.	[22]
International Food Policy Research Institute (IFRI)	Private	IFPRI-Bangladesh is made up of globally renowned experts with extensive technical expertise in nutrition, agriculture, gender, and social protection. The goal is to implement research and building capacity in Bangladesh and beyond	[23]
Cassava Recipe for Farming Success in Bangladesh	Public-private	ADB's partnership with food company PRAN-RFL helps expand contract farming, make cassava an attractive crop, and build the agribusiness sector. With the success of the contract-farming model, the company plans to expand cassava cultivation area to 10,000 acres within two years, from around 3,700 in 2017	[24]
Flower Power in Bangladesh	Public-private	The project has introduced or promoted 35 high-value crops, with a focus on helping women farmers. Also, farmers have to learn specialized skills to cultivate the often delicate and temperamental high-value plants	[25]
UN-REDD - July 2015-Dec 2019	Public-private	The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) is a multilateral body that is supporting nationally led REDD+ initiatives in 64 developing countries	[26]

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Initiative	Initiative type	Summary	Source
Geopotato	Public-private	Geopotato will develop and implement a decision support service (DSS) in Bangladesh for an optimal control strategy of late blight in potatoes. The DSS will provide farmers with preventive spray advice when a late blight infection period is predicted to occur. The DSS also evaluates past sprays, which may result in curative spray advice when, despite past sprays, infection is likely to have occurred in the past few days	[27]
Small producer empowerment and inclusive market	Public-private	A key problem is that small producers are unable to acquire access to opportunities, skills, and resources. Interventions like lobby-advocacy, capacity building, and research and knowledge are being taken. The stakeholders are producers, service provider associations, private sector, extension agents, etc.	[28]
Empowering Self Help Groups (SHG) on Convening and Convincing	Public-private	The objective is to contribute to an enabling service-and-governance environment at local, regional, and international levels, resulting in the increased inclusion of marginalized group (small-scale producers including women, youth, and workers) and their organizations in value chains, which contribute to improved incomes and livelihoods of these groups and sustainable value-chain development	[28]
The Salt Solution	Public-private	Together with Salt Farm Texel, ICCO will train 5,000 farmers in the coastal areas of Bangladesh to start growing salt tolerant crops. These are natural varieties of crops that grow on saline soil. The contribution from the National Postcode Lottery enables these farmers to make their salt-affected lands productive again by growing saline-tolerant crops. This will improve food security as well as income for them	[29]
Security Market Access Rights and Transparency in Bangladesh	Public-private	The coastal areas of Bangladesh are home to 45,000 poor, landless, and vulnerable households. The program aims at strengthening the coping mechanisms and enhancing sustainable livelihoods	[30]
Agri-friendly Cookstoves in Bangladesh	Public-private	The objective is to support the local implementing partner, CCDB, in introducing a low-cost and agrofriendly cookstove called Akha Stove in Bangladesh. The stoves produce biochar that enhances the soil's ability to retain nutrients and water, thus making it more productive with less inorganic fertilizer	[31]

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APPENDIX A

CAMBODIA

Initiative	Initiative type	Summary	Source
Agricultural Mapping Project	Public	In 2018, authorities announced that their program to boost yields through the use of spatial information technology will be extended to the whole country, an endeavor that will take at least three years to complete. A number of crops will be planted as part of the agricultural mapping project, including upland rice, floating rice, cashew, pepper, corn, mango, durian, and carrots	[1]
The economic land concessions (ELC) programme	Public	The program that began in the 1990s gave long-term leases to companies to clear land for industrial agriculture, i.e., large-scale plantations and factories to process agricultural products The Ministry of Agriculture, Forests and Fisheries website states that between 1996 and June 2012, the Ministry signed ELC contracts covering 1,204,750 hectares However, data from NGO Licadho (which excludes land allocated for mining exploration) suggests that 2.14 million hectares have been leased Much of the increased production, of products such as rubber and cassava, is a result of industrial agriculture, which has been a key focus area of the government's agricultural development strategy However, the massive ELC program has not added significant value. As a 2015 World Bank report found, "Except for rice, the agroprocessing industry has played a limited role in agricultural growth. Almost all crops were exported to neighboring countries unprocessed"	[2]
Agricultural Census	Public	The objective is to map the number of households having agricultural holdings and assess total land areas of agricultural holdings for productivity improvements	[2]
Cambodia overview of food safety standards (2015)	Public-private	The Cambodian government will introduce a food safety law in 2015 that will see the country adopt a set of standards and ensure greater coordination across ministries, according to a health official According to Didier Fontenille, director at Institut Pasteur du Cambodge, a bio-medical research lab, there are currently 452 food safety standards being passed across different ministries, but only 12 have been officially published so far In the absence of a food safety law, many food and beverage businesses are adopting third-party standards such as Hazard Analysis and Critical Control Points (HAACP)	[3]
Department of Agricultural Extension	Public	The Department of Agriculture Extension (DAE) of the Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) was established in 1995 to develop a demand-driven, district-implemented, provincially managed, and centrally overseen extension system appropriate to the needs of Cambodia	[4]

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Initiative	Initiative type	Summary	Source
Increasing Resilience to Climate Change for Farmers in Rural Cambodia through Climate-Smart Agriculture Practices (IR-CSA)	Public	The resilience of vulnerable smallholder farmers is increased by mainstreaming the planning and implementation of climate resilience-building practices by MAFF 100 staff from MAFF at national level, subnational agricultural officials, and undergraduate students from Royal University of Agriculture (RUA) will benefit from knowledge and skills in undertaking the participatory climate vulnerability assessment 750 vulnerable farmers will be involved in the diagnosis of the vulnerabilities in 36 different villages to increase their resilience 300 stakeholders and RUA students will also directly benefit from the lessons learned from the project through dissemination workshops and field visits	[5]
Organic & Export Certification	Private	The Cambodian Organic Agriculture Association (COrAA) is a nationwide private-sector organization working for the promotion of organic agriculture in Cambodia COrAA is unifying organizations and individuals in Cambodia that are active in organic farming, processing, marketing, trading, and any kind of support for organic agriculture It provides Organic & Export Certification, as well as training and consultation	[6]
Cambodian Derivatives Exchange	Private	It was founded in 2016. Creating history in Cambodia's financial sector is the biggest mission of Cambodian Derivatives Exchange Co., Ltd. (CDX) Until now, CDX has gained credential reputation both in public and among market peers. Only within a few years of operation, CDX has already obtained a number of derivatives brokers under its supervision, reflecting sustainable development and growing public confidence in this sector as well as in CDX	[7]
Mex Exchange	Private	This is Cambodia's first mercantile exchange that opened in 2010. The exchange, which was registered with the Ministry of Commerce in January, will operate like similar exchanges worldwide. It covers energy, industrial metals, rubber, precious metals, and agricultural	[8]
Emerging Markets Investment Advisers (also investment fund)	Private	This successful investment fund in Cambodia has raised USD20m. An initial batch of 136 entrepreneurs or small and medium-sized enterprises (SMEs) have been introduced to the business incubator, and the selection process has narrowed this down to five companies that are seen as potential incubatees. Of these five, three are in the agribusiness/food processing field	[9]
ICT4D Solution Incubator Cambodia	Private	The ICT4D Solution Incubator initiative aims to empower Cambodia-based development actors to integrate ICTs strategically, effectively, and sustainably in their programs (including agriculture) for maximum social impact	[10]
Young Innovator Programme	Private	Organized by Smart Axiata, the SmartStart Programme is on the lookout for groundbreaking solutions related to four verticals, namely, digital education, digital commerce and payments, digital entertainment, and content as well as for other disruptive industry models in areas such as transport, health, agriculture, and internet of things	[11]

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Initiative	Initiative type	Summary	Source
Food, Agriculture & Social Entrepreneurship (FASE)	Private	FASE is revitalizing rural economies through sustainable agriculture skills and business development and is fighting rural poverty and rural exodus by (1) addressing a lack of education in the countryside; (2) promoting sustainable farming techniques: (3) addressing a lack of social capital in the countryside; and (4) promoting rural entrepreneurship	[12]
Agriculture Skills in Public Schools (ASPUS)	Private	Since 2014, the main focus of ASPUS is to introduce small-scale farming techniques within the school curriculum. To date, Green Shoots (the organization behind ASPUS) has set up gardens in 42 schools, introduced skills to almost 5,000 students, and trained 47 teachers in not only managing the gardens but also provided lessons in planning and conducting the training	[13]
Cambodia-Australia Agricultural Value Chain Program (CAVAC)'s initiative for rice milling and export	Public-private	the goal is to support Cambodia's rice export targets and increase its competitiveness in international markets by introducing new rice seed varieties to ensure the quality and consistency required by export markets It works with private seed companies and millers to improve the availability of quality seed	[14]
CAVAC's initiative to improve irrigation and water management	Private	In its first five years, CAVAC constructed 20 irrigation schemes that now deliver year-round water to over 19,000 households, thus allowing for double or triple rice cropping each year. This means farmers can now potentially produce an extra 200,000 tons of rice per year, valued at over USD43 million The schemes focus on farmland in areas where surface water from rivers can be diverted via canals to farms farther away. Local communities are consulted to select locations, and the knowledge and support is provided so that farmers can manage and maintain the schemes after construction In the second phase of CAVAC, during 2016–21, several new schemes are already underway, with another 18,000 to 22,000 households to benefit from year-round water supply	[15]
CAVAC's initiative for improving productivity and diversification	Private	The goal is to improve incomes for smallholder farmers, and a large part of the interventions is focused on delivering knowledge about new farming techniques, especially for improving yields with the best use of fertilizers and pesticides Diversification activities are encouraging farmers to move away from dependence on rice, which is currently at record low prices, to try different, more profitable crops like maize, chilis, and pulses The private sector is a key factor in Cambodia's farming system as the source for seeds, fertilizers, and pesticides. By partnering with the suppliers of agricultural inputs and services, CAVAC hopes to reach around 135 000 farming households with information on how to improve their incomes An Giang (now called Loc Troi Group) is a Vietnamese company that already used farmer meetings to promote its products in Vietnam, but due to staff shortages in Cambodia, An Giang and CAVAC agreed that retailer training might be the most effective way to deliver information to farmers	[16]
Sustainable and Inclusive Fisheries and Livelihoods (SIFAL)	Private	The project aims to increase the organizational and technical capacities of multiple stakeholders in Kampong Thom and Kampong Chnnang provinces. ICCO's specific activities focus on ensuring increased opportunities for fishermen in the two provinces to develop aquaculture and alternative livelihoods	[17]

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Initiative	Initiative type	Summary	Source
Investing Smallholder Producer Groups Accessing Markets (ISPAM)	Private	Started in 2016, ISPAM is a two-year project funded by Women's Bank and Finn Church Aid (FCA). It aims to contribute to the enhanced social and economic status of women in agriculture cooperatives in the Cambodian provinces of Kampong Speu, Kampong Chhnang, Pursat, and Battambang. As one of the key implementing agencies, ICCO is responsible for two main program components, i.e., loans and savings, and collective centers	[18]
Cooperation for Women's Economic Development II	Private	This project aims to contribute to the enhanced social and economic status of women in 17 Women Agriculture Cooperatives (WACs) in the Cambodian provinces od Kampong Speu, Kampong Chhnang, Pursat, and Battambang	[19]
Community Fish Sustainability and Market Inclusiveness	Private	This project aims to improve organizational capacities of Community Fisheries (CFi) management, sustain fisheries finance through capacity building for Community's Revolving Fund (CRF) committees, and increase the income of fishers' families through promoting 'adding value' and access to markets	[20]
Accelerating Inclusive Cassava Market Development (AI-CMD)	Public-private	The overall objective of the project is to enhance prosperity of smallholder cassava farmers through increasingly profitable links to agribusinesses and markets	[21]
Tonle Sap Poverty Reduction and Smallholder Development Project	Private	The Tonle Sap Poverty Reduction and Smallholder Development project (cost $65.30 million) will respond to the need for increased productivity of integrated farming systems and improved livelihoods of the resource poor households. This project will improve the livelihoods of poor rural households in four provinces of the Tonle Sap basin.	[22]
Accelerating Inclusive Markets for Smallholders (AIMS)	Private	The goal is to stimulate agriculture through intensification, diversification, and commercialization. This project (cost $61.61 million) aims to increase returns from farming for smallholders, including young people, through efficient public-sector investment. It will work to develop five high-value product value chains covering crops and livestock and increase private investments in them	[23]
Agricultural Services Programme for Innovation, Resilience and Extension (ASPIRE)	Private	The program's objective is that by 2021 an improved model of extension services for Cambodia would be helping smallholder farmers to contribute to broad-based economic growth. It will achieve this objective through profitable and resilient farm businesses. ASPIRE will have four components (1) evidence-based policy development; (2) capacity development for extension services; (3) improved extension services; and (4) infrastructure to support climate-resilient agriculture. It will target productive poor people and vulnerable smallholder farmers	[24]
USAID Programs	Private	USAID Programs has (1) trained nearly 345,000 (64% female) persons or 124,500 households in agriculture and food security, 25% of them being poor; (2) helped over 193,000 (53% female) farmers or 78,000 households to apply new technologies on 87,600 hectares of land; (3) assisted beneficiary farmers to increase their incremental sales by USD40 million (each household has an additional income of USD110) from selling agriculture products each year; (4) trained over 230,000 (70% female) people in improving nutrition practices; (5) helped 41,000 (50% girls) children below five years old to receive nutrition program; (6) reduced nearly 30% of underweight children in the last five years; and (7) helped 73 students (33 female) to pursue Associate, Bachelor, MSc, and PhD degrees in agriculture, food security, or environment-related sectors	[25]

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Initiative	Initiative type	Summary	Source
Cambodia Agribusiness Development Facility (CADF)	Public-private	Through CADF, International Development Enterprises (iDE) identifies market opportunities and constraints for small-scale farmers and then designs solutions that can be implemented by small local businesses By improving access to technical assistance, market information, quality inputs, and new technologies, iDE strengthens the value chain that links all agricultural market players together	[26]
Farm Business Advisors (FBAs)	Private	The enterprise recruits, trains, and provides a range of services to the FBAs including bulk purchasing of products and expert agronomy support. Lors Thmey is buying produce from farmers to sell in bulk to big buyers, thus guaranteeing farmers a profit on their produce and a means to sustainability	[27]
Irrigated Agriculture Improvement Project	Public-private	The project will assist the government to (1) rehabilitate, modernize, and climate-proof four irrigation systems in Battambang, Kampong Cham, Kampong Thom, and Takeo provinces and deliver irrigation services to 291,847 persons; (2) ensure sustainability of irrigation schemes; (3) improve farming practices for increased agriculture productivity and crop diversification; and (4) improve water resources information system and irrigation asset management system for better water resources planning and investment	[28]
Climate-Friendly Agribusiness Value Chains Sector Project	Public-private	The project will boost the climate resilience of critical agricultural infrastructure and help commercialize rice, maize, cassava, and mango production. It will help increase crop productivity and diversification; improve the capacity for storage, processing, and quality and safety testing; and promote the use of solar and bioenergy	[29]
Tonle Sap Poverty Reduction and Smallholder Development Project	Public-private	Enhance agricultural productivity and improve access to markets in 270 target communes through investments in climate-resilient productive infrastructure; building capacity in disaster risk management of the communities and commune councils; and creating an enabled environment for agricultural productivity, diversification, and climate resilience	[30]
Agricultural Value Chain Infrastructure Improvement Project	Public-private	It tackles the core problem of low productivity, low value addition, and low resource efficiency of Cambodia's agriculture with the following outputs: (1) strengthened post-harvest and logistic facilities; (2) improved agricultural production and service infrastructure; (3) improved rural connectivity and disaster risk management capacity; and (4) enhanced business partnership among value chain stakeholders	[31]
Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project (CAM)	Public-private	ADB is helping Cambodia to strengthen disaster risk management and raise the ability of vulnerable communities to cope with floods and droughts. The project will upgrade irrigation systems and other infrastructure, enhance the national flood forecasting center, and provide training and support to farmers for community-based disaster risk management and climate change adaptation	[32]
Development and Dissemination of Climate-Resilient Rice Varieties for Water-Short Areas of South Asia and Southeast Asia	Public-private	It provides support for large-scale dissemination of promising breeding lines seed multiplication; evaluation and dissemination of second-generation, climate-adapted water-saving rice varieties; development and initial dissemination of new, third-generation aerobic and alternate wetting and drying (AWD) varieties; and impact assessments	[33]

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Initiative	Initiative type	Summary	Source
Food Security and Resilience of the Association of Southeast Asian Nations Member States to Food Price Volatility	Public-private	Strengthen the regional public goods and services that Association of Southeast Asian Nation (ASEAN) provides, especially toward improving the resilience of the rice and food value chain markets to natural and economic shocks and ensuring the region's sustainable and inclusive food security	[34]
Uplands Irrigation and Water Resources Management Sector Project	Public-private	These two sub-projects are increasing farm productivity and farmers income while improving health services to prevent the spread of malaria. Irrigation systems are being improved in Kampong Thom and Battambang provinces	[35]
Irrigated Agriculture Improvement Project	Public-private	The impact of the project will be inclusive economic growth through agriculture and irrigation. The outcome will be enhanced water and agriculture productivity in the project areas. The project will deliver two outputs to achieve the desired outcome and impact including (1) enhanced efficiency and climate resilience of irrigation systems, and (2) improved water resource management	[36]
Agriculture Sector Development Program Loan	Public-private	The loan program will facilitate policy and institutional sector reforms to ensure a favorable environment for market-based agricultural growth. The project loans will provide farmers with extension services for delivery of improved knowledge and technology, and support for agroenterprise development and commercialization	[37]
TSSD- ADF Loan	Public-private	The project will help establish commune-based livelihood improvement groups that will provide revolving funds to members to buy agricultural supplies such as seeds and fertilizers. It will improve agricultural productivity and access to markets	[38]

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APPENDIX A

REPUBLIC OF CHINA

Initiative	Initiative type	Summary	Source
CRO Service	Public-private	The benefit of this technology platform will help biotechnology industries to accelerate R&D, from discovery through development, and produce certificated reports through a standard operating procedure. It will integrate the 'in vitro and in vivo' model to offer flexible package services to support early-stage development, FDA or CE registration, and commercialization for bio factories	[1]
Animal Vaccine Development Center (AVDC)	Public-private	AVDC, one of the ROC's principal veterinary research centers, is a task force of Agricultural Technology Research Institute (ATRI). AVDC is continually developing new products or technologies such as animal vaccines, diagnostic kits, and animal disease models. The responsibilities of AVDC are mainly animal vaccine research in pigs, poultry, fish, and crustacea, and coordination of all veterinary vaccine research in the ROC. AVDC also calls for international collaboration on animal vaccine development	[2]
Lee Sung Pigs	Public-private	The initiative supports developing Lee Sung pig breeds and pigs for medical research. Services include biomedical application, commissioned test service, introduction for lab, genetic information, super ovulation and embryo, and customized services	[3]
Taiwan Agriculture Techno Mart (TATM)	Public-private	TATM offers various functions and services to meet the needs of industries, including (1) providing information about the Council of Agriculture (COA)'s popular agricultural innovations; (2) announcing the government, business, and academia collaboration project; (3) displaying all the COA's research accomplishments which can be licensed; and (4) publishing a monthly e-paper covering the latest agriculture R&D news and marketing activities	[4]
New agriculture innovation promotion program	Public	The goal is to reverse the conservative subsidy policy in the past so that existing resources could be redistributed to strengthen interdisciplinary communication and integration, expedite industry structural transformation, create favorable environment for young talents to return and work in agriculture, in hopes of raising agrobusiness added value and forging a revolutionary new agriculture through the implementation of three pillars encompassing 10 key policies: (1) Establishing new agricultural paradigms: This encompasses six key policies, i.e., promote green payment on farmland, stabilize farmers' income, improve competition of livestock industry, advocate environment-friendly farming, support sustainable usage of agricultural resources, and develop innovation agriculture; (2) Constructing food security and food safety system: This comprises two key policies, i.e., enhance food security, and ensure agricultural product safety; and (3) Enhancing abilities of agricultural marketing: This covers three key policies, i.e., expand diverse domestic and overseas distribution channels for agricultural products, and increase agricultural added value	[5]

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Initiative	Initiative type	Summary	Source
Implement dual system of green environmental payment and guaranteed purchase	Public	In order to encourage farmers to adopt environment-friendly measures for the production of quality paddy, the COA has implemented preliminary dual system of direct payment policy and guaranteed purchase on rice in six townships, since the second crop season in 2016 The declared direct payment area took up 49% of the declared rice cultivation area. The implementation of direct payment policy expanded to 20 trial areas in the first crop season of 2017, and the declared area accounted for 63% of the declared trial paddy area, which has effectively brought down farmers' dependence on guaranteed purchase	[6]
Encourage the use of local fresh ingredients for school lunch	Public	The Executive Yuan put forward the 'Five Links of Food Safety Policy' to enhance the verification of agricultural products and boost the use of traceable local ingredients for school lunches. In this way, the feature of school lunches was created while food safety policy was implemented step by step. In March 2017, six municipalities, cities, and counties, namely Hsinchu City/ County, Taichung City, Tainan City, Yilan County, and Taichung County were in initial trial. In the same year in September, 20 cities and counties including Penghu Counties also participated in the use of '4-labels-1-Q' (GAP, CAS, CAS Organic, TAP, and QR Code) ingredients for school lunches, which were beneficial to 1.86 million students from 3,500 schools and boosted 4,000 hectares of production area. The COA assisted school procurement staff in identifying 4-labels-1-Q agricultural products correctly, thus reinforcing and putting school lunch inspection and ingredients registration into effect	[7]
Organic agriculture and eco-friendly farming promotion	Public	Organic agriculture and ecofriendly farming provide safe and outstanding agricultural products for consumers. In order to promote the development of organic agriculture in the country, organic agriculture technical service groups were formed to hold training on organic agrobusiness management and counsel the farmers to apply for organic certification and production facilities as well as equipment Since the initiation of organic and environment-friendly cultivation subsidy in 2017, verified organic area had reached 7,541 ha at the end of November and 13 ecofriendly farming promotion groups had registered 497 ha of ecofriendly farming area, which is expected to go up to 15,000 ha in 2020	[8]
Traceable Agricultural Products (TAP) and Certified Agricultural Standards (CAS) integration	Public	Traceable agricultural product (TAP) provides certification service for consumers on production process control and product verification, regulating the producers to comply with food safety and sustainable environment standards as certified by international third-party accredited certification bodies. Only those that are certified are entitled to use the TAP mark, which allows consumers to purchase at ease. By the end of 2020, an integrated agricultural product certification system that is reliable, transparent, and easy to understand for consumers will be completed	[9]
Big granary project and action plan	Public	The COA encourages farmers to grow high-quality, diversified, and import-substituted crops, with plans to promote changing the cropping system for grain crops	[10]

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Initiative	Initiative type	Summary	Source
Green power in pig farms	Public	In order to encourage pig farms to generate electricity with biogas, Bureau of Energy has raised the electricity rate to NTD5.0087 per kilowatt hour in 2017, and the COA has lowered the interest rate of Policy-Oriented Special Agricultural Loan to 1.04% while the loan limit has increased from NTD10 million to NTD30 million. According to 'Directions of Electricity-Generating Reward and Subsidy for Pig Farms,' different reward schemes and subsidies for pig farms based on various scales are ongoing An expert counseling group was set up to carry onsite visits to pig farms with more than 5,000 pigs and to assist in solving relevant issues. Consequently, 38 pig farms were equipped with power generators, with a total of 340,000 pigs	[11]
New farmers program	Public	New farmers program has been launched for the period 2017–22, targeting the demand in different stages of farming and assisting new farmers to conquer the barriers of technology, farmland, capital, and marketing so that they could minimize the gap between learning and applying Impact: It is estimated that 3,000 new farmers will be trained every year. From the first through the third classes of the Hundred Young Farmers program, 318 young farmers were selected. The fourth classes started in September to select 93 young farmers and 12 farmers' teams (58 people). Moreover, 16 'service platforms' for local young farmers were established in cities and counties to boost collective collaboration. The Farmers' Academy also provided professional training on technical skills and business management to systemize the training of the agricultural workforce	[12]
Trial plan on promoting an improvement of agricultural labor shortage version 2.0	Public	In April 2017, COA recruited and hired young adults to form three agricultural technology groups and then added another eight technological groups in August. To continue dealing with the shortage of agricultural labor, the COA was to recruit 50 pasture managers for daily cow nursery groups, who were to be assigned to dairy farms to do annual work in November. The COA also anticipated to form two tea expert groups and two agricultural technology groups in Chiayi City	[13]
Promoting the New Southbound Policy	Public	The New Southbound Policy is to elevate the scope and diversity of the ROC's external economy and to reconstruct the connection between the ROC and Asia. It drew up 11 potential agricultural items to facilitate trade by using the mutually beneficial model with the New Southbound Policy partner countries	[14]
Guidance of the Founding of the MITAGRI Company and its Operations	Public	The MITAGRI Company was founded and formally began operations on 5 December 2016. It aimed for agricultural products' import and export, material export and overseas investment, and technical output The company has already selected banana, pineapple, pineapple sugar apple, lettuce, carrot, and onion as the main exporting products. MITAGRI will strengthen the export-oriented contractual farming system, goods collection, logistics and quality control, branding, and overseas marketing of agriproducts, thereby constructing an export supply chain with stable quantity and quality assurance	[15]
Maintaining International Food Security	Public	COA, through promotion of the Regional Food Security Action Plan, and since initiating the APEC multi-year program titled 'Strengthening Public-private Partnership to Reduce Food Losses in the Supply Chain' in 2013, has effectively upgraded the understanding that both public and private sectors in APEC members have of food losses and waste	[16]

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Initiative	Initiative type	Summary	Source
Undertaking Agricultural Insurance	Public	Considering that many countries in the world use agricultural insurance systems to reduce the risks of farming operations and stabilize the economic security of farmers, in 2017 the COA has continued to offer insurance on top-grafting pears, pears, and mangos, and has added, on a trial basis, sugar apple income protection insurance. It has also added protection insurance for rice, aquaculture, grouper, among others Impact: There are 92 cases of sugar apple insurance, covering 51 ha; 4,518 cases of rice insurance, covering 7,798 ha; and 44 cases of aquaculture insurance, covering 43 ha. In 2018, the COA planned to introduce banana income protection insurance, and insurance products for wendan pomelo, pineapple, and papaya. In future, the COA will continue to expand trial items	[17]
Promoting Rural Regeneration 2.0	Public-private	In order to speed up the pace of rural regeneration (RR), the RR policy was upgraded to Rural Regeneration 2.0 (RR2.0) in 2017. It puts the rural community at the center and constructs regional network based on rural characteristic, production, resource, and culture Impact: The new policy involves different plans to expand public participation and collaboration, innovation, friendly agriculture promotion, and regional cooperation. Up to 2,540 communities had educated their inhabitants, 780 communities had submitted their own RR projects, and 1,936 communities had improved their living environments	[18]
Strengthening International Cooperation to Combat Illegal, Unreported, and Unregulated (IUU) Fishing	Public	The three fisheries Acts governing the distant-water fisheries came into force on 20 January 2017, and 15 implementing regulations also became formally effective on the same day. The three fisheries Acts clearly stipulate the obligations with which the operator, employee, and national must comply. COA has also established a 24-hour Fisheries Monitoring Center (FMC) and concretely implemented 11 action plans to combat IUU fishing	[19]
Promoting the Satoyama Initiative	Public-private	The main reason behind the launch of the Satoyama Initiative was to correct the imbalance in the relationship between humans and the land. It was aimed at composite rural ecological systems with Satoyama-like landscapes, and it emphasizes harmonious coexistence between humans and nature. Internationally, the Satoyama Initiative is already seen as a tool for new international systems, and is helpful for passing along of the traditional wisdom and cultures of mountain communities Impact: During 2016–17, more than 70 communities, aboriginal organizations, NGOs, green industries, and departments in government participated in the communicative activities of TPSI. They shared their individual practical experience of 'harmonious coexistence between man and nature.' The COA also promotes the plan to put into practice 'Satoyama ecological rural communities.' In 2017, the COA has selected three communities with the potential to be pro-actively guided: the Gongrong Community in New Taipei City, the Nanpu Community in Hsinchu County, and the Shangde Community in Taitung County	[20]
Food Safety Standards	Public	Regulated by the Taiwan Food and Drug Administration, these cover a broad range of sub-categories, e.g., food safety assessment, food imports management, food registration, labeling, food industry management, and food service sanitation	[21]

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Initiative	Initiative type	Summary	Source
Food and Agricultural Import Regulations and Standards	Public	The ROC was the seventh-largest export market for the USA's food and agricultural products in 2015, valued at USD3.28 billion. Imported food and agricultural products must comply with a range of laws designed to protect human health and prevent the introduction of animal and plant pests or diseases These regulations cover general food laws, food additives regulations, pesticides and other contaminants, packaging and container regulation, labeling requirements, other specific standards, facility and product registration requirements, other certification and testing requirements, import procedures, copyright and trademark laws, government regulatory agency contacts, and other import specialist contacts	[22]
Moving towards Agricultural 4.0 in Taiwan with Smart Technology	Public	COA is currently promoting smart production and digital services in the agricultural industry to optimize manpower, resources, and the overall industry. In order to promote the Smart Agriculture 4.0 Program, the COA targeted three major fields, namely agro-biotechnology, quality agriculture, and precision agriculture Precision agriculture is divided into two major categories: establishing foundations and promoting excellence. Ten leading industries, including moth orchid, seedling, mushroom, rice, agricultural facility, aquaculture, waterfowl, traceable agricultural product, dairy, and marine fishery industries were prioritized for promotion	[23]
NPUST Innovation Incubation Center	Private	NPUST is a 92-year-old tropical agriculture university. NPUST Innovation Incubation Center was established in 2001 and focuses on agriculture, food, and biotechnology fields, in which 117 companies have been incubated. It connects many resources, such as government resources, technology experts, business consulters, banks, venture capitals, factories, human resources, and sales channels. Some of products can be test marketed in its school shop. Impact: It has helped Yang-Da Biotechnology Co., Ltd.; got government resources of NTD1.5 million for R&D; got Innovation Research Award and NTD300,000 from the government; got the Outstanding Biotech Award from InBIA; got a hatched-out enterprise award from Ministry of Economic Affairs in 2016; assisted to attend Japan Foodex exhibition in 2016 and 2017; helped Yong-Da Food Technology Co., Ltd.; Got a hatched-out enterprise award from Ministry of Economic Affairs in 2013; and got government resources (SBIR) of NTD1.1 million for R&D	[24]
Agricultural Incubation & Promotion Center at NTU	Private	The 'Chuhe Building,' or the Agricultural Incubation and Promotion Center on NTU Yunlin Campus, was officially inaugurated on 18 July 2018. It will be used as the venue for large-scale displays, various education and training events, and exhibition and marketing of research results. It will also serve as a model for advanced agricultural technology research	[25]
Agricultural Incubator Program Integrated Resources	Public-private	Compared with the innovation and incubation center in universities, these centers are more industry-oriented and have garnered recognition from participating companies. In addition, the COA collaborated with its four innovative incubation centers in establishing an integrated agricultural incubation system, which has already assisted many companies in applying for counseling resources or raising funds	[26]

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Initiative	Initiative type	Summary	Source
Pingtung Agricultural Biotechnology Park	Public-private	Its plan covers a full range of office, production, storage and transportation, research and development, and leisure functions, which create an irreplaceable competitive advantage for the industries that are stationed here. The park is located at Pingtung County, and is estimated to accommodate up to 120 companies in future and offer up to 8,000 job opportunities	[27]

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APPENDIX A

FIJI

Initiative	Initiative type	Summary	Source
(National Movement) The Green Growth Framework for Fiji: Restoring the Balance in Development	Public	It was developed in early 2014, to keep the balance between the three pillars of sustainable development, namely economic, social, and environmental by (1) reducing carbon footprints at all levels; (2) improving resource utilization and productivity; (3) developing a new integrated approach, with all stakeholders collaborating and collectively working together for the common good; (4) strengthening sociocultural education of responsible environmental stewardship and civic responsibility; (5) increasing the adoption of comprehensive risk management practices; (6) supporting the adoption of sound environment auditing of past and planned developments; (7) enhancing structural reforms in support of fair competition and efficiency; and (8) incentivizing investment in the rational and efficient use of natural resources	[1]
Fiji 2020 Agriculture Sector Policy Agenda	Public	This compliments the National Green Growth Framework by implementing 'climatesmart agriculture' that generates both adaptation and mitigation benefits The policy also addresses the 'sustainable intensification' that will increase production The holistic and focused vision of this policy pursues sustainable development with an inclusive approach to modernize Fiji's agriculture sector by 2020	[2]
Kava (Yaqona) Processing Standard	Public	This standard applies to kava (yaqona) products used as food or food ingredients and/or other products intended for human usage. It covers quality factors, contaminants, hygiene, labeling, sampling methods, and methods of analysis	[3]
A Guide to Healthy Catering	Public	A Healthy Catering Guideline has been developed to assist government ministries to provide healthy and nutritious food for staff, volunteers, and visitors attending workplace meetings, workshops, and sponsored events	[4]
Food Safety Regulation (2009)	Public	This covers preliminary, relationship to Codex Alimentarius, sampling and analysis, good hygienic practices, labeling rules and packaging, food additives and nutrients supplements, incidental constituents, commodity standards, licenses, authorized offices and inspectors, offences, penalties and publication of offenders, and revocation	[5]
SME Grant	Public	It provides support to small and medium enterprises (SMEs) in the agricultural sector including advice (mentoring) on the business and financial management of SMEs A grant is equivalent to 25% of the total investment required, in association with a loan from a commercial bank of 50% of the total and 25% of the SME's equity. The maximum size of a matching grant would be FJD50,000	[6]
Government's Costed Operational Plan 2018/2019	Public	Programs on these strategic priorities include Food and Nutrition Security (highest budget allocated); Sustainable Agriculture Livelihoods and Poverty Alleviation; Climate Risk, Resilience and Sustainable Land Management; Commercial Agriculture Development; and Quality Public Sector Performance and Service Delivery	[7]

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Initiative	Initiative type	Summary	Source
FAO Implementation of the Global Strategy in Fiji	Public-private	The goals have been to (1) develop a Strategic Plan for Agricultural and Rural Statistics (SPARS); (2) support and assist in developing a planned 2016 agricultural survey; (3) develop an agriculture module for the 2017 Population and Housing Census; (4) evaluate administrative data collection methodologies and recommend areas for improvement; (5) assist in adoption of mobile technologies for agriculture and fisheries data collection; (6) develop a master sampling frame for survey activity that takes place after the censuses; and (7) train individuals and agencies in basic statistical methods, advanced statistical methods, methods used in agricultural statistics, and specialized statistics techniques	[8]
Improvement of Key Services to Agriculture and Livestock in Fiji	Public-private	Helping agrofood enterprises and their clusters of farmers in Fiji's sugar belt to access new markets for food products in retail, tourism, and catering; and to increase the value of exports of agrofood and livestock products to the Pacific region. Two projects have been funded by the European Union (EU), including Accompanying Measures for Sugar Protocol Countries (AMSP) Programme to support developing the supply and marketing of Fijian crop, and livestock products to win new business	[9]
Fiji Agricultural Partnerships Project	Public-private	International Fund for Agricultural Development (IFAD) is supporting the Government of Fiji to promote the concept of 'farming as a business' Training was delivered to the target group on good governance, gender and agriculture, and resource management. Between February and September 2018, Partners in Community Development Fiji (PCDF) visited each of the 41 project villages three times to introduce the project and for the community to identify cluster community facilitators (CFs) PCDF has implemented a farmer registration initiative for a training program, to be delivered in partnership with the MoA Extension staff (1,500 farmers were registered against a target of 2,000) As part of technology transfer for increased productivity and profitability, seven trainings, instead of the three initially planned, to introduce vegetable production, were conducted in five districts and was attended by 393 farmers, of which 111 are women (28.2%) As part of a certification system for highland farmers, PCDF subcontracted POETCom in October 2018 to deliver this cluster of activities. No work had been carried out by POETCom yet as only a down payment was triggering the start of POETCom work, as per the SPC policy	[10]
Aquaculture Project	Public-private	The objectives of this project are to (1) assist research stations under the Ministry of Fisheries produce 4.25 million larvae of seawater shrimp (litopenaeus vannamei), 4.25 million larvae of freshwater prawn (macrobrachium rosenbergii), and 2 million male tilapia fries in four years, as the task will also improve the water supply system and upgrade the management system in these stations; (2) breed 200 adult milkfish as future broodstock; (3) hold eight workshops and training sessions in four years; (4) carry out capacity building for five local collaborators; and (5) make a list of standard operating procedures for various aquaculture techniques, including the production of fish feeds, culture, and management of broodstocks; and larval rearing By the end of December 2018, the activities completed were (1) production of 0.56 million larvae of freshwater prawn (Macrobrachium rosenbergii), 0.51 million larvae of seawater shrimp (Litopenaeus vannamei), and 0.30 million male tilapias was done in research stations under the Ministry of Fisheries; and (2) two capacity building workshops for 140 people were held	[11]

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Initiative	Initiative type	Summary	Source
Vegetable Production, Marketing Extension and Capacity Building Project	Public-private	The objectives of this project include (1) assisting with vegetable production techniques in the Nadarivatu highlands; (2) vegetable marketing extension in Sigatoka valley; and (3) capacity building in vegetable production at the Nasinu military farm By the end of December 2018, the activities completed were (1) production of 4,114,790 vegetable seedlings; (2) marketing of 422.34 tons of fruits and vegetables to export agents and/or supermarkets through the Coral Coast area collection center in Sigatoka valley; (3) plantation of 37.35 hectares of fruits and vegetables at the demonstration farm for the purpose of technical training; (4) 34 workshops on vegetable production and marketing for 886 people; (5) nine 'farmers field days' on vegetable and tropical fruit production marketing link for around 998 people; (6) four agriculture shows with around 6,500 visitors; and (7) 40 capacity building workshops for 1,055 people at Nasinu Republic of Fiji Military Forces (RFMF) Veterans Farm	[12]
Pilot Implementation of AquaRating in Fiji	Public-private	The objective of this pilot and demonstration activity (PDA) is to introduce the AquaRating Tool, an independent water-auditing tool, to the Water Authority of Fiji (WAF), as part of an ADB-funded investment program that will improve access to sustainable water supply and sewerage services in the Greater Suva Area Results: On the whole, the AquaRating tool proved to be useful to WAF in reviewing its performance, providing them with a comprehensive analysis and motivation to develop and implement an improvement plan. As for ADB's perspective, the AquaRating results were seen as aligned with the planned investment program. Furthermore, AquaRating was deemed applicable to other utilities in Asia and the Pacific	[13]
Development of livestock and livestock products	Public-private	Develop new ITC technical cooperation projects to support Fijian sugar belt communities and Vanuatu WTO accession and agribusiness export sector's development	[14]
Improvement of key services to livestock and livestock products	Public-private	Directly increase the number of export-ready enterprises in livestock, and at the impact level increase the incomes of more than 1,500 farmers, members of poor communities and ex-sugar cane workers in the sugar belt of Fiji through market-led development of livestock products and animal-feed enterprises. It is estimated that the livelihoods of another 2,000 people involved in livestock activities will be improved as they will benefit from access to better sector-support services being made available in the sugar belt	[15]
Fiji Institute of Agricultural Science (FIAS)	Public	This will now act as a central body that will provide sound practical advice to harness Fiji's agricultural research and development	[16]

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APPENDIX A

INDIA

Initiative	Initiative type	Summary	Source
Pradhan Mantri Fasal Bima Yojana	Public	This is a crop insurance policy with relaxed premium rates on the principal sum insured for farmers. Implemented with a budget of INR17,600 crore, this scheme will provide financial support to farmers and cover for their losses. This initiative was expected to go on floors from the next Kharif season of farming, i.e., from June 2016	[1]
Blue Revolution	Public	This is an integrated scheme designed to increase the productivity and profitability from aquaculture and fisheries resources, inclusive of both inland and marine. With a budget of INR3,000 crore offered by the government for the five years spanning 2017–22, this scheme aims to maintain an annual growth rate of 6–8% for the agriculture and allied sector	[1]
Improve milk productivity	Public	With a milk-producing animal population of more than 118 million, the milk yield per animal is very low. To meet the steadily growing demand for milk, the National Dairy Development Board (NDDB) has announced 42 dairy projects, with a budget of around INR2,210 million. These projects will focus on improving the milk productivity of major milk-producing states such as Uttar Pradesh, Maharashtra, Karnataka, and Tamil Nadu	[1]
Energy-efficient irrigation	Public	Power Minister Piyush Goyal had said that the government is planning to invest INR750,000 million to provide energy-efficient irrigational facilities to farmers, over the next three to four years. Under this scheme, close to 30 million energy-saving pump sets would be given to farmers and the cost would be recovered via savings in the electricity consumed This would result in about 46 billion kWh of power being saved and 2 million jobs getting created	[1]
Paramparagat Krishi Vikas Yojana	Public	The government will support and improve the organic farming practices prevalent in India. Following the cluster approach mode of farming, at least 50 farmers will form a group having 50 acres of land to implement organic farming. The government aims to cover 10,000 clusters and 500,000 ha of arable land under organic farming within three years	[1]
Agricultural Marketing	Public	Some of the projects are Integrated Scheme for Agricultural Marketing, National Agriculture Market (e-NAM), Model Agricultural Produce and Livestock Marketing, and Formulation of Model Contract Farming	[2]
Cooperation	Public	Projects include Cooperative Education & Training, Assistance of National Cooperative Federations, Assistance to National Agriculture Cooperative Marketing Federation of India. (NAFED), and Price Support Scheme (PSS)	[3]
Credit	Public	Projects include Pilot Modified National Agricultural Insurance Scheme (MNAIS), National Agricultural Insurance Scheme (NAIS), Modified National Agricultural Insurance Scheme (MNAIS), Weather Based Crop Insurance Scheme (WBCIS), Investment in Debentures of State Land Development Banks (SLDB), Pilot Modified National Agricultural Insurance Scheme (MNAIS), and Flow of Credit to Agriculture	[4]
Drought Management	Public	The key projects are Drought Measures, and Draft National Disaster Mitigation Plan	[5]

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Initiative	Initiative type	Summary	Source
Horticulture	Public	Projects include Central Institute of Horticulture (CIH), Directorate of Arecanut and Spices Development (DASD), Mission For Integrated Development of Horticulture (MIDH), National Horticulture Board (NHB), Coconut Development Board (CDB), and Directorate of Cashewnut & Cocoa Development	[6]
Integrated Nutrient Management	Public	Projects include Mission Organic Value Chain Development for North Eastern Region, Soil Health Management (SHM) Under National Mission for Sustainable Agriculture (NMSA), Strengthening of Soil Testing Laboratories (STLs), Promoting use of integrated nutrient management, Strengthening of fertilizer quality control laboratories, Continuation/strengthening of Central Fertilizer, and Quality Control & Training Institute, Faridabad and its regional laboratories	[7]
Plant Protection	Public	Projects include Integrated Pest Management, Campaign for Seed Treatment, Farmers Field Schools/ Biocontrol Efforts/Trainings, Central Insecticides Laboratory(Implementation of Insecticides Act 1968, RPTLs/ SPTLs/NPRR/NPIL (Implementation of Insecticides Act 1968, Techno-legal Cell (Quality Control of pesticides) Implementation of Insecticides Act 1968, Locust Warning Organization (LWO) Strengthening & Modernization of Pest Management Approach in the Country, Strengthening & Modernization of Plant Quarantine Facilities in India, and Monitoring of Pesticide Residues at National Level	[8]
Rainfed Farming System	Public	Projects include National Watershed Development Project for Rainfed Areas (NWDPRA), Rainfed Area Development Programme (RADP), Accelerated Fodder Development Programme (AFDP), Watershed Development Fund (WDF), Statistical data on Rainfed Area, National Mission for Sustainable Agriculture (NMSA), and Agriculture Contingency Plan	[9]
Seeds	Public	Component details of the Central Sector Scheme 'Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds'	[10]
Mission Mode Project (NeGP)	Public	Provides Information on crops, farm machinery, training, and good agricultural practices	[11]
National Animal Disease Reporting System (NADRS) - Online Portal	Public	The system (1) identifies which diseases exist in the country; (2) determines the level and location of diseases; (3) determines the importance of different diseases; and (4) sets priorities for the use of resources for disease control activities	[12]
Sanitary Import Permit System for Livestock Products - Online Portal	Public	Trades in livestock and livestock products are regulated as per the Foreign Trade Policy–Export Import Policy (EXIM) of Government of India, implemented by Department of Commerce	[13]
Registration and Licensing of Fishing Craft (ReALCraft) Online Portal	Public	ReALCraft is a workflow-based online application system for vessel registration under MS Act and License Certificate under MFR Act for the fishing vessels operating along the Indian coast. It is a national project sanctioned by the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India, for implementing in all coastal states and union territories	[14]
Animal Quarantine & Certification Services (AQCS)	Public	The purpose and scope of setting up of quarantine stations is to prevent the ingress of dangerous exotic diseases into the country through imported livestock and livestock products. The increased and faster international trade and travel have exposed every country to the danger of infiltration of known and unknown transmissible diseases, which have the potential of very serious and rapid spread, with adverse socioeconomic and human/ animal health consequences	[15]

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Initiative	Initiative type	Summary	Source
Food Safety and Standards Authority of India	Public	Various food quality standards have been enforced. These include India Food Sharing Alliance, Import Clearanc, Jaivik Bharat, Serve Safe, InfoINet, Food Smart, Safe & Nutritious Food, SNF @Workplace, Eat Right India, Swasth Bharat Yatra, and Eat Right Mela	[16]
Indian Commodity Exchange Limited	Private	This exchange facilitates online trading of energy, precious metals, base metals, and agricultural products	[17]
Multi Commodity Exchange	Private	The exchange facilitates online trading of precious metals, base metals, energy, and agricultural commodities	[18]
National Commodity and Derivatives Exchange	Private	This is a leading agricultural commodity exchange in India	[19]
National Multi-Commodity Exchange of India Ltd	Private	Precious Metals, Base Metals, Agricultural	[20]
Bhatinda Om & Oil Exchange Ltd.	Private	Agricultural products	[21]
Villgro Innovations Foundation (agriculture incubator)	Private	Focus sectors are agriculture, education, and energy and cleantech	[22]
Periyar Technology Business Incubator (agriculture incubator)	Private	Focus areas are (1) agro, bio, and food technologies; (2) manufacturing; and (3) herbal products	[23]
VIT Technology Business Incubator (agriculture incubator)	Private	The areas covered are (1) biotechnology-based industries; (2) environmentally friendly solutions and products for leather industries; (3) automotive/mechanical engineering sector-related products and services; and (4) information technology products and solutions	[24]
eAgriculture: Using Technology to Empower Farming Communities	Private	A successful eAgriculture project in the state of Odisha, India, demonstrates how technology can be used to address agricultural issues and improve the livelihoods of small farmers. In just over one year, the eAgriculture project has helped 6,000 farmers increase their incomes by as much as 300%, while creating job opportunities for local entrepreneurs	[25]
Assistance to the Farmer	Private	Assistance has been provided to farmers in soil and water conservation, water management, construction, renovation, and maintenance of water harvesting structures for improving surface and ground water availability. This activity has led to not only better agricultural produce but also to an increase in water availability for domestic use and rise in the ground water level	[26]
Soil and Water Testing	Private	Bank of Maharashtra has established Soil Testing Lab (STL) through MARDEF Trust at RDC Bhigwan. Mahabank Agricultural Research and Rural Development Foundation (MARDEF) is a trust established by Bank of Maharashtra and undertakes various projects and village improvement programs. MARDEF imparted training to farmers on various subjects in agriculture. The trust has implemented 94 training programs for farmers at RDC Bhigwan and Hadapsar	[26]
Krishi Mitra	Private	Multinational company Mahindra & Mahindra Ltd. helped small and marginal farmers by training them in effective farming practices including soil health, crop planning, creating model farms with bio-dynamic farming practices, thereby increasing crop productivity, through the Wardha Family Farming Project, Krishi Mitra and Integrated Watershed Development Project	[26]

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Initiative	Initiative type	Summary	Source
Agricultural Skilling	Private	The program is aimed at increasing incomes of farming community around sites through productivity enhancement of agriculture and livestock. The project created a cadre of entrepreneurial farmers or local youth. At the end of 2015, the first batch of 21 Cairn AgroFellows graduated to start their own enterprises, including dairying, goat farming, mushroom farming, or to work as field extension workers	[26]
Farmer Centric Watershed Management	Private	This is to develop 'model sites of learning' in Mahabubnagar district of Telangana state and Anantapur district of Andhra Pradesh with an aim to sustainably increase agricultural productivity and improve the livelihoods of the rural poor in vulnerable rain-fed areas	[26]
Farmer support programme	Private	Adani Foundations CSR wing is engaged in the agricultural and animal husbandry sectors. The Foundation collaborated with the Krishi Vigyan Kendra and took 30 farmers from five villages of Mundra on an exposure tour to make them aware about agricultural technologies	[26]
Assistance to Apple Growing Farmers	Private	360 apple growing farmers have been provided rainwater harvesting tanks including various equipment like anti-hail nets, power sprayers, pruners, planting material of high apple yielding varieties, etc. as well as technical training that will help them in increasing their apple yields	[26]
Seed The Rise	Private	Mahindra & Mahindra launched 'Seed the Rise,' a digital crowd funding campaign aimed at supporting Indian farmers who are seeing terrible times due to bad weathers and difficult circumstances. Flying Cursor Interactive is the digital agency that has partnered in developing, launching, and managing this campaign	[26]
Wardha Farmer Family Project (WFFP)	Private	This project introduced a new method of agriculture for the farmer. WFFP also helps the farmer to solve the drought issue by implementing drip irrigation, which ensures an economic use of water, and use of biodynamic techniques which improve soil water retention capacity and ground water levels	[26]
Irrigation Support	Private	Installation of 100 solar water pumps of 5 HP capacities is to encourage the use of solar energy by farmers in villages	[26]
Farmers First	Public-private	Numaligarh provided assistance to farmers of nearby localities for traditional and alternate farming by way of providing fertilizers, seeds, tractorization support, etc.	[26]
Strengthening Institutional Capacities for Sustainable Mountain Development in the Indian Himalayan Region	Public-private	The key outcomes include (1) informed and evidence-based decision- and policymaking on mountain agriculture and allied sectors, including animal husbandry, fisheries, forestry, biodiversity, land degradation, and climate change; (2) enhanced provision of goods and services in/from mountain agriculture and allied sectors; and (3) improved livelihoods of mountain communities in the Indian Himalayan region through sustainable management of natural resources	[27]
Support to the implementation of Indian Ocean Tuna Commission (IOTC) Regional Observer Scheme	Public-private	Outcomes include (1) improved scientific information and management advice on the fisheries for tuna and tuna-like species operating in the IOTC area of competence; and (2) improved capacity (knowledge, understanding, tools, skills, systems, and good practices) of individual observers and national bodies to collect information as required by the IOTC	[27]
Implementing the Monitoring and Analyzing Food and Agricultural Policies (MAFAP) Programme in India	Public-private	MAFAP aims to establish and strengthen a country-owned, robust food-and-agriculture policy-monitoring-and-analysis mechanism. This will complement ongoing government efforts to improve the evidence basis for agricultural and food policies and enhance productivity, especially for the smallholder farms	[27]

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Initiative	Initiative type	Summary	Source
Sustainable Livelihoods Initiative in Odisha	Public-private	The project trained villagers on practicing bio-fertilizer cultivation to grow vegetables for self-consumption initially. After the training, many households were provided with vegetable seeds such as tomato, ladyfinger and bitter gourd. Village farmers also started cultivating vegetables using organic manure	[28]
Strengthening Rural Financial Inclusion and Farmer Access to Markets in India	Public-private	The current level of commercial bank lending to agriculture in India remains inadequate, while limited access to finance for the rural population constrains their ability to undertake critical investments to improve yields and income. ADB's assistance will help improve access to finance for small farmers and low-income women and their families in rural India	[29]
Private Enterprises Spice Up India's Rural Incomes	Public-private	Smallholder spice farmers in India receive training, advice, and financial support through a private sector initiative aimed at making the production of chilies, cloves, turmeric, and other food condiments a sustainable, climate-proof, and profitable activity	[30]
Post-Tsunami Sustainable Livelihoods Programme for the Coastal Communities of Tamil Nadu	Public-private	The goal of the program is to enable thousands of tsunami victims living in the coastal areas of Tamil Nadu to return to a stable and productive way of life Targets include people who live in coastal areas, including fishers, wage workers in the fisheries sector, farmers, and agricultural laborers. There is a specific focus on marginalized groups such as women who are heads of households and members of scheduled castes	[31]
Integrated Livelihood Support Project	Public-private	This project will support poverty reduction in Uttarakhand, a predominantly rural hill state, by promoting sustainable livelihood opportunities for 143,400 rural households. Priority target groups include small rural producers, women, scheduled-caste households, and young people	[32]
Andhra Pradesh Drought Mitigation Project	Public-private	This targets smallholders in the Rayalseema region and Prakasam area of Andhra Pradesh, affected by vulnerability to drought and depletion of groundwater resources in a context of climate change and climate variability	[33]
Jharkhand Tribal Empowerment and Livelihoods Project	Public-private	The overall project goal is to improve the living conditions of tribal communities, especially primitive tribal groups (PTGs), across Jharkhand. Specifically, the project aims to empower and enable 136,000 tribal households, including 10,000 PTG households, to take up livelihood options based on sustainable and equitable use of natural resources. Toward that end, project activities involve community empowerment, integrated natural resource management, and livelihoods support	[34]
Livelihoods and Access to Markets Project	Public-private	This project covers the entire state of Meghalaya and is fully aligned and integrated with the state government's plans for river basin development. It directly supports the objectives of the Country Strategic Opportunities Programme in India, which includes increasing access to agricultural technologies, natural resources, financial services, and value chains	[35]
Odisha Particularly Vulnerable Tribal Groups Empowerment and Livelihoods Improvement Programme	Public-private	The overall goal of the program is to achieve better living conditions and reduce poverty for the most vulnerable in Odisha's heavily forested Eastern Ghats and Northern Plateau regions. Tribal populations living in the target area derive their livelihoods from shifting cultivation, rainfed agriculture and from gathering non-timber forest products (NTFPs). Farming practices are basic, and mostly include growing rainfed rice and millet. Many tribal people are landless	[36]

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Initiative	Initiative type	Summary	Source
Fostering Climate Resilient Upland Farming Systems in the North East (Mizoram and Nagaland States)	Public-private	As 60% of the area under foodgrain cultivation in these regions is covered by the 'jhum system' (shifting cultivation system), there is a great need for development in farming technologies and practices	[37]
National Agricultural Higher Education Project	Public-private	The objective of the National Agricultural Higher Education Project for India is to support participating agricultural universities and ICAR in providing more relevant and higher-quality education to agricultural university students. There are three components to the project, the first component being support for agricultural universities	[38]
Assam Agribusiness and Rural Transformation Project	Public-private	The objective of the Assam Agribusiness and Rural Transformation Project for India is to "add value and improve resilience of selected agriculture value chains, focusing on smallholder farmers and agroentrepreneurs in targeted districts of Assam"	[39]
Tamil Nadu Irrigated Agriculture Modernization Project	Public-private	The objective of the Tamil Nadu Irrigated Agriculture Modernization Project for India is to enhance productivity and climate resilience of irrigated agriculture, improve water management, and increase market opportunities for farmers and agroentrepreneurs in selected sub-basin areas of Tamil Nadu	[40]
Maharashtra Project on Climate Resilient Agriculture	Public-private	The development objective of Maharashtra Project on Climate Resilient Agriculture Project for India is to enhance climate-resilience and profitability of smallholder farming systems in selected districts of Maharashtra. This project has four components	[41]
AP Integrated Irrigation & Agriculture Transformation Project	Public-private	The development objective of Andhra Pradesh Integrated Irrigation and Agriculture Transformation Project for India is to enhance agricultural productivity, profitability, and climate resilience of smallholder farmers in selected districts of Andhra Pradesh	[42]

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APPENDIX A

INDONESIA

Initiative	Initiative type	Summary	Source
Secretariat General Administration Services	Public	Programs include new plants variety registration, pesticide registration, agriculture MoU service, law enforcement service, and Indoagropedia (Indonesian farming term)	[1]
Department of Food Crops	Public	Programs include provision of seeds of natural pesticide plants, provision of experimental insects, quality test of fertilizers, quality test of seeds, and sample identification services	[2]
Department of Human Resources Development	Public	Programs include farming training programs, selling of farm animals' waste, agribusiness consulting services, examination of farm animals, and quality testing of milk	[3]
Department of Quarantine	Public	Programs include online quarantine examination, certification of exports of animal products, certification of imports of animal products, and examination of plant quarantine services	[4]
Department of Food Resilience	Public	Programs include Indonesia Farming Store, panels showing food prices, and registration of plant-based foods	[5]
Department of Research and Development	Public	Programs include examination of nutrients contents in water and soil, examination of biochemicals, examination of nutrition in animal foods, quality test of rice, and examination of pest and diseases	[6]
Department of Plantation	Public	Programs include services for plantation permits, services for seed permits, certification of seed quality, and certification of fertilizers	[7]
Indoagropedia	Public	This application publishes information on farming terms in Indonesia, coupled with pictures and related illustration about farming techniques and policies	[8]
Bogor Agricultural University Agribusiness and Agroindustry Incubator	Public-private	The incubator for agribusiness and agroindustry at Bogor Agricultural University, Indonesia (IAA-IPB) assists during three stages in the incubation process: early incubation (mentoring creative ideas, assisting in evaluation of market prospects, defining, and outsourcing technology needs); incubation (helping production begin); and post-graduation (consulting on business plan revision and facilitating access to financial resources and a market network for new products and new-technology implementations)	[9]
Various techno parks around Indonesia	Public	There were 60 out of the planned 100 such parks in 2017. However, most of them were very localized and small, and not much agriculture-focused	[10]
Indonesian National Standard (SNI)	Public	Indonesian National Standard (SNI) is the only agriculture and food standard that is applied nationally in Indonesia. SNI formulated by the Technical Committee (formerly known as the Technical Committee) and assigned by BSN	[11]
Indonesia Commodity and Derivatives Exchange	Private	The exchange facilitates online trading of agricultural products, base metals, and financial products	[12]
Jakarta Futures Exchange	Private	The exchange facilitates trading of cocoa, arabica and Robusta coffee, precious metals, olein, CPO, coal, tea, and rubber	[13]
Incubator 1: Indigo Incubator	Private	The incubator runs a program called Indigo Nation under Startup Digital Indonesia, under which it offers to the incubated startups mentoring, market access, API support, access to global accelerators and incubators, and coworking spaces in Indonesia, across 15 cities	[14]

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Initiative	Initiative type	Summary	Source
Incubator 2: Jakarta Founder Institute	Private	The Founder Institute is a startup launch program for entrepreneurs. Based in Silicon Valley and with chapters across 60 countries, the Founder Institute's mission is to "Globalize Silicon Valley" and build sustainable startup ecosystems worldwide	[15]
Incubator 3: FasterCapital	Private	FasterCapital is an accelerator based in Dubai and has partnered with local startup ecosystems in Indonesia including Eri Taruna and Itho Suryoputro	[16]
Advancing Sustainable Business and Ancestral Land Recognition (ASBALR)	Public-private	Access to and control over land and natural resources is causing conflicts between private companies and indigenous communities in Riau Province, Indonesia. ASBALR Pact empowers indigenous and forest dependent communities in Riau by increasing their capacity to protect their communal and cultural rights through peaceful dialogue and negotiations between communities, public authorities, and the private sector	[17]
Making Jakarta (& Manila) Sustainable Inclusive Cities	Private	Urbanization is a complex, irreversible and worldwide phenomenon that has global dimensions and long-term consequences for everyone. The project aims to contribute to the development of inclusive and sustainable cities by bringing together a wide range of partners to help solve major urbanization challenges, particularly those faced by urban poor communities. Pilot interventions will be developed for Jakarta and Manila	[18]
SpiceUp Indonesia	Public-private	SpiceUp will implement a financially sustainable information service that supports 100,000 pepper farmers in Indonesia to increase their production, income, food security, and optimize their inputs of water, fertilizers, and pesticides	[19]
Geodata for Agriculture and Water: SMARTSeeds Indonesia	Private	SMARTseeds is a consortium of public and private partners who will implement a financially sustainable information service that supports 100,000 vegetable (e.g., chili, tomato, and cucumber) farmers to increase their production, income, and food security and to reduce the inputs of water, fertilizer, and pesticides. Weather, advisory, and market information services will be provided to smallholder farmers via SMS services	[20]
Production and Marketing of High Premium Rice in Central Java	Public-private	The demand for rice in Indonesia is growing every year, whereas production is slowly decreasing. Farmers in Central Java are able to increase their supply, but they produce low-quality rice and face many production challenges. In this project, members train and coach 10,000 farmers in using certified seeds, organic fertilizers, and pesticides so as to improve the production and marketing of high premium rice	[21]
Support to The Establishment Of Indonesia REDD+	Public-private	This project is designed to support the task force in the preparatory work for strengthening the reducing emissions from deforestation and forest degradation (REDD+) readiness and its infrastructure	[22]
Rural Empowerment and Agriculture Development Scaling-up Initiative	Private	It aims to deliver sustainable improvements in the livelihoods of the rural poor by further increasing smallholder household assets and incomes, reducing chronic malnutrition in children, improving access to markets and services, and decreasing food insecurity. The project will directly benefit at least 342,000 small farmers, 50% of whom will be women	[23]
Integrated Participatory Development and Management of the Irrigation Sector Project	Private	The overall goal of the Integrated Participatory Development and Management of Irrigation Sector Project is to improve food security, incomes, and livelihoods for 900,00 poor rural smallholder households in Indonesia. The project's development objective is to increase the value and sustainability of irrigated agriculture	[24]
FAO Projects in Marine Affairs & Fisheries	Public	The goal is supporting local feed self-sufficiency for inland aquaculture in Indonesia	[25]

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Initiative	Initiative type	Summary	Source
FAO Projects in Marine Affairs & Fisheries	Public	These are for enabling transboundary cooperation for sustainable management of the Indonesian Seas (FSP)	[25]
FAO Projects in Marine Affairs & Fisheries	Public	These are for mainstreaming biodiversity conservation and sustainable use into inland fisheries practices in 'Freshwater Ecosystems of High Conservation Value' (FSP)	[25]
FAO Projects in Marine Affairs & Fisheries	Public	These provide support for capacity building for international food safety standard development and implementation in ASEAN countries	[25]
FAO Projects in Food Security and Nutrition	Public	The projects are for strengthening inter-institutional coordination mechanisms to enhance food systems	[25]
Program to Accelerate Agrarian Reform (One Map Project)	Public-private	The project aims to establish clarity on actual land rights and land use at the village level in the targeted areas. The objective of this component is to produce village-level parcel boundary maps in the targeted areas, record all land right claims, and facilitate land rights regularization and registration in the Electronic Land Administration System (eLand), thus covering all legal rights including communal rights and joint and individual ownership registrations for women	[26]
Training and Certification for IBI Biochar	Private	The Biochar Association of Indonesia (ABI) is a non-profit association that focuses on activities such as the application of biochar in improving food security and stability and biochar as a soil amendment	[27]
Fertilizer Producer Online Database	Private	This serves to organize all fertilizer industries in Indonesia into one organization, based on healthy industrial principal cooperation, especially for the benefit of all members and for strengthening the national development in general, with the aim of a good and disciplined national economic life as written in Article 33 of UUD 1945	[28]
20-20-20 vision	Public-private	PISAgro aims to promote the value of public-private partnership as a cost-effective way of delivering multiple benefits for the wider society by manifesting 20-20-20 visions, i.e., to support a 20% increase in Indonesia's agricultural output to be done in a manner that would contribute to 20% reduction in carbon emissions and improve smallholder farmers' income by 20%, through various programs in agrifinance, beef cattle, cocoa, coffee, corn, dairy, horticulture, palm oil, potato, rubber, soybean, and vocational training	[29]
Training for Sustainable Agriculture in Indonesia	Public-private	This project empowers local communities to secure land tenure rights, protect biodiversity, and improve incomes through sustainable agriculture and formation of forest-protection committees	[30]
Australia-Indonesia Center Project: Assessing food security and resilience of small island communities	Public-private	The primary goal of this project is to assess food security and resilience of the small island fishing communities in Indonesia in view of socio-environmental changes, particularly the declining stock of fish due to the increasing number of fishermen in the area. The project will be based on a case-study work in the Kei islands in Southeast Maluku	[31]
Australia-Indonesia Center Project: Soil information to support sustainable agriculture and food security in Indonesia	Public-private	The primary goal is to investigate how a soil information system can be linked to socioeconomic data and be used to support sustainable expansion of agriculture and its management in Indonesia. This need to expand new areas of land is driven by Indonesia's imperative to maintain food security and adapt to climate change	[32]
Australia-Indonesia Center Project: Food processing and value chain development in Indonesia	Public-private	This project will review recent developments in the food processing and ingredients sectors in Indonesia, its integration with global and regional production networks, and capital flows. It will identify constraints and opportunities for enhanced value-chain integration with Indonesian farmers and investment opportunities for Australian and Indonesian firms	[33]

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Initiative	Initiative type	Summary	Source
Australia-Indonesia Center Project: Sustainability and profitability of cocoa-based farming systems in Indonesia	Public-private	This project aims to identify the main constraints to productivity and sustainability of cocoa production in Indonesia, and to make recommendations that will address these issues	[34]
Telapak Sustainable Businesses Projects	Public-private	Telapak is a local NGO in Indonesia since 1997. Its mission is to end ecosystem destruction through community-driven natural resource management. It has established different cooperatives around Indonesia pertaining to areas such as forestry, herbs and spices, and beans	[35]
Kalimajari	Public-private	Founded in 2002, Kalimajari is a non-profit organization that aims to enable local stakeholders to utilize natural resources sustainably. Kalimajari not only gives training but also deploys trained personnel at various cooperatives and other local business associations. Kalimajari has partnered with seaweed cooperatives around Indonesia since its inception Additionally, Kalimajari has partnered with a cacao cooperative in Bali since 2011	[36]
Network of Farmers across Indonesia	Private	The organization does a lot of networking and training programs for its farmer members	[37]
FIELD Indonesia	Public-private	Since its establishment in 2001, FIELD Indonesia has undertaken various community developments through education and training in the areas of climate change; biodiversity development; agroforestry development; system of rice intensification (SRI); water supply and watershed management; development of economic community through Credit Union; participatory action research, advocacy, and organizing people; disaster risk reduction and climate change; strategic planning, people media development, and development of genetic resources by farmers; and local food systems and community livelihoods development	[38]

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APPENDIX A

IR IRAN

Initiative	Initiative type	Summary	Source
Production in Greenhouse Plan	Public	The plan's main goal to increase production in greenhouse-controlled environments include (1) increased production with the goal of increasing the food security and health, (2) decreasing water consumption, and (3) increasing the export of agricultural products in order to positively increase agricultural trade balance The major policies are (1) providing cheap equipment for greenhouses development; (2) modification and remodeling of deteriorated production units; (3) improvement and increase in product yield per unit area of the greenhouse; (4) use of seedling instead of direct seeding; (5) making new markets and coordinating for entering into foreign markets; (6) using high-quality commercial grades; (7) strengthening and completing the value chain of products; and (8) reviewing and setting up and maintaining the marketplaces, branding in target markets, and encouraging exporters	[1]
Protective Agricultural Technology	Public	Principles of protective agricultural technology are (1) minimum soil irrigation and reduction of soil tillage operations; (2) maintaining sufficient amounts of plant residues and soil cover; (3) increasing water efficiency to improve physical, chemical, and biological properties of the soil with a stable production for a long period of time; (4) use of crop rotation and variable crop rotation to reduce the damage caused by weeds, pests, and diseases; and (5) economic benefits, i.e., along with reducing costs related to production in a short span of time, there is an increase in production in medium and long terms, which can give benefits to farmers	[2]
Transplantation	Public	At the end of the sixth plan/program, all plants and vegetables that can be cultivated through transplantation, will be planted using transplants. Goals for 2021 include (1) sugar beet seeding cultivation program for 35,000 ha; (2) corn seeding cultivation program for 45,000 ha; (3) rapeseed seeding cultivation program for 10,062 ha; and (4) cotton seeding cultivation program for 40,000 ha Other activities include holding educational workshops, creating patterned and exemplary farms, and assistance in providing suitable seedlings	[3]
Fish Breeding Development in Cages	Public	The necessary plans for the development of fish breeding in cages with the scope of producing 200,000 tons by the end of the sixth program, and 400,000 tons by the year 2025. The actions taken include (1) accomplishment of supplementary studies to locate and identify suitable areas for development of fish farming in cages by collecting all marine data and map overlaps using GIS method in the Caspian Sea, the Persian Gulf, and the Oman Sea; (2) study and construction of coastal docks supporting fish shrimp at sea, using existing ports and breakwaters which were built on the southern coast of the country; (3) localization and transfer of technical knowledge for the propagation and production of marine fish and supporting the private sector to set up marine duplication centers; (4) localization and transfer of knowhow of construction and installation of cages and providing equipment needed for fish breeding in cages; (5) increase in technical knowledge and training of experts and fish farmers; (6) carrying out of the necessary coordination and concluding MOUs with related organizations with the aim of making stable development; (7) providing low-interest bank facilities (fixed capital and turnover) to make enable purchase of cages and accessories and coastal construction for fish breeding, as part of the defaults by the operating bank; (8) establishment of insurance coverage for products, structures, and personnel; (9) supporting the establishment of new production facilities for the production of feed and special supply of marine fish; (10) international cooperation with Norway, Italy, PR China, France, and Turkey; and (11) carrying out market studies for IR Iran and overseas	[4]

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Initiative	Initiative type	Summary	Source
Iran Mercantile Exchange	Private	Iran Mercantile Exchange was established on 20 September 2007 in accordance with article 95 of the new law of the Securities Market of IR Iran and following the merger of the agricultural and metal exchanges of Tehran. The merger marked a new chapter in IR Iran's capital market, providing endless trading opportunities for the clients in and out of the country. The exchange covers industrial and mineral products, oil by-products, and petrochemicals, and agricultural products	[5]
Capacity Building for Food Loss Reduction in the Near East	Private	The goal is to strengthen regional capacities, enhance regional information exchange, and build the framework for the adaptation of pathways for increasing water productivity in selected farming systems of the beneficiary countries	[6]
Support to the Regional Collaboration Platform of Water Scarcity Initiative to increase water productivity	Public-private	The goal is to strengthen regional capacities, enhance regional information exchange, and build the framework for the adaptation of pathways for increasing water productivity in selected farming systems of the beneficiary countries	[6]
Integrated Programme for Sustainable Water Resources Management in the Urmia Lake Basin	Public-private	The project supports (1) halting and inverting the lake's drying-up process by targeting 40% reduction of water consumption within the Urmia Lake basin after four years from the starting of the project; (2) empowering the national stakeholders with powerful tools and advance methodologies to monitor water consumption, agricultural water productivity, and drought, while enhancing its capacity to disseminate good agricultural practices in agricultural water management while taking into account ecosystems and the equitable use of water resources; and (3) providing sustainable alternative income-generating solutions to be implemented	[6]
Assistance to Strengthening the Resilience of Zagros Forests to Oak Decline and Caspian Forests to Boxwood Blight and Development of National Forest Monitoring System in the Islamic Republic of Iran	Private	This project is designed particularly to (1) provide technical support for the development of a comprehensive national program of work for the control of boxwood dieback in the Caspian region; (2) provide technical support for FRWO to build an effective national forest monitoring system for undertaking more accurate assessment and better monitoring functions to track the spread of dieback across the boxwood forests; and (3) establish a domestic quarantine program to prevent the spread of disease into the remaining healthy boxwood forest patches (this will be the basis for the development of a national early detection program for invasive species and control and/or eradication capabilities in the event of a pest incursion); and others (accessible through the corresponding hyperlink given in the next column)	[6]
Rehabilitation of Forest Landscapes and Degraded Land with Particular Attention to Saline Soils and Areas Prone to Wind Erosion Project (RFLDL)	Public-private	This project, ongoing since mid-August 2011 in two pilot sites of Rigan and Sarayan, has been designed for restoration and enhancement of goods and services delivered by the ecosystems for improving the capacity of degraded lands and forest landscapes in arid and semi-arid areas, leading to generation of sustainable livelihoods, further food security, and biodiversity as well as desertification control	[6]
Genetic Improvement of Rainbow Trout in the Islamic Republic of Iran	Private	Goals include (1) improved food security and livelihoods for people in IR Iran, especially those involved with producing, distributing, and consuming farmed fish; and (2) increased availability of farmed Rainbow Trout in the country	[6]
Improve Agriculture Monitoring Systems through Satellite Imagery for Iran	Private	The project aims to assist IR Iran in the establishment of an improved and operational agriculture monitoring system based on sustainable methods, tools, and technologies that improve the quality of agriculture information and reporting based on the integral used in geospatial technology	[6]

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Initiative	Initiative type	Summary	Source
Building Capacity Toward Sustainable Intensification of Oilseed Crops in Iran addressing the Soybean Value Chain	Private	The program is effectively integrated with the research for development programs along five crop value chains. Soybean improvement will be emphasized as a component of cereal-based production through capacity building, along with enhanced coordination among stakeholders. Emphasis is also on development of an investment-grade program to enable scaling of farmer adoption and to address needs for enhancing other oilseed crops	[6]
There are a total of 42 Science and Technology Parks (STP) and 186 Incubators in Iran; further information can be found on the English websites of the Iranian STPs below.			
Isfahan Science and Technology Town (ISTT)	Private	Isfahan Science and Technology Town (ISTT), as a pioneering organization, is a combination of many science parks and incubators located on 520 ha of land, next to the Isfahan University of Technology (IUT) in the North of Isfahan, IR Iran. The town started its official operations in 2000, and includes science parks, pre-incubators, and incubators	[7]
Pardis Technology Park	Private	Pardis Technology Park (PTP) as the region's paradise of technology, under the auspices of Vice-Presidency for science and technology and a Board of Trustees comprising corporate and real bodies from ministries, science centers, and academies, is headed by the First Vice President. It pursues the goals of commercialization of research results, and establishing sustainable ties between the university and the industry	[8]
East Azarbaijan Science & Technology Park (EASTP)	Private	EASTP promotes the economic development and competitiveness of the region and cities by (1) creating new business opportunities and adding value to mature companies; (2) fostering entrepreneurship and incubating new innovative companies; (3) generating knowledge-based jobs; (4) building attractive spaces for the emerging knowledge workers; and (5) enhancing the synergy between universities and companies	[9]
Fars Science and Technology Park (FSTP)	Private	FSTP, authorized by the Ministry of Science, Research and Technology, officially started its operations in 2002 to create appropriate infrastructures for technology development. FSTP encompasses three incubator centers and a multi-tenant building for entrepreneur companies (graduated companies from incubators). It is located on 20 ha of land, north-west of Shiraz city, along with eight affiliated centers in different cities of Fars province	[10]
Food Safety Symbol	Public	The Ministry of Health & Medical Education has established a special symbol for food quality and safety. The symbol consists of a green apple (resembling health) and the words safety and health which are written next to the apple figure. In 2012, 22 companies and 31 products were stamped	[11]

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APPENDIX A

JAPAN

Initiative	Initiative type	Summary	Source
Japan GAP	Private	The Japan GAP Foundation develops and manages ASIAGAP and JGAP standards. ASIAGAP is the only international standard developed in Japan. Established as an NPO corporation in November of 2006, JGAP's third-party certification system began the following year. Target categories included fruits and vegetables, tea, grains and pulses, and livestock and livestock products. The Japan GAP Foundation offers the guarantee of safe and secure agricultural products to consumers through voluntary GAP standards for producers that are easily accessible to all farms, including smaller ones, around the world	[1] [2]
Quarantine Station System	Public	There are 32 quarantine stations located at international seaports and airports. At the quarantine stations, food inspectors conduct document examination; inspect and monitor imported foods and related products; and guide importers on practical procedures of food import	[3]
Regional Bureaus of Health and Welfare (Hokkaido, Tohoku, Kanto-Shinetsu, Tokai-Hokuriku, Kinki, Chugoku-Shikoku, and Kyushu)	Public	Regional Bureaus of Health and Welfare are located in seven regions across the country. These are Hokkaido, Tohoku, Kanto-Shinetsu, Tokai-Hokuriku, Kinki, Chugoku-Shikoku, and Kyushu. They register and inspect facilities introducing Hazard Analysis and Critical Control Point (HACCP) in cooperation with local governments and provide technical advice for hygienic practices based on the HACCP approach. Also, they register private laboratories for operating the food inspection business in compliance with Good Laboratory Practice (GLP) under the Food Sanitation Act	[3]
Ministry of Health, Labor, and Welfare guides for Hazard Analysis and Critical Control Point (HACCP)	Public-private	HACCP is a hygiene control system that controls hazards such as contamination of pathogenic microorganisms, foreign objects, etc. throughout the process, from receiving raw materials to shipping a final product based on scientific evidence. As a general rule, all food business operators are requested to implement hygiene control based on HACCP principles, in addition to any prerequisite program. Considering the burden for small businesses, the Ministry of Health, Labour and Welfare promotes making guides for HACCP implementation	[3]
Japan External Trade Organization (JETRO)	Private	This program was designed to certify overseas restaurants, bars, and retailers, which carry Japanese food and beverages as official 'Japanese Food Supporters' in order to further promote Japanese agricultural, forestry, fishery, and food products around the world. Its missions are (1) branding, to promote the appeal of selling and using quality, safe, and trusted Japanese food and ingredients; and (2) information, to attain quality foods by communicating and sharing information with Japanese food distribution networks	[4]
Ministry of Agriculture, Forestry and Fisheries (MAFF) Electric Application System for Plant Variety Protection (EASPVP)	Public	The objective of this initiative is to protect plant breeders' rights as an intellectual property right by introducing the MAFF EASPVP with a user-friendly application tool and by improving convenience and efficiency for applicants. MAFF notes that the current registration number for plant variety is the fifth-largest in the world and that this system is expected to promote and document the creation of new plant breeds. However, data on its efficiency is not yet available, as MAFF EAS was launched on 26 March 2018	[5]

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Initiative	Initiative type	Summary	Source
Food and Agricultural Materials Inspection Center	Public	The mission of FAMIC is to assure food safety and consumer confidence through inspection and analyses of agricultural materials and food, or specifically ensuring the safety of fertilizers, soil improvement materials, agricultural chemicals, animal feeds, and feed additives and ensuring the quality and proper labeling of agricultural, forestry, and fishery products	[6]
National Agriculture and Food Research Organization (NARO)	Public	NARO is the core institute in Japan for conducting research and development on agriculture and food. Its overall mission is to contribute to the development of society through innovations in agriculture and food. It conducts technological developments to make agriculture a competitive and attractive industry, and contributes to increasing the nation's food self-sufficiency rate; to increase the productivity and safety of agriculture and lessen production costs; and to promote new markets and future industries by developing value-added agricultural products through incorporating market needs into respective products. NARO aims at the speedy implementation of its achievements by promoting public relations and promulgation efforts through industry-academia-government cooperation. Its missions are (1) establishment of regional farming models; (2) advancement in crop breeding using genomic selection; (3) incorporating market needs into research; (4) global issues and the utilization of local agricultural resources; and (5) becoming a creative research organization	[7]
National Livestock Breeding Center (NLBC)	Public	NLBC has, through a close cooperation between the head office and 11 stations, played a role as an agency to contribute toward (1) higher rural living standards in Japan; (2) improving the animal breeding process; (3) producing and supplying seeds of forage crop; (4) developing new technologies, bringing them into practical use, and spreading them nationwide through training; and (5) managing a cattle identification information service	[8]
Agriculture and Livestock Industries Corporation (ALIC)	Public	ALIC collects and analyzes information that helps promote stable producer operations and enhanced understanding of the supply-and-demand situation of agricultural and livestock products. It disseminates this information to producers, related industries, administrative organizations, universities, and research institutes. The objective is to provide stability measures for producers, e.g., market adjustment and price stabilization measures, emergency measures, and information collection and dissemination with the ultimate goal of food supply stability for consumers	[9]
Farmer's Pension Fund	Public	The Farmer's Pension Fund is an incorporated administrative agency and manages all the assets including the contributions paid by farmers	[10]
Japan International Research Center for Agricultural Sciences (JIRCA)	Public	JIRCA's main objectives are to (1) undertake comprehensive experimental research for technological advancement of agriculture, forestry, fisheries, and related industries in tropical and subtropical zones of developing regions; and (2) collect, analyze, and publish information of domestic and international research that are relevant to agriculture, forestry, and fisheries as well as farming systems in these developing areas. Through these objectives, JIRCAS seeks to contribute with solutions to global food and environmental problems as well as to the stable supply of agricultural, forestry, and fishery products and resources	[11]

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Initiative	Initiative type	Summary	Source
Keihanna Science City	Public-private	The Keihanna Science City (officially known as the Kansai Science City) is one of Japan's national projects, much like the Tsukuba Science City in the east of Japan. Twelve cultural and scientific research districts (around 3,600 ha) cover the 15,000 ha of land that forms the Keihanna Science City. Housing more than 140 research facilities, including universities and cultural facilities, the city has accomplished remarkable success in the fields of cultural and scientific research. Its objective is to serve as a platform for innovation. In agriculture specifically, it looks to increase production in rice cultivation, tea farming, and eggplant farming	[12]
Kyoto Research Park (KRP)	Private	KRP was born as the first privately operated research park in Japan. Since its opening in 1989, KRP has now grown to host over 480 tenant companies and institutions in the fields of ICT, biotech, electronics, machinery, and others. It aims to be the base for new business creation and for collaboration between industry, academia, and government in the Kyoto region. KRP offers two types of services to its tenants and to the region. The first, Spatial Services, is to provide safe, secure, and pleasant environment for the tenants and visitors at KRP. The second, Support Services, consist of new business creation activities and business support activities. KRP's aim is to become the innovation hub of the region. Through this process, KRP aims to contribute to regional development	[13]
Tsukuba Science City	Public	Tsukuba Science City was built in order to ease congestion of Tokyo and conduct high-level research and education by transferring national research and development, and educational institutions systematically. The city is now among the largest science technology accumulation site in the country, where more than 300 public and private institutions and enterprises are located	[14]
Niigata City Agripark	Public-private	The agripark provides food processing technology and commercialization instruction mainly to farmers and offers various programs to support efforts for the sixth industrialization, or the vertical integration of primary secondary, and tertiary industries to achieve added value	[15]
National Strategic Special Zone: Niigata City	Public-private	The purpose of the National Strategic Special Zone is to revitalize Japan's international competitiveness in agriculture by creating business-friendly conditions through various deregulations in six zones. Some examples include allowing corporations to enter farming business, accepting foreign workers, selling land, and taking other measures to increase collaboration between farmers and private companies. As part of its role as a special zone, Niigata City has 14 projects, mainly centered on agriculture, which include attempts to allow companies to control farmland to allow supermarkets, e.g., for offering advice to farmers on what to grow. Niigata also aims to revitalize farmlands. Although some cite rapid business growth and entry in Niigata as a sign of effectiveness, others point out that the effect of national strategic special zones is limited due to Japan's hesitance to truly deregulate	[16] [17] [18] [19]
National Strategic Special Zone: Yabu city	Public-private	The purpose of this National Strategic Special Zone is to revitalize Japan's international competitiveness in agriculture by creating business-friendly conditions through various deregulation in six zones. Some examples include allowing corporations to enter farming business, accepting foreign workers, selling land, and taking other measures to increase collaboration between farmers and private companies. After being designated as a National Strategic Special Zone, Yabu has revitalized its original local industry and is aiming to become a sustainable agricultural city. Yabu restores abandoned farmlands, implements revolutionary agriculture with high added value for agricultural produce and food products, and establishes an agricultural model that has an eye to exporting agricultural products and collaborating with private corporations that have working capital and management knowhow	[20]

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Initiative	Initiative type	Summary	Source
Japan Association of New Business Incubation Organization (JANBO)/JBIA	Private	JANBO was established as a control center for nationwide business incubation activities. Since its inception, more than 600 incubation managers were trained by its training institute and stationed at 200 business incubation facilities and programs. JANBO's activities came to an end when the Japanese regulation that supported the business incubation growth in the country expired in 2009. The Japan Business Incubation Association (JBIA), a private organization, was then established in 2008 by hundreds of incubation managers to replace JANBO since the activities that JANBO provided were indispensable for the fundamental infrastructure of the nation's economy. Recently, due to the drastic worldwide depression, JBIA, in addition to its existing tasks, has also developed new policies to facilitate the creation of self-employed businesses	[21]
Tech Planter	Private	Tech Planter is an initiative targeted at individuals or teams before the incorporation phase, to discover and nurture business seeds in the 'real tech' field. It provides support throughout the year without setting fixed periods. Globally, it conducts business plan contests in nine countries. Afterwards, it provides support for collaboration for R&D, investment opportunities, and partnership with large corporates	[22]
JA Group	Public-private	The purpose of this initiative is to improve agricultural operations in Japan through various business functions and to improve the living standard of farmers. JA Group provides its members with five essential services: insurance, guidance, credit, marketing and purchase, and welfare. JA Group is one of the most important political bodies in Japan and exerts great power over agricultural policies and prices. However, many blame its restrictive policies for the decline of Japan's agriculture in recent years	[23] [24]
Aso Farmland	Public-private	Aso Farmland is a health enjoyment theme park developed and operated by the Aso National Park Health Forest Group. It provides medical care, food, exercise, and shopping facilities to facilitate healthy and comfortable living for customers. Aso is also accredited as a health promotion facility by the Ministry of Health and conducts research on the effectiveness of its services. It operates vegetable cultivation plants and functional mushroom cultivation plants to grow vegetables without pesticides and to provide fresh food daily. Recent studies have used the Sustainable Livelihood Framework to claim that overall, the well-being of farmers and their community improved through rural tourism and agrotourism	[25] [26] [27]
Namegata Shirohato Farm	Private	Namegata Shirohato Farm is an agricultural theme park that uses the concept 'farm-to-table' to market fresh agricultural products and activities to customers looking for specialized local foods and experiences. The objective is to offer customers quality local foods and offer them unique experiences in the agricultural production process. Recent studies have used the Sustainable Livelihood Framework to claim that overall, the wellbeing of farmers and their community improved through rural tourism and agrotourism	[26] [27] [28]

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Initiative	Initiative type	Summary	Source
Kunisaki Peninsula Usa Integrated Forestry, Agriculture and Fisheries System, Japan, 2013	Public	Globally Important Agricultural Heritage Systems (GIAHS) in the Kunisaki Peninsula Usa area is a system where forestry and agricultural production are sustained by the connected system of Sawtooth Oak forests and multiple interlinked irrigation ponds Mushrooms have significant nutritional and medicinal values, and have the potential to make significant contributions to nutritional and livelihood security where arable land is limited. Mushroom cultivation decomposes biomass and supports nutrient cycling in the ecosystem. The objective of this initiative is to promote log wood cultivation of Shiitake mushrooms, which is a traditional system of agriculture in Japan and remains an important source of livelihood for many Japanese farmers. The traditional system depends on sustainable forestry to produce quality log wood Sawtooth Oaks ('Kunugi' in Japanese) provide a necessary source of nutrients to the growth of Shiitake mushrooms and produce the log wood cultivated Shiitake food product. They also stimulate the forest's metabolism and recharge the water resources, as well as help in maintaining the unique agriculture and forestry industries such as rice paddy agriculture and in conserving the various ecosystems Recent studies have used the Sustainable Livelihood Framework to claim that overall, the wellbeing of farmers and their community improved through rural tourism and agrotourism	[26] [27] [29]
Nishi-Awa Steep Slope Land Agriculture System, Japan, 2018	Public	The objective of this initiative is to preserve the system used in the Nishi-Awa area, one of Japan's leading areas for controlled burn agriculture, and the cultivation of grains, which was used as staple foods in the Nishi-Awa area since ancient times. Recent studies have used the Sustainable Livelihood Framework to claim that overall, the wellbeing of farmers and their community improved through rural tourism and agrotourism	[26] [27] [29]
Takachihogo-Shiibayama Mountainous Agriculture and Forestry System, Japan, 2015	Public	The objective of this initiative is to promote the preservation of the peaks of the Kyushu-Mountains, which are mentioned in ancient Japanese chronicles such as the Kojiki and Nihon Shoki, myths, and traditions cherished even today. In this tough, forest-enclosed environment where flat land is extremely sparse, people have established a distinctive and sustainable composite system of agriculture and forestry in the mountainous site The local people have established a composite management system of agriculture and forestry, which combines timber production with diverse farming that generates revenue each year. With the system, households earn their livelihoods by using forest through timber harvesting and reclamation in a sustainable manner, which makes this site a valuable model for the world. The local people, with a growing passion for maintaining forest resources and developing the site, have been devoting their energy to not only maintaining the traditional mountainous composite management system of agriculture and forestry but also to promoting interchange between cities and rural communities, providing experiential learning activities. This is based on a shared Forestopia vision of creating a spiritually rich lifestyle by effectively leveraging the abundant forest resources and the traditional life and culture arising from them	[30]

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Initiative	Initiative type	Summary	Source
Osaki Kôdo's Traditional Water Management System for Sustainable Paddy Agriculture, Japan, 2017	Public	The objective of this initiative is to preserve the paddy agriculture and water management system in Osaki Kôdo. The region frequently experiences drought; is prone to flooding due to the topographical features of a landscape that rolls down from precipitous mountain areas to low gradient plains; and suffers cold temperature damage caused by the yamase, a cold and moist seasonal wind that is unique to the Pacific coast of the Tohoku region In order to secure food and maintain their livelihoods under such challenging environmental conditions, farmers of this region have accumulated a wealth of knowledge and used their ingenuity to manage and coordinate water resources. Other activities are also taking place such as forestry and charcoal-making, silkworm breeding, horse breeding, and wooden crafts for daily use. Approximately 20% of the labor force, or 20,451 people, still engage in integrated agricultural practices centered on rice production today, while 7,185 commercial farm households rely on profits from agricultural produce sales	[31]
Traditional Wasabi Cultivation in Shizuoka,	Public	The objective of this initiative is to preserve traditional wasabi cultivation methods, which result in the production of large stems, little crop damage from disease, and little danger of nutrient depletion from repeated cultivation that is so often seen in agriculture. Furthermore, wasabi fields in steep mountainous areas currently possess a structure that is resilient to natural disasters because these fields have high water-holding capacity, and they also function to protect downstream areas from flooding disasters This region accounts for 40% of the nationwide wasabi production. Moreover, processed wasabi goods have not only been a source of additional income for farmers since ancient times, but have also led to the establishment of many industries affiliated with wasabi processing in the surrounding area, creating workplaces for local residents	[32]
Traditional Tea-grass Integrated System in Shizuoka	Public	The objective of this initiative is to promote 'Chagusaba,' a traditional tea cultivation technique, where grasslands are maintained around tea fields to supply mulch that improves the quality of tea cultivation. Chagusaba is a rare example of codependence between agricultural production and biodiversity, each of which enhances the other's value The area of semi-natural grasslands has been reduced with the modernization of agriculture, leading to a serious and rapid decline in the biodiversity of Chagusaba. The objective is therefore to use the certification of GIAHS to help build a framework in which farmers' efforts to produce quality tea can be appropriately rewarded by adding value to their work. This will facilitate conservation of Chagusaba and its biodiversity, as well as stabilize tea prices. Recent studies have used the Sustainable Livelihood Framework to claim that overall, the well-being of farmers and their community improved through rural tourism and agrotourism	[26] [27] [29]
Sado's Satoyama in Harmony with Japanese Crested Ibis	Public	The objectives of this initiative are to (1) strengthen local identity and pride as well as improve local livelihoods through adding values to products of GIAHS, and enhance biodiversity; (2) boost the branding of Ibis-Satoyama rice and other agriculture products from Sado through GIAHS recognition; (3) raise the branding of Ibis rice and other products and tourism of Sado in the face of depopulation, and revitalize the local economy; (4) build on-going efforts of ibis restoration to further expand the coverage of land where ibis friendly farming is practiced; (5) enhance biodiversity and ecosystem services on the whole island; and (6) aim to achieve the outcomes of GIAHS initiative with all relevant stake-holders by developing a Sado model, as a good practice, to promote living in harmony with nature including the Japanese crested Ibis Recent studies have used the Sustainable Livelihood Framework to claim that overall, the well-being of farmers and their community improved through rural tourism and agrotourism	[26] [27] [29]

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Initiative	Initiative type	Summary	Source
Satoyama Initiative	Public	Under the Satoyama Initiative, Japan is reaching across borders to communities around the globe to work together to enhance understanding and raise awareness of the importance of socioecological production landscapes for humankind's wellbeing and to support the cultural heritage and diversity of socioecological production landscapes globally. This initiative started with the recognition of Noto's Satoyama and Satoumi as members of the UN's GIAHS. Their specific objectives are (1) the reinforcement of sales and production by branding agricultural products through regional PR activities; (2) the enrichment of sightseeing resources: this aims to increase the number of people engaged in exchange activities by adding activities, including green-tourism and experiential learning, to ordinary tourism, which will lead to more publicity for the agricultural products of the region and acquisition of more customers; (3) the promotion of local revitalization; (4) the growth in number of people and companies engaged in the agricultural activities through increasing and assuring income-earning opportunities; (5) the conservation of biodiversity by continual sustainable development of the farming, forestry, and fishing industries; and (6) the acquisition of international recognition and improvement of skills through exchange with other GIAHS sites	[33] [34]
Employ various policy instruments and programs to protect agricultural producers	Public	The general objective of these policies is to protect the economic interests of the agricultural industry and its workers. Some measures to achieve this goal include border protection by means of tariffs and levies, regulation of rice and riceland, direct supports on farm product prices, subsidies on agricultural production inputs (especially land), high support prices to stimulate domestic production, and government responsibility for raising agricultural productivity Specifically, the last measure creates incentives to expand the production of the high-income-elasticity agricultural commodities and to enlarge the scale of the production unit. The WTO's evaluation remains unsure whether Japan's inclination towards protectionist policies lessens production incentives or increases agricultural efficiency	[35] [36] [37] [38]

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APPENDIX A

REPUBLIC OF KOREA

Initiative	Initiative type	Summary	Source
Daedook Innopolis	Public-private	Daedook Innopolis is a professional technology commercialization institution whose objective is to efficiently pursue the business of fostering according to the Special Act on the Promotion of Special Research and Development Zones. It creates the base to commercialize and transfer technology, and commercialize public research achievements; foster high-tech companies; foster professional science masters and provide management support services; construct a global network, create a favorable business environment for foreign companies, and improve the settlement conditions; support the management of Innopolis, its innovation cluster, and development businesses; and construct an industry-academe-research institute network	[1]
Build Basis for Farming Village Tourism, Attract Domestic and Foreign Visitors	Public	The main objective is to provide Farming Village vitalization support, increase leisure and cultural consumers, revitalize farming village tourism with high-growth potentials and creation of leisure and relaxing space in farming villages. To do this, reliable information related to farming village tourism is provided to urban citizens and farming village tourism businesses are encouraged to autonomously improve service quality	[2] [3]
Female farmer fostering policy	Public	The objective of this initiative is to implement healthy farmhouses and promote development in farming and farming society by protecting rights of female farmers, improving their quality of life, and supporting them to become skilled professionals	[4]
Direct Payment for Landscape Conservation	Public	Through cultivation of local specialty landscape crops and village landscape conservation activities, the objective is to create, maintain, and improve appearance of farming villages and promote regional economy in connection with local festivals, farming village tourism, and urban and rural interchange. Effective data implies increase in enforced areas, landscape crops, and farmhouses	[5]
Farming Village Resources Complex Industry Support	Public	Based on rich resources in farming villages, the objective is to promote complex industrialization of the first, second, and third industries and revitalize startups and businesses to diversify the region's economic activities and to increase income levels and employment opportunities	[6]
Center for Farmers' Safety & Health	Public	The objective is to improve the health and wellbeing of farmers	[7]
Foster social farming	Public	The objective is to secure sufficient social services in farming villages by fostering 'farming village community enterprises' and contribute to promoting farming villages by creating jobs	[8]
Nationally Important Agricultural Heritage System	Public	With the tangible and intangible agricultural resources accumulated over a long period of time, the objective is to designate those with values for conservation as Nationally Important Agricultural Heritage to generate rural values and promote quality of life for people	[9]
Measures to Improve Quality of Life of Farmers and Fishers	Public	The objective is to create happy and livable farming and fishing villages by vitalizing communities	[10]

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Initiative	Initiative type	Summary	Source
Rural Convergence Industry Vitalization Support	Public	The objective is to vitalize the local economy in farming villages by increasing income levels of farmers in the region and creating related jobs; foster rural convergence industrial enterprises by supporting during the growth phase; designate candidates for local specialty industries linked with production, processing, and tourism; and provide support for target groups in each district	[11]
Farmland Banking Project	Public	The objective of this initiative is to carry out various farmland-related policy projects aimed at scaling up agricultural businesses, promoting efficient use of farmlands, improving agricultural structures, stabilizing farmland markets, and stabilizing revenues of farmers to promote economic and social development of agricultural industry and farming villages	[12]
Farmer Safety and Disaster Insurance	Public	The purpose of this policy is to provide guarantees against damages in farming business due to disasters through insurance policies to promote business stability of farms and assist stable reproduction. There are three types of insurances: Farmer Safety Insurance, which compensates for physical damage of farmer during farming business and diseases related with farming; Farming Laborer Safety Insurance, which compensates for physical damage and diseases related to farming of day laborers employed by farmers (agricultural corporation) with five or less permanent workers; and Comprehensive Farming Machine Insurance, which compensates for disasters from accidents of farming machines during farming	[13]
Crop damage insurance	Public	The purpose of this policy is to compensate for crop damages due to natural disasters to promote business stability of farmers. The targets are individuals or corporations engaged in agricultural and forestry industries, and the project budget will support 50% insurance cost of farmers insured for damage. Since introduction, insurance of KRW1.6529 trillion has been paid to around 200,000 farms that were damaged in 17 years (2001–17) to contribute to stable business of damaged farms	[14]
Damage Measures Cost	Public	In case of a damage in the agricultural sector in crops, livestock, agricultural facilities, and repairing facilities from natural disaster, this project aims to provide farmers a part of the recovery cost to assist in business stabilization	[15]
Back-to-earth Promotion Project	Public	This project supports farming startups and housing of those who wish to return to farming from urban life to foster them into new farming manpower and promote agricultural, farming, and food industries	[16]
Agricultural goods fund of funds	Public-private	The objective is to expand a new policy financing in the form of a joint investment between private and public sectors to promote investment in the agricultural goods industry and create a solid growth basis for agricultural goods producers	[17]
Trust guarantee funds for agricultural and fisheries businesses	Public	The objective is to establish trust funds up to 85% for agricultural and fisheries operators and corporations, or 80% for others in order to expand capital investment and increase productivity	[18]
Direct payment for damage	Public	The purpose of this policy is to compensate the producer for the decrease in price of item that has fallen due to abrupt increase in import volume, following the enforcement of FTA. Ministry of Agriculture, Food and Rural Affairs (MAFRA) will compensate 95% of the difference between the base price and the average price of the year	[19]
Closure support	Public	The objective is to provide closure support fund on items deemed to cause difficulties in continuing with the cultivation and breeding of an item	[20]

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Initiative	Initiative type	Summary	Source
Youth Farmer Fostering Policy	Public	The objectives are to (1) link and support startup funds, technological and business education and consulting, and rental and sales of farmland purchased by the farmland bank for stock holding to encourage growth into a solid business entity; (2) provide agricultural settlement subsidy to young farmers whose early income levels are unstable; and (3) thus, build a virtuous cycle that promotes the advancement of young and talented manpower into the agricultural sector and improve the labor structure in the agricultural industry by reversing the aging trend of farm owners	[21]
Targeted Rice Price Policy	Public	This policy has been introduced as a safety net for farm businesses after the abolishment of the purchase policy in 2005 in preparation of a rapid fall in rice prices. When the local rice prices during the harvesting season fell below the targeted price, the fixed direct payment already paid from 85% of the difference between the targeted price and the local rice price was paid as a variable direct payment	[22]
Direct Payment System for Rice Income Compensation	Public	After abolishing the purchasing system in 2005, the food administration system was revised so that farmhouse income is compensated by a fixed direct payment and rapid fall in rice prices is compensated by a variable direct payment	[23]
Saemangeum Project	Public	This undertakes comprehensive development of reclaimed land for main purpose of agriculture	[24]
Mass Agricultural Development	Public	This regionalizes focuses on rivers to comprehensively repair and improve agricultural productivity through industrial water development, organization of land, improvement of drainage, and reclamation	[25]
Supports to Cultivate Different Crops in Rice Paddy	Public	The purpose is to encourage growing economic crops other than rice in to preemptively deal with excessive rice and to increase self-sufficiency rates of other food crops	[26]
Deulnyeok Business Fostering Project	Public-private	Deulnyeok Business jointly produces and manages field over 50 ha to increase competitiveness in food industry and income levels of farms through production of high-quality rice, reduction of production cost, and business diversification	[27]
Overseas Advancement of Agricultural Goods Industry	Public	The goal is to assist overseas advancement of agricultural goods companies in order to secure overseas supply channels for food resources for expansion of ROK's agricultural industry and in preparation for any emergency	[28]
Livestock Industry Permit & Livestock Breeding Industry Registration	Public	This is to ensure efficient preventive control and improve the livestock industry. Breeding farms of or above a certain scale will seek permit or register at the local government by fulfilling criteria such as facilities and devices and by completing training	[29]
Horse Industry Fostering Support	Public	This is to improve quality of life for people and vitalize the economy in agricultural and fishing villages by fostering the horse industry	[30]
Livestock Systematization Project	Public	This project supports production-bases facilities; processing, distribution, and sales facilities; breeding costs, etc. Its target is systematization for business owners of pigs, chickens, ducks, and goats	[31]
Breeding Facility Modernization Project	Public	This will increase productivity by improving livestock breeding facilities, and increase income level of livestock farms and their international competitiveness by decreasing livestock mortality	[32]

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Initiative	Initiative type	Summary	Source
Animal Improvement Support	Public	By repeatedly registering decent examining abilities, evaluating inheritance ability, selecting, and crossbreeding based on certain plans, the livestock such as Korean cattle, milking cows, pigs, and chickens improve into breeding animals with excellent hereditary traits, which offers people (livestock farms and consumers) to utilize the abilities of the developed entity	[33]
Smart Stable	Private	These are stables that automatically (or remotely) control livestock diseases, foul odors, feeding and selection by using ICT or fourth industrial revolution technologies	[34]
Livestock Traceability System	Public	From birth of livestock to production, importing and selling, information in each stage is recorded to manage the traceability of livestock and livestock goods so that prompt measures may be taken by retracing the paths in case of problems and providing traceability information in assurance of consumers	[35]
Revitalizing Local Ecological Livestock Project	Public-private	This is to reduce livestock goods production cost by independently supplying bulky feed from idle mountainous areas and establishing sustainable livestock basis by linking ecofriendly livestock goods production and animal welfare	[36]
Securing Bulky Feed Production Basis	Public	This initiative utilizes production and use of domestic bulky feed to increase competitiveness of livestock industry by reducing production cost, etc.	[37]
Creating Clean Breeding Environment	Public	This initiative supports stable development of livestock industry by creating a clean livestock environment. It also helps revitalize agriculture based on natural circulation by promoting recycling of livestock excretions and prevention of environmental pollution for improved water and soil quality	[38]
Direct Payment System for Eco-friendly & Safe Breeding	Public	The objective is to compensate farmers who practice ecofriendly livestock farming the difference between the decreased initial income and production cost to promote ecofriendly livestock farming, and build sustainable livestock by conserving the environment	[39]
Smart Farm Dispersion Method	Public-private	Based on the crop cultivation data and environmental data, this creates the optimum cultivation environment to improve productivity and quality of agricultural goods with less use of labor, energy, and fertilization than before. It also introduces remote management of farms to improve technology through new technology education in spare time, increase income levels, and improve quality of life by offering overseas trips	[40]
Demonstration of Low Carbon Agricultural & Livestock Goods Certification System	Public	The purpose is to motivate production and consumption of low-carbon agricultural and livestock goods and contribute to reducing greenhouse gas emissions	[41]
Promote Agricultural Goods Technology Based Start-ups	Public-private	The objective is to create and support startup boom by discovering potential startups with creative ideas in agricultural goods sector and fostering them into success cases through intensive support and incubation centers	[42]
Field-oriented R&D Reinforcement	Public	This aims to promote field-oriented R&D for agricultural goods to resolve agricultural management agendas and difficulties on site and develop innovative technologies for smart farming	[43]
Fostering Eco-friendly Farming	Public	This initiative is to promote and spread the introduction of an agricultural environment preservation program that supports comprehensive agricultural environment improvement activities in areas such as soil, industrial water, atmosphere, landscape, and ecosystem; ecofriendly certifications; and ecofriendly processing and distribution	[44]

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Initiative	Initiative type	Summary	Source
Increased Competitiveness in Seed Industry	Public-private	This project aims to improve seed industry and industrialize exports by first, focusing on building basic infrastructure; second, focusing on expanding exports and scaling up companies; third, scaling up the industry; and fourth, increasing supports to export	[45]
Fostering Farming Equipment Industry	Public	This serves to mechanize upland field crops and introduce modern farming machines in major producing districts, and improve fertilizer quality and the pesticide safety management policy	[46]
Direction of Distribution and Consumption Policy	Public	This is for creating a healthy distribution environment by improving distribution structure and stabilizing agricultural goods	[47]
Strengthen Safety and Environmental Management in Production Step of Agricultural and Livestock Goods	Public	The objective of this is to reinforce safety management of agricultural and livestock goods and promote both awareness and compliance	[48]
Increase Competitiveness of Horticulture Industry	Public	This is to foster the growth of specialized agricultural products and of products that are of interest to consumers	[49]
Korean Industry Promotion Act	Public	The objective is to promote the sound development of the food industry through reinforcement of the link between the food industry and the agriculture and fisheries industries, and providing a variety of quality food in a stable manner by enhancing the competitiveness of the food industry	[50]
Increase Supports to Food R&D	Public-private	The purpose is to reinforce ties between agriculture and food industries, improve exporting competitiveness of the food industry, and develop customized food in response to changes in food consumption trends to increase competitiveness of the food industry and to promote accompanying growths of agriculture and food industries	[51]
Foster Professional Talents in Food & Culinary	Public-private	This program will establish and operate trial groups to foster future talent in the food industry and spread the bond of sympathy; reinforce customized employment capacity to demand in the food industry and provide vocational training to youths with professional skills and administrative abilities centered on field practices; and target mall and medium food enterprises in agricultural industrial complexes in rural regions by providing opportunities to improve expertise and job competency. It will also provide an employment and startup network between the youths intending to advance into food sector and the promising enterprises	[52]
Provide Statistics & Information of Food Industry	Public	This project aims to collect, survey, analyze, and provide major information on the food industry	[53]
Reinforce Ties between Agriculture and Corporations	Public	This program will establish regional consultative groups to discover suitable ties with regional characteristics. It will support contract cultivation between agriculture and food enterprises to secure stable sales channels and increase income of farms; create bonds of sympathy and resolve field difficulties to promote corporate ties; and build a virtuous cycle system by discovering and spreading exemplary cases for coexistence. By encouraging direct trade between the food industry and local organizations, it aims to provide the basis to increase incomes of farms and stabilize business of small and medium food enterprises	[54]

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Initiative	Initiative type	Summary	Source
Foster SME Food Enterprises	Public-private	This policy aims to increase competitiveness by providing customized support to food and culinary enterprises, providing technological and management consulting for requirements such as HACCP certificate, supporting online and offline sales, and marketing beneficiary businesses It also aims to foster agricultural-industrial-commercial convergence by supporting small and medium enterprises (SMEs) that contribute to promote local economy It will support SMEs by providing loans for facility modernization to improve safety of the facilities This program will also provide loans to purchase ingredients to expand use of domestic agricultural goods, including culinary businesses	[55]
Foster Traditional Food Industry	Public	Among its strategies to improve the food consumption market are the following activities: to build and operate professional support centers for promoting fermented ingredient-based sauce industry; and to build and operate customized culture production facilities for promoting distribution of beneficial fermentation culture, among other activities	[56]
Foster Traditional Liquor Industry	Public	This policy aims to create the basis for promoting traditional liquor industry; increasing quality competitiveness of traditional liquor; and promoting distribution and consumption of traditional liquor. It will operate a 'liquor quality certification system' and increase applicable liquor types; carry out constant education, promotion, and consulting by operating traditional liquor gallery; hold Korean liquor shows and support promotion of awarded products; and designate unique breweries in regions as 'visiting breweries;' and introduce sixth industry by improving environment and providing storytelling, experiences, and promotions	[57]
Foster Functional Food Industry	Public	This policy aims to build an industrial basis for functional food by providing domestic and overseas functional agricultural food resources; assisting businesses' exploration of raw ingredients by building database for functional agricultural food; and improving functional indication system of food. It also aims to support sales promotion and exports of excellent functional foods in the ROK by resolving nontariff barriers through the analysis of overseas policies and problematic cases	[58]
Foster Culinary Industry	Public	To foster the culinary industry, MAFRA will conduct the following activities: (1) incubate culinary startups, which provide youths who wish to start up culinary businesses the opportunities to operate stores for a certain period of time prior to starting up; (2) reinforce ties between the culinary industry and agriculture, to encourage group purchase of food ingredients through cooperation between culinary businesses to reduce business costs and promote direct trade of domestic agricultural goods; (3) reinforce management capacity of the culinary industry, to provide capacity building education to improve responsive skills for situations like business crisis and business solvency; (4) reinforce industrial data and statistical analysis, provide culinary-related statistical data and precise analysis on markets with high levels of interest in the industry; and (5) provide customized support to domestic culinary enterprises wishing to advance into overseas market through means such as international franchise exhibitions	[59]

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Initiative	Initiative type	Summary	Source
Promotion of Korean Cuisine and Food Tourism	Public	This policy aims to (1) provide the basis for spreading Korean cuisine domestically and internationally by developing and distributing Korean cuisine contents, and promoting registration of 'Jang culture' as a UNESCO intangible cultural heritage; (2) distribute and spread food tourism contents linked with representative food ingredients of the developed region and promote domestic food tourism; (3) promote the Korean food industry by supporting private Korean cuisine training institutions and reinforce competitiveness of Korean restaurants overseas by strengthening Korean food education overseas; and (4) strengthen the roles of overseas Korean restaurant consultative groups and provide domestic and overseas Korean food industry information. Main activities are the support and promotion of Korea's food industry, including a Korean cuisine culture center, and the registration of Jang culture under UNESCO's cultural heritage	[60]
Increase Export of Agricultural Food	Public	This policy aims to diversify the export market, expand the distribution channel, improve the competitiveness of exporters, and establish an exporting basis for fresh agricultural foods. To do this, MAFRA will create an integrated export organization, an integrated support system, and a sales platform, and provide export vouchers, etc.	[61]
Build National Food Industrial Cluster	Public-private	This is to provide comprehensive supportive measures such as R&D, manpower, and funding; create a business-friendly industrial environment from R&D to production and exports, through collaboration with related institutions; and build a comprehensive supportive platform for corporate growth	[62]
Development of Soil and Fertilizer Management Technologies	Public	This project aims to develop soil, water, and nutrient management technologies aimed at achieving secure and sustainable food production. These include chemical and physical techniques to develop soil fertility, protect pollutants, recycle organic matter, and irrigate crops	[63]
Development of Agricultural Technologies for Climate Change Mitigation	Public	Covering a wide range of climate change and agro-ecology research areas, this program aims at developing a national inventory of greenhouse gases (GHGs), mitigation technologies, and carbon sequestration and balance. It will also evaluate ecosystem services by monitoring biological and agricultural water resources. Weather information system will be established for an early and emergency weather warning system. Assessment of water and energy balance of agricultural land as well as crop conditions such as area, growth, and yield will be done using remote sensing technology	[63]
Development of Low-input and Ecologically intensified Organic Agriculture	Public	The national agricultural science and technology R&D agenda is accelerated to promote the development and expansion of organic agriculture in the ROK. A series of organic agriculture R&D activities have been undertaken while synthesis and packaging of organic agriculture R&D took off in early 2014 Studies have been done to assess the multi-functionality of organic agriculture as well as to ensure safety of organic products. In addition, the certification period for low-pesticide food products is expected to end by 2015. To address the prevalence of insect pests and diseases in fruit trees, a study on the development of organic production technology was implemented to convince growers to shift from low-pesticide certification to organic farming. Moreover, development of soil and nutrient management technologies is needed to ensure production of high-quality organic fruits. Rural Development Administration (RDA) plays a vital role in the development of production technologies for organic apples, peers, citrus, persimmon, and grape, and hence, on-farm research for these fruit crops is being strengthened. Producing safe and high-quality organic products is one of the best solutions to actively respond to the requirements of emerging markets	[63]

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Initiative	Initiative type	Summary	Source
Development of Application Technology for Rural Environment and Resources	Public	Value creation for rural environments and resources entails conservation and development of attractive rural landscape through the use of available rural amenity resources; cultural and indigenous knowledge; and boosting of farm household economy through on-farm diversification activities like rural tourism. Settlement support for re-farmers, rural in-migrants, and multi-cultural families as well as rural residents is also implemented to achieve sustainable rural society progress	[63]
Developing technology to utilize cocoon and honeybee	Public	The focus is on breeding technology for stable supply of excellent cocoon/honeybee species in a bid to make the sericulture and apiculture industry the new future growth engine. This includes development of blood sugar-depressing agents, silk toothpastes, soaps, artificial eardrum out of cocoon, and cosmeceuticals for humans and livestock out of bee venom	[64]
Developing insects as useful resources	Public	The focus is on studying the economic value of some common insects. Likewise, a study will be conducted to commercialize high-value income sources by developing technology to use insects in actual agricultural fields, discovering new functional materials from insects through cutting-edge fusion technology, and recycling of resources, among other measures	[64]
Applying beneficial microorganisms to actual farming	Public	This will study the use of microorganisms in farming, including production of green and safe agricultural products; identification, selection, and growth simulation of beneficial microorganisms for pest control; and development of technologies to utilize them	[64]
Automation and robotization of agriculture, development of customized agricultural machinery, modernization of facilities	Public	Expected in this program is the development of novel technologies such as weed-cutting robots and high-speed rice transplanters. Furthermore, it is expected to achieve highly efficient and pleasant work environments in agriculture and the rise of domestic competition Practical applications, e.g., a vertical plant factory and a rapid detection system for food-borne pathogens, will guarantee safe and stable agricultural products. This will contribute to preventing agriculture-related accidents and minimize the tremendous socioeconomic losses and human casualties. This will result in improved farming conditions, increased agricultural productivity, and a more attractive and competitive agricultural industry	[65]
Development of Novel and Basic Agricultural Biotechnology	Public	The objective of this agenda is to develop fundamental and novel biotechnologies and produce bio-crops against climate changes using high-throughput crop transformation and phenomics technologies. Through this agenda, cutting-edge genomics and bioinformatics will be used with agriculturally important plants and microbes Structural and functional genomics as well as operation of national database will be implemented as a result of completion of the Genome Project for plants (rice, Chinese cabbage, radish, etc.) and microbes (a pathogen of rice bacterial blight disease) and the conduct of a follow-up research on functional genomics to explore valuable information such as useful genes, gene network models, and resources for molecular breeding	[66]

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Initiative	Initiative type	Summary	Source
Industrialization and Value Addition in Food and Agricultural Products	Public	The objective of this initiative is to contribute to the development of fundamental and commercial technologies that would result in greater use of agrofood resources. Also, there is a need to promote a healthy image of agricultural food and discover traditional food, develop processing technology for various agrofoods, and further confirm their nutritional values Discovering useful microzymes from traditional fermented foods is a key to help revive and promote the Korean food industry as well as to develop new products. Analyzing the nutritional and functional substance and developing a variety of health-improving food materials are also deemed important value-adding activities. Various applicable processing food technologies will help improve the value of regional food specialties. Specifically, technologies for making traditional liquor and fermented vinegar will be improved using traditional starter microzymes and functional synbiotics from fermented vegetable food. Also, data on the 'National Food Standard Composition Table' and 'Functional Food Composition Table' will be published to provide reliable information to the public. In addition, evaluation of various biological activities of agrofood resources will be done to improve and discover new functional food materials	[67]
Collection, Preservation, and Utilization of Germplasm	Public	The target in this agenda is to ensure the conservation and availability of agricultural diversity for food security as well as income generation	[68]
Stabilizing Food Production Using Rice Paddy	Public	This agenda is envisioned to solve food security issues by stabilizing food production. Through this agenda, it is hoped that new varieties of main grains including rice, wheat, barley, and oat, which are mainly grown in paddy fields, will be developed. It also aims to produce stable high-quality crops, create cost-saving technologies, and increase the rate of farmland utilization using measures such as (1) improvement of rice variety; (2) development of crop cultivation technology and product quality management; and (3) development of winter cereal varieties as well as technologies for higher productivity	[69]
Improving Self-sufficiency in Upland Crops Production	Public	The Department of Functional Crop of the National Institute of Crop Science (NICS) will lead the agenda focusing on the development and expansion of upland crop cultivars to the farmers' field, development of high-quality and low-cost crop production technologies, and responding to changes in crop production and consumption The overall goal of this agenda is to develop new soybean varieties, Azuki bean, other legumes, sesame, perilla, peanut, potato, and coarse cereals such as foxtail millet, proso millet, and sorghum. It also aims to produce stable high-quality crops, create cost-saving technologies, and increase the rate of farmland utilization. The agenda is expected to increase farm incomes and add commercial values to upland crops and bring about an import-substitution effect on soybean, sesame, and other upland crops. The total added value to upland crops can reach up to KRW500 billion through the development of functional and name-brand crops. Finally, this program will help jumpstart and activate processing industries and increase the upland crop consumption	[70]

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Initiative	Initiative type	Summary	Source
Enhancing Functionality and Value Addition in Crops	Public	The objective of this initiative is the isolation, identification, and development of functional materials and nutraceuticals with a focus on functional rice varieties. Research are divided into two major categories. The first is the development of functional rice varieties by conventional breeding method mixed with latest genetic techniques. The second is the development of new functional materials, which involves candidates for functional food ingredients by examining the efficacy of novel bioactive materials such as secondary metabolites and natural components found in crops, which can act as health promoting agents for the general public The Bioenergy Crop Research Center at NICS is developing new cultivars of bioenergy for maximum production of allium crops and biodiesel and bioethanol in all available lands such as reclaimed and idle lands. It will also carry out research on the collection, conservation, and evaluation of germplasms of those crops	[71]
Increasing Arable Land Utilization Rate and Producing Environment-friendly Crops	Public	The key outcomes of this research will include the knowledge and the ability to grow crops in places that are currently unsuitable, particularly the reclaimed saline lands. The technology in utilization of reclaimed saline soil, including desalination, will help achieve reliable crop production. Higher food-and-feed self-sufficiency can be obtained through increased production of forage crop using sophisticated cropping system. Additionally, this research and the resulting technologies will provide lower input of chemical fertilizers and pesticides, thus supporting the government's policy of sustainable agriculture and healthy landscapes	[72]
Growing New Varieties of Horticultural Crops and Productivity Improvement	Public	The goals include development and dissemination of new horticultural varieties or cultivars to improve export competitiveness; construction of stable and environment friendly horticultural crop production system under abnormal weather; and improvement of labor-saving cultivation techniques and horticultural products' quality for reducing production cost	[73]
Research on Production Safety and Value Addition in Ginseng	Public	This initiative is aimed at upgrading the production and distribution system of ginseng, medicinal crops, and mushrooms, and discovery of functional materials from these crops in order to increase exports of new food products based on functional materials	[74]
In response to climate change, increased international agrofood trade and high oil prices, groups in Agenda 14 are focused on the study of production environment and practical application of horticultural and herbal crops	Public	A protected horticulture industry is placed in the situation of increased heating and greenhouse material costs, labor shortages, farm scale enlargements, and increased demand for environment friendly agriculture. To develop technologies for reducing production costs and improving productivity, research is focused on heating and cooling cost reduction, environment friendly hydroponics and micro-environment control, and disaster resistant and high-productivity greenhouse model development	[75]
Program 50	Public	The objective is to focus on the technical development of high-value new materials using transgenic animal. This includes development of pharmaceutical proteins from transgenic pig, production of xenotransferable biological organs from transgenic cloned pig, and production and dissemination of cloned elite service dogs for public interests	[76]

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Initiative	Initiative type	Summary	Source
Program 51	Public	The objective is production of whole-genome sequences for major livestock and development of their industrial applications. This includes the reference genome mapping of livestock and database development for useful genes related to economic traits, biomarkers, and bio-resources for the establishment of industrial application system	[76]
Program 52	Public	The objective is to develop technologies for collection, conservation, and evaluation of animal genetic resources at a national level. This includes the establishment of national strategies for efficient management of animal genetic resources through research on collection, conservation, and evaluation, and their sustainable utilization	[76]
Program 53	Public	This initiative aims at the improvement of the national animal improvement system and development of animal improvement technologies in Hanwoo cattle, dairy cow, swine, and poultry	[77]
Program 54	Public	This leverages the Hanwoo feeding technology for high-quality beef production at lower cost	[77]
Program 55	Public	Here, the goal is the development of breeding, rearing, and disease management techniques to increase productivity of dairy cow	[77]
Program 56	Public	Here, the goal is the development of increasing swine productivity (MSY) and safe pork production technology	[77]
Program 57	Public	This aims as developing technologies for exporting, novel poultry species, and productivity improving techniques	[77]
Program 58	Public	This aims at promoting domestic riding horse, and developing techniques for selection and industrialization of outstanding breeding stocks using traditional domestic animals	[77]
Program 59	Public	The initiative aims at the improvement of productivity of grassland and forage plant per unit area, diversification of forage species, and quality improvement techniques	[77]
Program 60	Public	The objective is to develop technologies for regulating animal metabolism and improving feed quality as well as to advance environment management technologies, e.g., creation of valuable resources from animal manure, odor emission, and animal welfare. This includes major studies on the establishment of standards for livestock distribution, development of safe and high-value livestock products, and novel animal-food materials	[78]
Program 61	Public	The objective is to develop technologies for regulating animal metabolism and improving feed quality as well as to advance environment management technologies for creating valuable resources from animal manure, odor emission, and animal welfare. Also included is the development of technologies to regulate animal metabolism and improve feed quality through revision of the Korean feeding standard, development of techniques for evaluating feed nutrients, improving feed safety, and reducing feed cost by recycling agro-byproducts and exploitation of high value-added animal feed and techniques for reducing methane emission from rumen fermentation	[78]

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Initiative	Initiative type	Summary	Source
Program 62	Public	The objective is to develop technologies for regulating animal metabolism and improving feed quality as well as to advance environment management technologies for valuable resources from animal manure, odor emission, and animal welfare. The program is focused on developing techniques to recover valuable resources from animal manure and manage odor emissions from animals. To this end, the program will develop related facilities to advance general animal management system including designing animal housing facilities, reflecting the concept of animal welfare, and addressing ongoing climate changes	[78]
Next Generation BioGreen 21 Program (NGBP)	Public	NGBP is a 10-year program that supports the national economic growth driven by agricultural biotechnology. It strengthens the competitiveness of the agricultural sector through agricultural R&D, and established pipelines from basic research to ag-biotech product development. In its first stage, NGBP has developed 330 projects worth USD250 million (KRW281 billion)	[79]
National Agriculture Genome Program	Public	The following are included: (1) Millennium Agricultural Living Resource Genome Project: Development of resources for sequencing of agricultural living resources (original key group setup, and characteristic analysis of resources); and new genome sequencing of agricultural living resources (analysis of expressome and chromosome, reference genome sequencing, and establishment database); (2) Agricultural Bio-informatics Advance Program: Unified management system of agriculture bio-information and advanced database, and integrated service for agricultural bio-informatics hub; and (3) International Cooperation Program: Global bio-informatics network	[79]
Greenhouse gas reduction techniques for low-carbon agriculture	Public	This involves (1) development of national greenhouse gas reduction technique in the agricultural sector; (2) development of carbon storage and sink for emission trading response; (3) development of fossil fuels saving technique and renewable energy; and (4) designing of climate change management approaches and scenario building for greenhouse gas emission in the agricultural sector	[80]
Prediction tools for proactive crop productivity monitoring	Public	The objectives include (1) variation assessment and development of agricultural productivity analysis model according to new scenario (food crops, horticultural crops, pests, and agricultural infrastructure); (2) vulnerability assessment for biodiversity due to climate change (insect pollinators, birds); (3) integrated construction of agricultural production model and economy model; and (4) expansion of research infrastructure with adjustable factor control of climate change and meteorological disasters	[80]
New cultural methods for climate change adaptation	Public	The roles include (1) development of cultivation techniques and reset of regional cropping system and crop arrangement; (2) development of new variety with high resistance to extreme temperature (drought), high CO2, pests, etc.; (3) development of integrated control system on influx of subtropical pests and new problems in relation with unexpected pests; (4) development of polices on varietal diversity promotion; and (5) assessment and distribution of tropical/sub-tropical variety	[80]
Early-warning system to prevent loss and damages due to erratic weather conditions	Public	This encompasses (1) development of an early-warning system; (2) development of an assessment model for damage occurrence, criterion, and mitigation; and (3) distribution and reset of greenhouse and cattle shed as a stress-tolerant structural system	[80]

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Initiative	Initiative type	Summary	Source
KOISRA	Private	This is designated to help Korean and Israeli companies to develop mutual business relationships by providing one-stop business solution services in order to meet customers' various needs as efficiently as possible	[81]
The Small and Medium Business Administration (SMBA)	Public	SMBA's primary mission has been to foster challenging and innovative SMEs in order to maximize the growth potential of the ROK	[82]
(Thailand–Korea/ Vietnam–Korea/etc.) Technology Exchange Centers	Public	The centers are expected to serve as gateways for Korean SMEs as they expand their operations to ASEAN markets There are 10 focal industries: next-generation cars, smart electronics, healthcare and well-being tourism, agriculture and bioengineering, future foods, robotics, air logistics, biofuel and biomedicine, digital, and medical herbs. By signing the MOU, the parties agreed to organize the Thailand–Korea Joint Committee tasked with conducting the annual review of the center's performance, and promoting policy exchanges and cooperation spanning all aspects of SME policies such as tech startups and small business owners	[83]
Global Market Policy Coordination Division	Public	In 2019, the Ministry of SMEs and Startups (MSS) will start taking measures to support overseas expansion in earnest, such as the expansion of Hallyu marketing overseas and the introduction of startup vouchers, by reflecting characteristics of related organizations. It will continue to discover customized projects to support overseas expansion through increased information exchanges between government agencies and exporting organizations	[84]
IM Shopping	Public	A public TV home shopping channel to help SMEs, venture firms, and farms opens new sales routes. It is expected to improve competitiveness of Korean farmers and fisherman, contribute to the expansion of the sales routes of creative and innovative products (including Korean agricultural goods), and address the chronic problem of existing distribution channels by differentiating it from other channels	[85]
Food Manufacturing and Item Manufacturing Report	Public	A person who seeks to manufacture or process foods or food additives must submit an item manufacturing report to the relevant local government prior to, or within seven days of production initiation	[86]
Self-Quality Inspection System	Public	To secure food safety prior to distribution, a business operator who manufactures or processes foods must conduct regular inspections to confirm that the manufactured or processed foods comply with relevant standards and regulations	[86]
Food Traceability System	Public	MFDS has established and operates a food traceability system to take measures such as cause analysis, tracking, and recalls when hazards occur in foods or in health functional food products, apart from providing more accurate information to consumers The application of food traceability is becoming mandatory for businesses that import or manufacture/process infant and baby foods or health functional food products with annual sales exceeding a certain level as well as for other food product retailers operating business on stores exceeding a certain level of size Businesses are investigated and assessed every two to three years for follow-up management. MFDS has established and operates the 'Food Traceability Information System,' holds training sessions to encourage voluntary participation of businesses, and provides on-site training and consulting (through visits) to help stabilize and expand the system	[86]

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Initiative	Initiative type	Summary	Source
Hazardous Food Sales Prevention System	Public	MFDS annually collects and inspects approximately 120,000 cases of food products to secure food safety in the domestic market. On the other hand, food manufacturers also check their products' quality and safety through regular self-quality inspections. The information on defective products gathered through these tests is reported to MFDS in real time, from approximately 85 inspection facilities nationwide MFDS operates the 'Hazardous Food Sales Prevention System,' which enables MFDS to prevent consumers from purchasing the reported products by sending out information on hazardous products in real time, directly to the check-out counters in convenient stores, supermarkets, etc. As of 2015, the Hazardous Food Sales Prevention System was being installed and extended to all stores distributing and selling food products nationwide, including major supermarkets, department stores, small and medium-sized distributors, convenience stores, and home shopping channels (online stores)	[86]
Consumer Food Sanitation Guard System	Public	As it is difficult to systematically monitor food service businesses with only public officers in charge of food sanitation inspection, the Consumer Food Sanitation Guard System is operated to promote consumers' active participation in food sanitation monitoring, to complement the monitoring activities of the administrative body and to secure higher transparency in food sanitation monitoring activities	[86]
Management of Food Standards and Specifications	Public	Food Standards and Specifications Regulations are created to provide legal ground for management of harmful elements in food products produced for distribution and sales, so as to block the risk of harming the human body by consuming foods and to ensure food safety	[86]
Management of Standard and Criteria	Public	In 2004, the 'Standards and Specifications for Health Functional Food' was established to set criteria for manufacturing, processing, production, import, distribution, and preservation of health functional food products. In addition, standards and specifications were established for functional ingredients and products to promote standardized distribution of health functional foods and to secure consumer safety	[86]
Functional Ingredient Recognition	Public	Health functional foods are products manufactured (and processed) with functional ingredients or elements useful for human health. 'Functional' implies adjustment of nutrients in the human body structure or function, or those that bring useful health effects such as in physiological reaction. Functional ingredients or elements can be categorized into those that are notified by the Minister of Food and Drug Safety and those that are recognized individually	[86]
Imported Food Safety Management System	Public	This includes business registration, overseas manufacturing facility registration, on-site inspection of overseas manufacturing facility and excellent importer registration system, import inspection, Preliminary Import Inspection System (OPERA), and imported food inspection and inspection order system	[87]

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Initiative	Initiative type	Summary	Source
Pan-Governmental Cooperative Council on Food Poisoning	Public	With the recent changes in people's dietary patterns, an increasing number of the population eat out and use meal services, but at the same time, 72% of food poisoning patients come from those eating out or using meal services In response, efforts to prevent and promptly respond to food poisoning were strengthened through pan-governmental cooperation, concentrated guidance, and inspections conducted during certain periods and facilities more vulnerable to food poisoning Preemptive prevention measures are conducted with stronger promotion activities tailored to each food poisoning causing bacteria and season	[88]
Food Poisoning Prediction Map	Public	To help clarify the cause of food poisoning, contamination monitoring has been strengthened for agricultural, livestock, and marine products across all stages of production, distribution, and imports.	[88]
Korea Integrated Pathogen Information Network (KIPIN)	Public	The most effective way to prevent food poisoning is through education and promotion on prevention of food poisoning educational programs titled 'Professional Instructor Training Course' and 'Intensive Training for Professional Instructor on Food Poisoning Prevention.' Educational and promotional materials are also posted on the Food Poisoning Prevention Promotion website for easy access and utilization	[88]
Reinforcing Safety Control of Children's Food	Public	MFDS recognized the need to have a comprehensive and systematic solution led by the government to reinforce safety of children's food, and released the Comprehensive Safety Measures for Children's Food in February 2007. Based on this, the Special Act on Safety Management of Children's Dietary Life was enacted in March 2008 and put into force in March 2009. According to the Special Act, zones within 200 meters radius from schools are designated and managed as 'Green Food Zones' or Children's Food Safety and Protection Zones. Businesses that cook and sell children's favorite foods within these zones, with facilities satisfying the sanitation standards prescribed in the Special Act on Safety Management of Children's Dietary Life, without selling high-calorie and low-nutrition foods or high-caffeine foods, are designated as exemplary business places selling children's favorite foods	[88]
Quality Authentication System on Children's Favorite Food	Public	This policy aims to promote the manufacturing, processing, distribution, and sale of safe and nutritious children's favorite foods	[88]
The 'Nutrition and Dietary Life' textbook	Public	MFDS is carrying out education and promotion activities on children's favorite foods, so that children can develop the ability to put healthy and suitable dietary life into practice. The 'Nutrition and Dietary Life' textbook for elementary school (with different levels for low, mid, and high-grade students) developed in 2010 has been used for steady education on food safety and nutrition since 2011. Then in 2013, textbooks on food safety and nutrition education were developed for middle- and high-school students and extended education based on these is being provided since 2014	[88]
Center for Children's Food Service Management	Public	The objective of this initiative is to ensure safe management of meal services for children. To be more specific, expert dieticians from the center systematically support sanitation and nutrition management for food services provided at children's meal service facilities	[88]

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Initiative	Initiative type	Summary	Source
Food Labeling System	Public	To provide consumers with more accurate information on food products, MFDS implements related regulations and standards that require the labeling of product name, ingredients, manufacturing and expiry dates (quality retention date), net contents, identity and principal place of business, and nutrition information, as well as sanitary instructions for safe storage and warnings on the packaging and container	[88]
Health Functional Food Labeling System	Public	To enhance the quality of health functional foods and to provide consumers with accurate information, MFDS implements related laws and regulations that require health functional foods to have the right marks and labels while providing information on product name, raw materials, expiration date, identity and principal place of business, and product functions. Health functional foods are also required to add intake instructions on the containers and packages	[88]
Approval Process for the Reliability of Certification Assurance Agencies for Labels, Food Advertisements, etc.	Public	The purpose is to promote the efficiency of labeling and advertisements tasks by prescribing matters necessary for the approval of labels and advertisements by Certification Assurance Agency for the permission of labels and advertisements certified. Assurance regarding food is defined in Article 13 (2) of the Food Sanitation Act, Article 8 (1) 6 (d) of the Enforcement Rule of the same Act, and livestock products defined in Article 32 (2) of the Livestock Products Sanitary Control Act and Article 52 (1) 8 (d) of the same Act	[89]
Business Development Services at Yonaco	Private	This initiative is dedicated to building businesses and executing transactions, and for generating opportunities, business transactions, and working relationships for our partners in technology, life-sciences, investments, green-tech, and other industries	[90]
Kye (Mutual Aid Associations/Rotating Credit Associations)	Public-private	The initiative is the equivalent of an insurance policy or savings account, which can be used to meet the expenses incurred or the equivalent of installment buying	[91] [92]
TIPS (Accelerator Investment-Driven Tech Incubator Program for Startup)	Private	This objective of this initiative is to identify and nurture the most promising startups with innovative ideas and groundbreaking technologies. In order to support them when entering the global marketplace, it appoints and designates successful venture founders, who are now angel investors and leaders of technological enterprises, as the incubators/accelerators. It then offers seamless service encompassing angel investor networking, incubating, mentoring/professional support, and matching R&D funds	[93]
Fast Track Asia (Company Builder)	Private	Fast Track Asia combines a VC, an incubator, and an accelerator with the purpose of kick-starting young startups	[94] [95]
Born 2 Global	Private	The global startup support center guides startups to enter the global market from the beginning	[96]
Seoul Startup Hub	Private	The objective of this initiative is to link startups and players to build connections and draw out viable startup policies and propositions backed by thorough research, to lend direct aid to businesses in marginalized areas of the startup ecosystem	[97]
National Eco-Industrial Park (EIP) program	Public	The objective of this initiative is to promote innovative industrial development that simultaneously achieves environmental sustainability. It seeks a comprehensive approach to improve environmental, social, and business performance in the Korean industry	[98] [99]

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Initiative	Initiative type	Summary	Source
Korea National Food Cluster (Foodpolis)	Public-private	The vision is to become a leading hub in the global food business with cutting-edge R&D, food innovation, and strong networks, along with quick and easy access to one of the world's most dynamically growing regional economies. Along with the food entrepreneurs, the National Food Cluster shall be the starting point of a 100-year strategy for the ROK to be a food power and to enrich lives of the next generation	[100]
The Industrial Complex Cluster Program	Public-private	The goal is to nurture a specific industry in a particular area or reinforce the innovation capability of existing industrial complexes. The ultimate goal is to strengthen industrial competitiveness through enhanced interconnection between the industry and the research sector	[101]
The Korea Rural Economic Institute (KREI)	Public	KREI is a government-funded research organization. In 1978, KREI was established by the Korean government to play an important role in developing sound agricultural and forestry policies aimed at a balanced development of urban and rural areas. KREI research covers agricultural economics, marketing of agricultural products, rural development, agricultural outlook, and international agricultural trade negotiations. About 100 experts are working to provide a new vision for agriculture. It contributes to the nation's economic development and the enhancement of public welfare by conducting comprehensive surveys and research on the agricultural and forest economy and rural community development	[102]
Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, and Forestry	Public	A leading global R&D planning and evaluation institute, it promotes science and technology for food, agriculture, and forestry to enhance competitiveness. It aims to have a transparent R&D management system, establish reliable labor relations and performance-oriented management system, and strengthen the cooperative network	[103]
Korea Agro-Fisheries and Trade Corporation (aT)	Public-private	It provides financial and business support to food companies, and contributes to attaining stable food security and the improvement of quality of life by promoting agrofisheries and food industries.	[104]
iCOOP Union	Private	iCOOP aims to (1) improve quality of life by creating alternatives for food, care, education, etc., based on ethical production and consumption; (2) create a people-oriented economy; and (3) secure a safe future where people and nature reside in harmony. Some of its key agrofood related goals are food reliability, ethical consumerism, cooperative innovation, sustainable production, and consumption	[105]
Warehouse receipts	Public	A warehouse business entity will issue a warehouse receipt to the depositor on request. After that, the deposited goods can only be delivered and sold against redemption of the warehouse receipt. The objective is to protect the title to goods in storage via documentation	[106]
Nonghyup Bank	Private	Nonghyup Bank provides specialized agricultural and commercial credit and banking services in the ROK. The company operates in four segments: personal financing, corporate financing, cards, and others Its deposit products include demand, time, savings, installment, and foreign currency deposits, as well as certificates of deposit It supports the economic activities of farmers, contributes to their wellbeing, and strengthens the competitiveness of ROK's agricultural sector	[107] [108]

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Initiative	Initiative type	Summary	Source
National Agricultural Cooperative Federation (NACF)	Private	NACF provides a variety of services such as marketing, supply, banking, and insurance The services support farmers from the field through the market and cover production, processing, and marketing stages The objective is to support and represents farmers' well-being and to improve their quality of life	[109]
Korea Exchange (KRX)	Public-private	Korea Exchange is committed to successfully achieving the economic policy objectives of the new administration, i.e., income-led growth, job creation, innovative growth, and a fair economy. It also implements the basic functions of a capital market including the facilitation of corporate financing, ensuring active trading, and protection of investors, while enhancing international competitiveness of the Korean capital market at the global level The Korea Exchange website offers a variety of information on market trends, notices on listing and disclosure as well as capital market rules and regulations.	[110] [111]
Korean Food Promotion Institute	Public	Its mission is to improve national competitiveness by promoting Korean food. It aims to do this through the sophistication of ROK's food infrastructure (i.e., development of a database and statistics system), the strengthening of ROK's restaurants (i.e., establishment of a private-group support system and support for food ingredients export connection), the cultivation of specialists, and the spreading of Korean foods domestically and internationally	[112]
Traditional Gudeuljang Irrigated Rice Terraces in Cheongsando, 2014	Public	Gudeuljangnon rice paddies were created by rearranging the natural environment to increase rice production in areas with disadvantageous soil and water conditions. The residents have constructed, maintained, and managed Gudeuljangnon and the irrigation systems as a means of livelihood. This initiative aims to conserve this system in response to the diminution of youths practicing agriculture, the urbanization of the island, and also for historical and cultural reasons	[113]
Jeju Batdam Agricultural system, 2014	Public	The objective of this initiative is to preserve the Batdam agricultural system, which blocks off strong winds and helps reduce evaporation, encourage seeds sprout, and separate cattle from the fields. In doing so, this initiative strives to combat new challenges like farmland arrangement and widespread urbanization, while also preserving the cultural significance of the Jeju way of life	[114]
Traditional Hadong Tea Agrosystem in Hwagae-myeon, 2017	Public	The objective of this initiative is to preserve the Hadong traditional tea agriculture, which is an example of symbiosis of the product of Hwagae-myeon residents'1,200 years of adaptation with the barren environment of the mountainous terrain of Jiri Mountain. In doing so, this initiative aims to ensure the livelihood of full-time tea farmers in the region and preserve its cultural significance. As Hwagae-myeon produces 20% of the total domestic tea production amount of the ROK, Hwagae-myeon's agrosystem is important to the country's agriculture	[115]
Geumsan Traditional Ginseng Agricultural System, 2018	Public	Ginseng cultivation areas form a single agricultural system incorporating all of the land's elements including the surrounding forests, farmlands, villages, and rivers. Geumsan Traditional Ginseng Agricultural System is a very important agricultural heritage. It represents the culture, long history, and traditions of the ROK. In addition, Korean Ginseng is considered a noble crop that, beyond being merely a specialty Korean product, has been inherited as one of the spiritual heritages of the nation. Therefore, the objective of this initiative is to maintain the integrated nature of cultural ceremonies, production, and processing inherent in the Geumsan Ginseng agricultural system	[116]

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APPENDIX A

LAO PDR

Initiative	Initiative type	Summary	Source
Lao Upland Rural Advisory Services (LURAS)	Public-Private	The LURAS project is establishing professional and effective extension services that respond to farmers' needs and support them to improve productivity and their own food security, and help them effectively engage in growing markets, with the aim to benefit smallholder upland farmers and farmer organizations. Project interventions include supporting proposals from state and non-state actors who deliver services to small upland farmers, including a small grant mechanism. The project also includes capacity building activities, including training and piloting of new approaches to improve performance in service delivery. As a result of the first phase of the project, 4,700 farmers increased their productivity by more than 10%, improving the lives of more than 20,000 people overall. During the second phase of the project, additional focus will be put on improvements in certification, processing of agricultural products, and connecting farmers to markets	[1] [2]
Khammouane Rice Hub	Public	The government selected this province as a rice hub and has contracted it to produce rice for the purpose of national food security and export to other ASEAN countries	[1]
Lao Farmers Network	Private	This serves to strengthen cooperation among smallholder farmers through information sharing, farmer-to-farmer learning, and policy dialogues. It also provides organizational development/management training, farmer technique training, aid for processing, and marketing strategies	[1]
Phutawen Farm Project	Public-Private	The purpose is to strengthen farmer awareness and establish regional market linkages. The project combines several activities, including food production, grocery shops and restaurants with ingredients sourced from their own farms, agrotourism, and a learning center. It aims to improve Lao's agricultural sector and turn the country to be the supply source of quality safe produce	[3] [4]
Special Economic Zones	Public	The objective of this initiative is to improve the productivity of Lao PDR's agriculture through various measures, such as, investing in better food processing facilities, building warehouses and cold storage areas, and improving access to agribusiness services Currently, there are two active SEZs in the country. Few linkages between foreign affiliates and local firms currently exist, notably due to the type of FDI attracted and the lack of absorptive capacities of local SMEs. Also, most companies currently operating in Lao PDR's SEZs are foreign-owned, and their links with local enterprises, including SMEs, could be further enhanced Incentives for special economic zones and specific economic zones are in compliance with the Decree on the Establishment and Activities of respective zones. These include corporate tax exemptions for four to ten years for zone 1 in agriculture, industry, handicraft, and service sectors. There are also some nonfiscal incentives such as immigration benefits for foreign investors. Monitoring mechanisms are very limited and KPIs have not been developed	[5] [6] [7]

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Initiative	Initiative type	Summary	Source
China-Laos Modern Agricultural Science Park	Public-Private	Lao Ministry of Agriculture and Forestry has signed a Memorandum of Understanding with China's Xuanye (Lao) Co., Ltd/AVIC International Beijing Co., Ltd on a modern agricultural industrial park project in Laos. The agricultural industrial park aims to become a regional center of agricultural products trading, warehousing, and logistics	[8]
China-Laos Technology Transfer Center	Public	This initiative aims to strengthen the cooperation among relevant parties; effectively integrate the technological resources of enterprises, colleges and universities, and scientific research institutes; and boost the technology transfer and collaborative innovation between Lao PDR and PR China	[9] [10] [11]
National Committee for Nutrition	Public	The objective is to change peoples' living style according to the three clean principles of drinking boiled water, eating cooked food, and promoting healthy eating behavior in children by providing milk and food supplements in school meals, among other things	[12]
Investment in the production of agricultural products	Public-Private	In the agriculture sector, investment is mainly in corn promotion project; sugarcane, rubber tree and other industrial tree plantations; and coffee and tea plantations for export	[12]
Construction and repair of the Nammao-Namnene irrigation systems and Nam Hin reservoir irrigation	Public	The objective of this initiative is to improve the productivity of farmers by constructing and repairing Nammao-Namnene irrigation systems	[12]
Promotion of food production, especially rice production,	Public	The objective of this initiative is to establish food security. Rice production is outstanding in Vientiane province where the total production area was 65,500 ha, which yielded 290,000 tons of rice, equivalent to 90% of the target. In Sayabouly, the total production was 192,980 tons, equivalent to 95% of the target, while in Xiang Khouang province the total production areas was 58,904 ha, which yielded 517,029 tons or 93% of the target. The reasons for not achieving the targets are land degradation, unimproved seeds, flood, and pest issues in some years	[12]
Promotion of commercial plantation	Public	The objective of this initiative is to support processing industries using production techniques and machinery to increase production efficiency and value addition. The most outstanding achievement was an increase in corn plantations. Corn production in Sayabouly province was 337,775 tons in an area of 62,394 ha; while in Houaphanh province, the production was 540,718 tons in an area of 19,698 ha. Corn was also planted in Oudomxay, Bokeo, and Xiangkhouang provinces for exports to Thailand, PR China, and Vietnam	[12]
Promotion of cattle and livestock farming, especially cows, buffaloes, and pigs	Public	The objective of this initiative is to improve the breeding and livestock industry. The most outstanding achievements are in Xayabouly, Xiangkhouang, and Houaphanh	[12]
Agro-Tourism Promotion	Public	The objective of this initiative is the promotion and development of ecotourism and cultural tourism through implementing community-based tourism projects; organizing festivals to attract tourists to famous areas such as Luangprabang, Vang Vieng, Muang Sing, and Xiangkhouang; improvement of tourism infrastructure; and enhancement of tourism services. Tourism and border trade have been progressing well	[12]

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Initiative	Initiative type	Summary	Source
Establishment of border trade regions	Public	A number of border trade areas have been developed. These include Lao PDR–PR China border trade in Luang Namtha province, Lao PDR–Thailand trade in Bokeo and Sayabouly provinces, and Lao PDR–Vietnam trade in Houaphanh province. This policy aims to regulate the safe import of agricultural products and promote trade on the borders	[12]
The Action Plan for Flood and Drought Control	Public	The Action Plan for Flood and Drought Control and Management has been developed to establish the National Early Warning Centre under the ADB-GMS Programme. Its primary objective is to reduce the impact of climate change on farmers and the rural community	[12]
The Participatory Development Training Centre (PADETC)	Private	The objective of this initiative is capacity building of nonprofit organizations to improve the skills of small businesses. PADETC manages a small grants fund, supported by Oxfam Novib. Grants of USD5,000–10,000 are available for institutional strengthening and program support, especially in the areas of agriculture, education, and youth development	[13]
Lao PDR Agriculture Competitiveness Project	Public	The objective of this project is to support 28,000 farming households in 224 selected rural villages to improve their yields and product quality and increase labor productivity and crop sales. Expanding access to high-quality seeds, machinery, and irrigation schemes aims to reduce transaction costs and enable higher returns for farmers. It focuses on agricultural quality, safe food, and products by having small and medium enterprises as the main engine for materializing the strategy. The project hopes to address these challenges by (1) promoting best practices in farming to improve the quality of produce and reduce costs; (2) linking farmers to agribusinesses to improve marketing; and (3) shifting to more modern and environmentally friendly processing facilities and technologies to improve the product value and reduce losses. Strengthening the enabling environment will also help reduce the costs of doing business in the agriculture sector	[14]
National Agriculture and Forestry Extension Service/"Lao Extension Approach"/Laos Extension for Agriculture Project	Public-Private	This initiative observes a set of policies, principles, structures, and processes that should be applied in all provinces and districts, and by all projects for the support of extension activities in Lao PDR as well as for the support villagers' efforts to do their own development	[15]
Agricultural Microenterprises	Public-Private	The objectives of this initiative are alleviating poverty, building the foundations of an expanding private sector, and creating decent work for greater numbers of people	[16]
The National Chamber of Commerce and Industry (NCCI)	Public-Private	It represents the business community in Lao PDR. It is the network between state and private enterprises and represents employers, groups, and joint ventures across all agencies that have been established under the laws of Lao PDR. LNCCI works to strengthen provincial CCIs, Vientiane CCI, and business associations and groups by upgrading services and management. As national economic development requires a pool of knowledge and skills, LNCCI seeks to build capacity through seminars, business meetings, and exhibitions where views can be exchanged, and experiences and skills shared The Chamber also seeks approaches to address the need of Lao businesses and facilitate them to operate in a friendly business environment	[17]

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Initiative	Initiative type	Summary	Source
International Aid Agencies (ADRA Lao, ZOA, Care International, World Food Programme, European Commission, GTZ, UNDP)	Public-Private	This initiative has various rural agricultural projects that provide village revolving funds, rice banks, animal banks, and help form credit unions. They also provide loans directly and/or through Agriculture Promotion Bank (APB) or other NGOs as part of the goals of providing poverty relief and aid	[18]
Projects by the Asian Development Bank (ADB)	Private	ADB implemented its Tree Plantation Project, which has provided loans for farmers and for farm enterprises through the Agriculture Promotion Bank (APB). ADB also expects to launch a Rural Finance Development project, which will help reform and improve the services of the APB and develop credit unions as an alternative source of rural financial services. ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia–Pacific, while sustaining its efforts to eradicate extreme poverty. It assists its members and partners by providing loans, technical assistance, grants, and equity investments to promote social and economic development	[19] [20]
Projects under the International Fund for Agricultural Development	Public-Private	This initiative funds the Xieng Khouang Agricultural Development Project, which has two credit components: cattle banks and irrigation loans. Other components include (1) an agricultural component mainly intended at strengthening the provincial and district agricultural services, with a main focus on training, extension, and adaptive research; (2) a livestock component to enhance animal health services and help the farmers to stock their farms; (3) an irrigation component that targeted the construction of new schemes (750 ha) and rehabilitation of 18 schemes (1,950 ha); (4) a credit component initially due to be operated by the State Bank of Laos; and (5) a provision for bridge construction (excluding roads)	[20] [21]
Projects under La Caisse Française du Dévéloppement	Public-Private	This initiative supports various projects, such as the Phongsaly Rural Development project and the Boloven Plateau Development Project, which provide loans for animal banks and mobilize savings deposits as part of a community-development credit-and-savings scheme	[20]
Lao-Swedish Forestry Programme	Public-Private	This initiative is a village-based credit program. It also promotes income-generating endeavors in agriculture, forestry, or home-based activities, with the aim of encouraging sustainable land use	[20]
National Socio-Economic Priority Programme	Public	This initiative covers eight areas, namely, (1) food production; 2) commodity production; (3) stabilization of shifting cultivation; (4) rural development; (5) infrastructure development; (6) expansion of external economic relations and cooperation; (7) human resource development; and (8) services development The objectives are to (1) explore and exploit those sectors endowed with potential in order to promote production; (2) set forward a policy that looks for funds and distributes investment appropriately; (3) shift from a nature-based economy to a production economy by focusing on integrated agricultural development; (4) concentrate on the interaction between farming production and distribution, and the application of new techniques; (5) promote family business sector; and (6) link agricultural expansion with rural development by stimulating production and encouraging family businesses	[20]
KumBan Pattana Village Clusters	Public	These are to establish information centers that provide government services, disseminate information and techniques, and improve the rural income of farmers	[22]

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Initiative	Initiative type	Summary	Source
Lao Agricultural Database (LAD)	Public	LAD was established by the National Agriculture and Forestry Research Institute (NAFRI) in collaboration with the Thai AGRIS Center, Library of Kasetsart University (Thailand) to improve the collection and dissemination of agriculture- and forestry-related information in Lao PDR	[23]
NAFRI Library System	Public	The objective of this initiative is to provide information on agriculture and forestry in Lao PDR and to promote the development of agricultural research	[24] [25]
Agriculture Law (1998)	Public	This policy aims to promote agricultural production to guarantee food and agricultural commodity supply, expand agroindustrial processing, and contribute to national economic without damaging the environment	[26]
Biotechnology Safety Law (2014)	Public	It sets the principles, regulations, and measures on management and monitoring of biotechnology safety to ensure safety in research, development, handling, movement, and use of genetically modified organisms (GMOs)	[26]
The National Growth and Poverty Eradication Strategy (2004)	Public	This strategy plans to end poverty by 2020 and sustain economic growth with a particular focus on rural areas and poverty districts. The aim is to provide an enabling environment for growth and development in the four key sectors of agriculture/forestry, education, health, and infrastructure The strategy recognizes that the most important policy objective for the agriculture and forestry sector is the improvement of household food security. To achieve this, sustainable forest and watershed management will be enhanced, disparities between lowland and sloping-land farming will be reduced and rural living standards will be improved through the development of market-based agriculture. Due to the extremely high reliance of the poor on the natural resource base, effective agro-biodiversity conservation and management will be central to the success of this strategy	[26]
MAF Agricultural Strategy 2025 and Vision 2030	Public	This policy seeks to ensure food security through clean, safe, and sustainable agriculture and build an agricultural production system that can significantly contribute to the nation's economy in line with its objectives of industrialization and modernization The strategy includes nine action plans and 120 projects/intervention areas related to crops, and seven action plans and 58 projects/interventions areas related to livestock and fisheries. Although the commercialization of agriculture is a strong focus, the new strategy and vision acknowledge and support the sustainable use of genetic resources and nice products including various vegetables, fruit trees, and NTFPs	[26]
The Agriculture and Forestry Research Strategy (2015-2025)	Public	This strategy identifies the degradation and loss of agrobiodiversity and natural resources as one of the seven most important constraints facing agriculture. The strategy has four goals (1) guaranteeing food security, safety, and nutrition; (2) the commercialization of agricultural production along with high-value addition; (3) ensuring sustainable management of agrobiodiversity and forest resources; and (4) promoting resilience to climate change The strategy comprises four research programs, including a sustainable agro-biodiversity program, which has the stated aim of supporting the development of improved methods, mechanisms and technical recommendations to ensure sustainable management of natural resources (land, forestry) and agrobiodiversity (genetic resources)"	[26]

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Initiative	Initiative type	Summary	Source
Northern Uplands Development Programme	Public	This initiative aims to implement a program-based approach to upland development in Lao PDR. The program comprises six components, namely, (1) land and landscape management; 2) local governance and planning; (3) pro-poor rural economy; (4) supporting the emergence of farmer organizations; (5) improving delivery of public agricultural advisory services; and (6) food facility action The program includes three cross-cutting areas aimed at improving national policy development and promoting aid effectiveness. These are (1) knowledge capitalization and policy formulation; (2) support for the Vientiane Declaration; and (3) improved governance and management of official development assistance	[26]
The Nagoya Protocol	Public	Lao PDR continues to develop human and institutional support for policies and issues related to access and benefit-sharing (ABS). A national ABS Framework is being developed and refined by the Science and Technology Research Institute of the Ministry of Science and Technology (MoST) with the support of UNEPGEF Although a national framework on ABS is still to be developed, valuable experiences have been gained in access- and benefit-sharing by promoting the plantation of economic crops including agarwood, for oil extraction and incense. The key concept is a joint collaboration between the government, a private company (e.g., Lao Agar International Development Company Ltd.), and farmers. Technology is then transferred from research institutions to farmers, while additional knowledge, marketing and credit are provided by a private company	[26]
Treaty on Plant Genetic Resources for Food and Agriculture	Public	The objective of this policy is the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising from their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security The Treaty aims to (1) recognize the contribution of farmers to the diversity of crops that feed the world; (2) establish a global system to provide farmers, plant breeders, and scientists with access to plant genetic materials; and (3) ensure that recipients share the benefits they derive from the use of these genetic materials with the countries where they originated. Currently, the ITPGRFA focuses on those crops for which modalities to exchange genetic materials already exist, for example initiatives by IRRI on the exchange of rice germplasm	[26]
Lao PDR Trade Portal	Public	The Lao PDR Trade Portal is the single-stop point for all information related to import and export to and from the country. The Lao PDR Trade Portal is hosted by the Department of Import and Export of the Ministry of Industry and Commerce on behalf of all the Government agencies involved in the import/export process. It is responsible for Trade Facilitation Committee Secretariat (TFCS) focal point. On this portal, traders will be able to get information about all the regulatory requirements they need to fulfill in order to carry out their transactions	[27]
Free Trade Areas	Public	Of the preferences that Lao PDR benefits from free trade agreements, the most important is the ASEAN Trade in Goods Agreement (ATIGA). Lao PDR is exporting and benefiting from preferential treatment to ASEAN markets, mainly to Thailand, followed by Vietnam, Singapore, and the USA, respectively. The preferential exports to Malaysia and Indonesia were less than USD2 million each. Lao PDRs also exports to ASEAN dialogue partners including PR China, Japan, and the ROK, with such exporting items as agriculture, garments, handicrafts, and nontimber forestry products	[28]

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Initiative	Initiative type	Summary	Source
Lao Agriculture Commercialization Project (LACP)	Public	The proposed Laos Agriculture Commercialization Project (LACP) seeks to enhance the competitiveness and sustainability of Lao PDR's agriculture sector, from technical and financial support to increase in agricultural productivity and commercialization in selected strategic value chains. The project focuses on (1) geographical areas with high agricultural development potentials; (2) farming systems with high potential for commercialization, i.e., paddy, maize, and vegetables; (3) promotion of good agricultural practices and climate-smart agricultural technologies and farming-system diversification to enhance food and nutritional security; (4) building capacity for farmers' organizations, agribusinesses, and public- and private-service providers; and (5) building on and developing synergies with other government/donor programs. The objective is to increase commercialization of selected agricultural value chains in the project areas	[29]
National Food Safety Policy	Public	The objective of this policy is the control and management of quality and safety of food in Lao PDR, throughout the food chain, including growth cultivation, rearing, processing, service, industrial production, storage, purchase, transportation, import-export, distribution to the point of consumption, and international technical cooperation and scientific research. This policy stresses on raising awareness of the knowledge of nutrition; eating and living in a clean and hygiene manner that is helpful for the body; controlling and inspecting the quality of foods and drugs including traditional medicine as well as services related to life and health of humans	[30]
Food Safety Laboratory	Public	This laboratory is Lao PDR's first food-safety laboratory and serves as the reference center for the control of food quality throughout the country. Its mission is to safeguard local populations against foodborne diseases by analyzing and certifying the quality of imported, exported, and domestic food, as well as ensuring safety across the food chain	[31]
Consumer Protection Hotline	Public	The hotline's launch was aimed at strictly implementing the Law on Consumer Protection and protecting the legitimate rights and interests of consumers. This has been noted as an important step forward for Lao PDR as it provides a tool for consumers to report issues to government agencies. The hotline also provides an option for consumers to complain or provide information and could serve to encourage manufacturers and business operators to pay more attention to production standards and ensure that they supply good-quality products, maintain standards, and ensure the safety of products and services at reasonable prices	[32]
Food Safety Regulations	Public	This initiative aims to observe and enforce food safety regulations to ensure a healthy population	[33]
The Pha Khao Lao Agrobiodiversity Resource Platform	Public	The platform is an attempt to find ways to strengthen local food systems in Lao PDR. The goal is to ensure that the rich natural heritage of Lao PDR is conserved and used, and that knowledge is used by the new generation in a different way. The project also aims to spur agricultural and culinary entrepreneurship among young people and provide a resource to students and researchers. The government hopes that the platform will help promote high-value and specialty agricultural products	[34]
Lao Global Futures Commodities Exchange Co., Ltd. (LGFEX)	Public	LGFEX will serve as a new trading platform and accelerate the management of market risks in purchasing and selling goods. Its business scope covers commodity futures trading in energy, metals, and agricultural products. It will adopt a membership system and provide trading venues, facilities, and related services for commodity futures trading, supervise commodity futures trading, and prevent market risks	[35]

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Initiative	Initiative type	Summary	Source
National Integrated Extension and Research Program	Public	This integrated extension and research program within the existing MAF structure serves as the functional technical unit that is responsible for services like providing agricultural services, training subject-matter specialists, and others. It also incorporated the then National Agriculture Research Centre (NARC) within the extension system under the Department of Agriculture and Extension (DAE)	[36]
The Lao-IRRI Rice Research and Training Project (LIRRTP)	Public	This initiative aims to conduct rice research in the country and hold extensive training programs in the area of rice production and management practices	[36]
Lao Certification Body	Public	It inspects and provides organic certification for production (from planting to harvesting products, processing, storage, packaging, and sale) and processing systems (from product and raw material management to processing methods, packaging, transport, and distribution). It has developed two labels for 'clean agriculture': one for organic agriculture (mainly for rice, coffee, and crops) and the other for good agricultural practices	[37]

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APPENDIX A

MALAYSIA

Initiative	Initiative Type	Summary	Source
Business Incubators at Malaysian Life Sciences Capital Fund	Public-private	It has facilitated the transfer of advanced biotechnology for improving oil palm yields and reduction of waste to Malaysia through joint ventures, intellectual property rights transfers, and co-investments in shared technologies. The services that the incubator provides are typical VC services, including mentoring, oversight, and matchmaking with other tech companies and outside investors. The objective was to create an advanced biotech sector in Malaysia by transferring advanced technology across borders and by starting up local biotech companies	[1]
Gene Bank and Seed Center	Public	Its purpose is to produce planting materials and seeds endorsed by MARDI and recommended by the Ministry of Agriculture and Agro-Based Industry, to maintain purity and quality of planting materials acclaimed and commercialized by MARDI	[2]
Center for Marker Discovery and Validation	Public	Some services that the CMDV provides are high-throughput DNA extraction; germplasm profiling and diversity analysis; DNA fingerprinting of germplasm, hybrids, and parental lines; genetic purity assessment and hybrid purity testing; discovery and validation of molecular markers (SNP/SSR); marker assisted selection (MAS) and marker assisted backcrossing (MAB); bioinformatics analysis, and consultation on markers usage in agriculture and conservation	[3]
Malaysian Agricultural Research and Development Institute (MARDI) Technology Incubator	Public	The objectives of this initiative are to (1) accelerate the transfer and commercialization of MARDI's technologies that are ready for commercialization; (2) develop enterprises/business entities that are innovative and competitive; (3) support and accelerate the development of the agricultural industry; (4) provide an avenue for MARDI's researchers to be involved in the areas of development and commercialization; (5) create spinoff companies that would be involved and assist MARDI in its commercialization efforts; and (6) establish smart partnerships between entrepreneurs and technology generators in order to keep abreast with the challenging local and international markets It offers four services, i.e., technical services; physical infrastructure; legal assistance and IPR management; and business, marketing development, and networking services	[3]
MARDI Technology Management Research	Public	It researches (1) the interface of business, technology, engineering, and science within the agriculture and agro-based industry; (2) demand for technology in the agricultural industry; (3) technology impact assessment of MARDI's technology as well as gathering of feedbacks regarding the strengths and weakness of the technology; (4) impact assessment of the existing technology delivery systems, aimed at improving the technology transfer and commercialization mechanism; (5) agricultural development and implication on natural resource use for sustainable development; and (6) ex-ante assessment of new technologies focusing on the identification of information gap, technology evaluation, and commercial viability of the technologies	[4]

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Initiative	Initiative Type	Summary	Source
MARDI technology Test Bed system	Public	This project provides a food processing technology laboratory, equipped with all the facilities and small-scale equipment, where entrepreneurs will be given guidance and training in terms of product development and MARDI's latest technology Objectives are to (1) provide practical training facilities to entrepreneurs and other SMEs under the Entrepreneur Guidance program; (2) increase the knowledge and skills of selected entrepreneurs in using the latest production technologies and systems for the production of existing products and new products for market testing; (3) increase and assure the quality of existing and new products developed by the entrepreneurs; (4) support the training program conducted by MARDI, NATC, and Ministry of Agriculture and Agro-Based Industry; and (5) encourage research officers to use the testbed facilities to test new products for upscaling purposes	[5]
MARDI Training Program	Public	This program provides training and training consultancy services in the agricultural and food sector. MARDI has a staff of more than 400 researchers from various science and technical disciplines and expertise. This is supported by a relatively complete infrastructure and networking with experts at the national and international levels. The institute is able to provide training and training consultancy services of high quality to clients locally, nationally, and regionally	[6]
Industrial Training	Public	As a government agency entrusted with the role of generating technologies on agriculture and agro-based industry as well as the promotion and commercialization of these technologies, MARDI is now the focus of both public and private institutions of higher learning within and outside the country to provide industrial training to their students. In order to realize its corporate social responsibility to the nation, MARDI provides the opportunity and facilities for industrial training to students of public and private institutions of higher learning to apply the knowledge, skills, and experience gained from a real working environment, thus increasing their marketability for employment	[7]
MARDI Training Complex	Public	It provides support services to organize technical training and courses, meetings, and events besides providing accommodation facilities to the participants	[8]
MARDI Promotion & Business Development Centre	Public	The main function of the center is to transfer and promote MARDI's Technologies to target groups, especially the public sector and entrepreneurs like traditional and animal-husbandry farmers. The mission is technology development and transfer required for the transformation of the agricultural and food sectors into modern, commercial, innovative, and competitive sectors The objective is to increase the level of technology usage amongst existing entrepreneurs (smallholders and livestock farmers), to develop technology-based small and medium entrepreneurs (SMEs)	[9]
Knowledge Center	Public	Its objectives are to (1) be a premier research library providing relevant information and services on tropical agriculture and its related fields in support of the institute's mission; (2) develop and maintain library collections at MARDI headquarters and all its stations in support of the institute's programs and activities; (3) provide excellent information services in agriculture and its related fields; (4) provide a conducive environment for research, reading and learning; (5) promote IT in a library environment; and (6) contribute effectively in the development of the institute and the country	[10]

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Initiative	Initiative Type	Summary	Source
MARDI Laboratory Services	Public	Food and agriculture products in markets need to have assurance in quality and safety. For that purpose, the laboratories provide services in food and agricultural analysis. These services are tailored to individual needs through expert, prompt, and cost-effective laboratory analysis. The laboratories are equipped with state-of-the-art equipment and experienced staff to provide chemical and microbiological testing of food, feed, and agricultural samples. The laboratories are also awarded with ISO/IEC 17025 certification from the Department of Standard Malaysia (DSM), which gives clients the confidence that the laboratories are being operated at a competent level	[11]
MARDI Quality Assurance System (MQAS)	Public	The objective of MQAS, a voluntary quality assurance program, is to endorse the quality of processed food products produced by companies under MARDI's Entrepreneur Development program	[12]
MARDI e-Services	Public	These facilitate the flow of information, transparency, and job vacancies	[13]
MARDI	Public	The objectives are following: Conduct research in science, technical, economy, and social fields with regard to (1) production, utilization, and processing of all crops (except rubber, oil palm, and cocoa), livestock, and food; and (2) integrated farming Serve as a center for collecting and disseminating information and advisory services pertaining to scientific, technical, and economic matter related to food, agriculture, and agro-based industries. These functions are accomplished through various methods including publication of reports, periodicals, and related papers and organization of exhibitions, conferences and seminars, and lectures Serve as a center that provides expert services in the food, agriculture, and agro-based industry, e.g., consultancy services, laboratory analysis, quality assurance, and contract research and development (R&D) Provision various forms of trainings to cater to the development of the food, agriculture, and agro-based industry Provision aid for pure and applied scientific, technical, and economic research and development related to the food, agriculture, and agro-based industry Maintain liaison with local and foreign public and private organizations engaged in scientific, technical, economic, and social research related to the food, agriculture, and agro-based industry Conduct commercial research and production Develop, promote, and exploit the research findings Provide extension services to the agriculture, food, and agro-based industry	[14]
Food Safety Research Centre (FOSREC)	Public-Private	The objectives are to (1) enhance the scientific knowledge and practices in food safety throughout the supply chain; (2) assess the microbiological and chemical food safety risk and develop tools to detect the risk; (3) develop the strategy in the reduction of food chemical contaminants and food pathogens; (4) Broaden the research opportunities in food safety for undergraduate and postgraduate students at Universiti Putra Malaysia; and (5) promote collaborative research efforts related to food safety and risk assessment; and promote the development of private and public partnerships	[15]

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Initiative	Initiative Type	Summary	Source
Young Agropreneur Program	Public	The approach of this program is to facilitate and encourage the involvement of the target group in entrepreneurship (agropreneur) based on agricultural activities. These include all activities within the agricultural industry value chain, encompassing the agricultural sector, such as crops, livestock, and fisheries; marketing, technology, and innovation; as well as special projects such as agrotourism and the agro-based industry	[16]
Urban Agriculture programme	Public	This is designed to help urban households reduce their cost of living through the production of their own food with the guidance of the Department of Agriculture. The integration of agriculture in urban planning and development is essential for sustainable development in terms of sustaining the needs of city life The objectives are to (1) encourage urban communities grow and produce their own food to meet their daily needs and reduce the cost of living, as an additional income for urban community through the sale of surplus produce; (2) support the government's efforts to ensure food quality and food security; and (3) promote awareness and interest on the importance of agriculture as a direct contributor to the well-being of urban communities and their surroundings	[17]
Doktor Pokok Development Clinic	Public	It is a place where the public can channel and resolve any issues pertaining to agricultural activities. Here, the clients of the clinic can meet and interact with experts in various agricultural fields and obtain information. This is a program by the Department of Agriculture that offers agricultural extension services as its core service	[18]
Registration of National Plant Varieties	Public	The objectives of the National Plant Variety Registration are to (1) record the inventory of genetic resources found locally; (2) give recognition to varietal owners; (3) serve as a state reference and varietal identification; and (4) serve as a basic source of varieties	[19]
MOA Laboratory Analysis Services	Public	The Analysis Service Section, Management and Conservation of Soil Resources Division, provides laboratory services to conduct analysis on the nutrient content in soil, leaf, fertilizer, and water samples. The main objective of the service is to support the implementation of development programs conducted by the Department of Agriculture	[20]
Land Assessment Service	Public	Department of Agriculture is the main agency that provides services on land assessment and acts as the custodian for the national land information. It provides land certification for planting, land survey, and land crop suitability report	[21]
Soil Fertility Service	Public	The Soil Fertility Service functions to identify and develop fertilizer technologies and management of soil fertility in order to increase crop production in addition to the development of the agriculture industry. Advice on soil fertility is given to farmers/entrepreneurs to solve their problems regarding soil management and fertilization. Department of Agriculture also assists by conducting soil fertility technology promotions and technology observations for soil management issues faced by the farmers/entrepreneurs	[22]

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Initiative	Initiative Type	Summary	Source
Soil Conservation Service	Public	Department of Agriculture produces soil conservation guidelines for land development in order to ensure soil preservation. Consultation and extension programs including field training are also provided to the planters and public. In order to assist in reducing soil erosion due to the development of a specific area, Department of Agriculture has provided a soil erosion risk map for Peninsular Malaysia, based on the Universal Soil Loss Equation. The information contained in this map enables planners to evaluate the potential of disaster caused by soil erosion and recommend the appropriate soil conservation methods required to reduce the erosion of soil	[23]
Land Utilisation Survey Service	Public	DOA collects and updates information on the use of land for agricultural and non-agricultural sectors from time to time. This will help land development planners use these data to analyze changes in land use patterns in the country for the purpose of planning development projects effectively. In addition to a systematic land utilization survey, a complete land utilization survey is also conducted for special projects such as those for coconut planting, paddy, oranges, and other projects as requested by various parties within the department. The survey is conducted with the purpose of acquiring the crop status or the mapping area for a specific crop. Usually, these activities are conducted in collaboration with the State Department of Agriculture and other governmental agencies	[24]
Geospatial Documentation	Public	The Department of Agriculture has set up a repository of land information, land use, soil erosion, soil conservation, and related data of land resources in Peninsular Malaysia where this information is very useful either for other government departments or for private parties who implement development projects. Information that has been updated is provided in the form of maps and geospatial documents may also be purchased through the Division of Land Resources Management and Conservation, Department of Agriculture	[25]
Malaysia Fumigation Accreditation Scheme	Public	This is to eradicate pests and diseases in agricultural produce in many countries. Although the method used, especially the use of methyl bromide (CH3Br), is acknowledged to have the potential to negatively impact the environment, fumigation continues to be considered as the appropriate method to free agricultural produce from pests and diseases. Malaysia has established a Fumigation Accreditation Scheme to ensure that all fumigation needs and requirements are aligned with the global best practice as outlined in the Australian Methyl Bromide Fumigation Standard	[26]
Crop Pest Diagnostic Services	Public	Plant Biosecurity Division provides diagnostic services on pests and diseases of crops to farmers, agriculture entrepreneurs, government agencies, private organizations, and individuals	[27]
Entrepreneurial Course on Food Processing Skill (PBU)	Public	The Entrepreneurial Course for Food Processing Skills has been conducted by the Department of Agriculture since 2002 to produce young entrepreneurs who are seriously involved in agro-based business such as frozen food, bakery, coconut-based products, fruit-based products, and snacks	[28]
Agriculture Certification Programme (IPSM)	Public	The program focuses on technical training with a balance of 30% theory and 70% practical studies. The curriculum comprises all cognitive, psychometric, and affective aspects. The curriculum offers the most relevant and up-to-date information according to the current needs to keep students at the forefront of the agricultural industry. It is in accordance with the Malaysian National Agro-Food Policy aiming to increase food production to meet the domestic demand and develop a high-value agricultural product that can contribute to national income and agricultural entrepreneurs	[29]

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Initiative	Initiative Type	Summary	Source
Agro Youth Entrepreneur Incubator Programme (IUBT)	Public	This program is intended at developing agriculture entrepreneurs among youths and college graduates through hands-on training for commercial food crop production	[30]
Entrepreneur and Farmers Course	Public	The Department of Agriculture is responsible for the transfer of agricultural technology to clients through its development program. All of its technological development effort is centered around enhancing the income of clients that are involved in the field of agriculture by giving focus on guidance and training in order to enhance the agriculture entrepreneur's level of skills in the field of technical agriculture, entrepreneurship, and farm management	[31]
Malaysia Skill Certification Programme	Public	It develops the National Occupational Skill Standard (NOSS) for the country's agriculture industry, which includes the national agricultural sectors such as food crop sector, plantation (estate), livestock, fisheries, and agriculture-based food processing	[32]
Malaysian Good Agricultural Practice Scheme	Public	This is a certification scheme drawn up by the Malaysian Department of Agriculture in 2002. Formerly known as Good Practice Scheme of Malaysia (SALM), it recognizes farms that practice a resource management system in agricultural production on a sustainable basis. This system can improve farm productivity and produce safe and quality food. It also takes into account the welfare, safety, and health of workers and employees; and involves preserving the environment. It is to be practiced by farm operators in carrying out activities in the field in order to produce fresh-quality products that are safe to eat	[33]
Malaysian Organic Certification Scheme	Public	This is a certification scheme drawn up by Malaysian Department of Agriculture to recognize farms that practice organic farming based on Malaysian Standard. It is to be practiced by farm operators in carrying out activities in the farm in order to produce better quality organic products that are safe to eat	[34]
Malaysian Phytosanitary Certification Assurance Scheme (MPCA Scheme)	Public	Export of agriculture commodities to overseas, especially plants and plant produce, requires Phytosanitary Certificate (PC) from exporting country for verifying that the consignment is free from pest/disease and soil. Therefore, the PC is a requirement for such exports. Th MPCA Scheme has been initiated by Department of Agriculture with the objective to provide certification to farm/nursery, packing house, and factory owners to have a quality phytosanitary system in place that complies with International Standard Phytosanitary Measures (ISPMs) and meets the requirements of the importing country	[35]
Malaysian Heat Treatment Accreditation Scheme (MAHTAS)	Public	MAHTAS is a scheme offered by Department of Agriculture to companies that are interested in doing heat treatment on wood packaging materials (WPM) in compliance with the International Standard of Phytosanitary Measures Number 15 (ISPM (15) and World Trade Organization (WTO)	[36]
Seed Certification Scheme	Public	Using verified planting materials guarantees the authenticity and quality of breeds. Pure and quality crop production can only be done through strict procedures of crop production and achievement of set standards. To realize these objectives, the Department of Agriculture has established a Seed Certification Scheme (SPBT)	[37]
Paddy Seedlings Verification Scheme	Public	The main objective of this scheme is to certify the genetic purity and variety identification of the paddy seedlings produced. This scheme is made available for the production of legalized paddy seedlings by appointed producers only	[38]

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Initiative	Initiative Type	Summary	Source
Plant Variety Protection (PVP)	Public	PVP is a form of intellectual property rights (IPRs). The objectives of the Act are to (1) provide for the protection of the rights of breeders of new plant varieties, and the recognition and protection of contribution made by farmers, local communities, and indigenous people towards the creation of new plant varieties; (2) encourage investments in and development of the breeding of new plant varieties in both public and private sectors; and (3) provide for related matters	[39]
The Permanent Food Park (TKPM)	Public	TKPM was designed as one of the strategies, under the 3rd National Agriculture Policy (DPN3), to encourage the implementation of large-scale, commercial, and high-technology agriculture projects by entrepreneurs and the private sector The objectives are to (1) develop a permanent zone for food productions; (2) encourage the involvement of entrepreneurs and the private sector in large-scale and commercial farming; (3) increase the involvement of private-sector companies as anchors to promote marketing and value-added activity; (4) target the net monthly income per participant to be at least RM3,000; and (5) increase the national food production, quality, and sustainability while also improving the Good Agriculture Practice (GAP)	[40] [41]
AgriMaths	Public	AgriMaths is one of the mobile apps developed under the project of e-Agriculture Extension. This is an initiative by the Department of Agriculture to transform agricultural extension services through mobile platforms to be accessed anytime anywhere. This application is an adaptation of the book 'Agricultural Mathematics' issued by the Department of Agriculture. It contains calculation methods for vegetable crops, as well as short-period crops, fruits, paddy, coconuts, mushrooms, honey and stingless bees, fertilizers, pesticides, agricultural engineering, fertigation, and cash flows. It serves as a quick reference and handy guide for agricultural extension officers as well as agroentrepreneurs	[42]
100 Tip Tanaman	Public	This is one of the mobile apps developed under the project e-Agriculture Extension. This is an initiative by Department of Agriculture to transform agricultural extension services through mobile platforms to be accessed anytime anywhere. It contains 100 brief and comprehensive tips about crop and plant care. The app is useful for quick reference and handy guidance, suitable for all ages. Plus, it is simple to use, user friendly, and can be easily accessed through smartphones	[43]
Report on Paddy Pest Attack	Public	The Report on Paddy Pest Attack is one of the new initiatives of Department of Agriculture to diversify its service outreach to its customer and other people. The MySMS Service will enable farmers to report addy pest problems including pest attacks and paddy diseases through SMS. This will enable immediate action to be taken by Department of Agriculture. Through this portal service, initial warning on pest attack can be issued swiftly and round the clock	[44]
Extension Media Catalogue Service	Public	This is part of the Department of Agriculture's new initiative to diversify its method of expanding services to its customers and eventually to the public. The MySMS Service will enable people to acquire the Extension Media Catalogue into their emails via SMS. The Extension Media Catalogue will contain the list and price of books on planting manuals and technology packages sold by the Department of Agriculture	[45]

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Initiative	Initiative Type	Summary	Source
Development of Fruits Industry	Public	The objective is to ensure that the quality of fruits supplied is high and meets the demand of fresh fruits in the country through observations and technology promotions, among other means	[46]
Development of Paddy Industry	Public	The objective is to ensure stable production of rice and focus on plant productivity for increased farmer income, improved farm infrastructure, and promotion of management-based business and technology	[47]
Development of Coconut Industry	Public	The objectives are to improve wellbeing of smallholder coconut farmers and meet the needs of the processing industry, as well as to generate new sources of growth in the agricultural sector; increase coconut yield through the planting of hybrid species and replanting activities; and create business opportunities along the value chain	[48] [49]
Development of Vegetables and Crop Farming Industry	Public	The objective is to raise the income of farmers, increase productivity and exports, and improve private sector's involvement by concentrating on the development of main food crops	[50]
Construction of Agriculture Complexes	Public	The objective is to develop agricultural complexes to provide technical services, such as the development of commodities, crop protection, land management, and training as well as to provide support to extension services	[51]
Development of Potential Commodity Industry	Public	The objectives are to incentivize the development of potential commodity industries; meet the demands of processing centers for quality raw materials; and establish strategic alliances between the industry, research, government, and the private sector	[52]
Agricultural And Food Business Development Center (Agri-BDC)	Public	Agri-BDC provides updated information on investment opportunities at all levels in the supply chain for all subsectors of crops, livestock, fisheries, and processed foods. The objectives are to (1) provide up-to-date information on investment opportunities at all levels in the supply chain for all sub-sectors of crops, livestock, fisheries, and processed foods; (2) attract and persuade existing investors and investors to invest in the agriculture sector, especially food subsectors; and (3) become a reference center for the planning process and implementation of agricultural sector investment	[53]
The High Impact Product Matching Grant (HIP) Program	Public	This program provides assistance in the form of matching grants covering the following: nutrition studies and product lifespan; packaging and labeling design; increased production capability; and addition of premises to certification	[54]
MOA Tax Incentives	Public	The objective of this initiative is to provide incentives to farmers to increase productivity and support the development of the agricultural sector	[55]
Club Graduate Entrepreneur Club (MYAGROSIS)	Public	The objective of this initiative is to help the country tackle its food import deficit. Agrobank will provide a guarantor-free loan scheme to MyAgrosis members with a ceiling of RM30,000 to venture into agrobusinesses. Tekun will provide funds for MyAgrosis participants while the ministry will provide facilities for MyAgrosis programs such as hydroponics and water-supply systems	[56] [57] [58]
Online Agricultural Information System and Investment Application (SIAPP)	Public	The objective of this initiative is to manage the tax incentive application of agrofood sector by eligible individuals and companies	[59]

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Initiative	Initiative Type	Summary	Source
ICT Complaint Management System	Public	This is a channel for the Ministry/Agency and the public to channel information or complaints regarding corrupt behavior or violation of the code of conduct. The SART unit will process, review, and evaluate information or complaints received before further action. If corruption is confirmed, then it will immediately be channeled to the Malaysian Anti-Corruption Commission (MACC) operations system for further investigation or intelligence purposes. In the event of a violation of the code of conduct, action will be taken by the Integrity Unit	[60]
Enterprise Knowledge Repository Information System (EKRIS)	Public	The objective of this initiative is to store and disseminate information about the scope of agroenterprises in Malaysia for research and other non-research purposes	[61]
Rural Transformation Center (RTC)	Public-Private	Rural Transformation Center (RTC) is a modern market infrastructure development project that connects the manufacturers and suppliers to users. Th RTC acts as an agriculture wholesale center and also plays additional roles of an information collection center and a food safety and efficiency driver center, including for agrotourism	[62]
Contract Farming	Public	The Contract Farming program is a high impact program that is being introduced as one of the mechanisms to aid small- and medium-scale agricultural entrepreneurs to ensure that their production of agriculture products is getting a fair return. In this program, the farmers agree to supply the quantity, quality, and delivery schedule specified beforehand and the buyers agree to guarantee the purchase from the farmers at an agreed price	[62]
Collection Center (CC)	Public	FAMA has set up Collection Centre (CC) and Collection Complex (KPL) at the agricultural production output stage. This project is aimed at resolving the agricultural marketing problems through post-harvest handling practice, quality-grading improvement, and labeling as an agriculture information channel. As of date, FAMA had set up 91 collection centers comprising 2,232 participants	[62]
Distribution Center (DC)	Public	FAMA has also created distribution centers in major town areas near to the wholesale market complexes. The DC acts as a product-received and value-added center, which later distributes agricultural products to supermarkets and institutional networks. Distribution centers are equipped with facilities for repackaging, storage, fermentation, and logistics delivery services. They also serve as information distribution centers to farmers and producers on aspects related to product marketing and technology. Currently, there are as many as 14 FAMA DCs operating nationwide	[62]
Malaysia's Best	Public	Malaysia's Best is a symbol of quality and food safety for Malaysian agriculture products. It guarantees the users that these products have received the quality standard approved by the MOA. The Malaysia's Best program was drafted in order to create an effective umbrella brand for the purpose of promoting Malaysia's agricultural products in both local and international markets. It is also aimed at capturing the consumer's confidence in the quality and safety of domestic products and further enhance a good image for Malaysian agricultural products	[62]
Supply & Demand Virtual Information (SDVI) Matching System	Public	SDVI is an integrated system that was developed by FAMA to monitor the market conditions by identifying demand and supply of agricultural products. SDVI's main objective is to assist the agricultural sector's growth through information and communications technology (ICT) by introducing a system that integrates marketing information and supply conditions	[63]

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Initiative	Initiative Type	Summary	Source
Mega Farmers Market	Public	The Mega Farmers Market was introduced to give a new image and further maintain farmers' market competitiveness. It is a successful effort for both agricultural entrepreneurs and manufacturers who participate in the agricultural market (e.g., farmers and fishermen). The Mega Agricultural Market has introduced several new features such as fun and customer friendly environment, better display of goods, and a more hygienic and wider shopping space. Until end of 2006, there were 35 Mega Agricultural Markets in operation	[62] [63]
Fresh Fruit Stalls (GBBS)	Public	It is basically a network of fruit stalls owned by local entrepreneurs who have been chosen for upgrading purposes with a uniformed, clean, and attractive arrangement of products. GBBS has become an alternative channel for consumers to get quality fruits and as an opportunity for entrepreneurs to increase their fruit business. It is an effort to attract the public to get direct supply and further upgrade the consumption per capita of local fruits. Currently, FAMA has successfully created 163 entrepreneurs with 326 stalls nationwide	[62] [63]
OLEMAS	Public	OLEMAS is a national brand of small and medium industry (SMI) food products that pass a quality standard to compete with other products in the market	[62] [63]
AGROMAS	Public	AGROMAS is also a product brand distributed by FAMA. The products chosen under the brand have the potential to be developed. AGROMAS comprises FAMA's own products and advances local SMI entrepreneurs	[62] [63]
Systems Development And Market Control	Public	In this globalization and liberalization era, the competition is very stiff. Quality factors such as application standard and traceability, a good and attractive packaging, etc. create an advantage for a product. FAMA will implement Federal Agriculture Marketing Authority Rules and Guidelines (grading, packaging, and labeling of agriculture produce), which set the following: agricultural produce grading standard, agricultural produce packaging standard, packaging labeling standard, and certificate of production for export agricultural produce	[62] [63]
E-Permits	Public	FAMA has also applied E-Permit to enable import permit to be issued electronically. Information on all approved import permits is sent electronically to Malaysia Customs Department. This system is web based. E-Permit was implemented in early 2004 and FAMA is among the first government agencies to implement this system	[62] [63]
Permanent Farmers' Markets	Public	Permanent Farmers' Market is a development project in which participants will be placed under one roof for carrying out daily businesses. This situation aims to increase the volume of transactions and the participant's income, while reducing the problem of marketing daily agricultural products. Permanent Farmers' Market will sustain farmers' retail market positioning, which focuses on fresh and quality products at affordable prices	[64]
The Economic Transformation Program (ETP)	Public	The Community Market and the Karavan or PARK are the Entry Point Projects (EPPs), which aim to modernize the market implementation under one concept through (1) modernization of trading in a permanent location according to clusters and designated trading times; (2) offering shopping experience in a modern and clean concept with the assurance of comfort to traders; (3) provisioning of platform/infrastructure as a site for community activities/activities; and (4) providing additional employment opportunities as well as increasing the entrepreneurial level and revenue target group involved	[65]

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Initiative	Initiative Type	Summary	Source
Farmer's Markets	Public	The establishment of the Farmer's Market is hoped to produce more responsive farmers as well as accelerate the socioeconomic development process of the farming community, in line with the National Agriculture Policy (NAP)	[66]
Farmer's Market Caravan	Public	The concept of the Farmers' Market Caravan is, 'mobile marketing of agricultural produce to the consumers.' It provides, through finished packaging, a good display of products that are neater and of high quality, and are sold at more competitive prices. The display image of participants' vans will be changed and allowed to trade in the available farmers' market sites The main objectives are to (1) expand the market for agricultural products; (2) increase farmers' incomes; (3) serve as a platform in introducing agricultural goods or new products; (4) encourage and provide a space to market products specifically to the Bumiputras; and (5) encourage the agricultural community, particularly the Bumiputras, to participate in trade	[67]
Three-Wheeled Motorcycle (M3R)	Public	The program was established following the rising needs to overcome the problem of excess agricultural products in rural areas. The Three-Wheeled Motorcycle entrepreneurs will act as collectors to purchase agricultural produce in villages and market them through different outlets The objectives are to (1) overcome poverty and provide employment opportunities for the rural population; (2) facilitate marketing of agricultural produce through middlemen entrepreneurs who purchase directly from farmers; (3) promote agricultural activities undertaken on a small scale among the villagers; (4) create new markets and new entrepreneurs in rural and remote areas; and (5) provide alternative marketing channels to small farmers and operators of agricultural produce	[68]
Agrobazaar Kedai Rakyat (AKR)	Public	AKRs are business premises owned by entrepreneurs conducting retail business of daily essential items, offering competitive prices with a display of attractive, systematic, neat, and uniform image throughout the country. The objective of the establishment of AKRs is to provide a place to collect, purchase, and sell agricultural produce cultivated by villagers, apart from selling essential items at predetermined prices; and to promote agribusiness activities	[69]
AgroBazaar Rakyat (ABR)	Public	This is an alternative channel of 'agromakanan' products market to help farming entrepreneurs market their products directly to obtain reasonable returns	[70]
AgroBazaar R&R	Public	The AgroBazaar R&R project is the FAMA retail outlet network at highway stops and serves as a center of marketing for the basic industrial products and local fruits. This project comprises retail outlets owned by FAMA and leased out to entrepreneurs as centers for sales and promotion of basic industrial products	[71]
Malaysia Mobile Market (PBM)	Public	A bus modified as a mini market enables movement of daily consumer goods directly to consumers in urban and suburban areas. It has the ability to distribute daily necessities, including consumer goods, to reduce the impact of price hikes and supply shortages. It aims to ease the burden of low- and middle-income people. Other objectives include creating a social service mechanism for the distribution of consumer goods and daily necessities to address the impact of rising consumer goods and shortages and creating alternative markets for promoting agro-based industrial products, especially Bumiputra products	[72]

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Initiative	Initiative Type	Summary	Source
Medan Niaga Satok (MNS)	Public	MNS is a collection and distribution center of various agricultural and agro-based industries. It is a one-stop entrepreneurial development center for agrotourism featuring a wide range of food products that are a unique attraction for tourists. It offers affordable prices for producers and consumers	[73]
The Contract Farm Supply (KUKUH) Strengthening Program	Public	This is aimed at strengthening the supply of vegetables and fruits in the market through the concept of direct selling (from farm to market). It helps to relieve inflationary pressure by offering more affordable prices than market prices, shortens the vegetable and fruit marketing chain, and offers better farm prices for producers	[74]
Agro-based Industry (IAT)	Public	The main focus of the Agro-based Industry (IAT) development program is to broaden and strengthen the SME product market as well as to develop competitive products in the domestic and global markets. Among the activities implemented include enhancing production capability and improving product quality by entrepreneurs in accordance with standards and good production practices; strengthening branding; developing a network of sales centers; and providing market access through carnival and promotional programs	[75]
AGROBAZAAR Malaysia Singapore (ABMS)	Public	ABMS is a 'specialty store' concept featuring 'fru-ce-rant,' i.e., Malaysian tropical fruits, Malaysian SMI products, and various Malaysian-style food menus. Singapore has made this outlet a center of promotion, sales, and distribution of Malaysian agrofood products in the international market	[76]
AGROBAZAAR Malaysia KLIA 2 (ABMKLIA (2)	Public	This is a FAMA retail outlet network that has the concept of 'Malaysia Cultural Experiences Store,' which was created at KLIA2 Airport. This outlet features Malaysian cultural elements such as unique, premium, and attractive agrofood products and provides hospitality services to foreign tourists through various programs and activities that provide new and exciting experiences. Objectives are to (1) serve as an alternative channel for users to get SMI products; (2) provide a platform for entrepreneurs to compete for a more open level; and (3) assist local entrepreneurs to market their products with a more organized and manageable concept	[77]
FAMA Market Education and Consulting Services	Public	This section is aimed at building the target group's capabilities through training, mentoring, advisory, and consultation in agrofood marketing. It also works to (1) transfer information, technology, and marketing skills to target groups through educational programs and advisory services; and (2) improve good marketing within the target groups towards food supply guarantees with value added to meet market demands	[78]
KopieSatu	Public	The objectives are to (1) be a leader for small and medium entrepreneurs in coffee-related industries; (2) meet the demand for the coffee industry and help promote the agro-based industry; and (3) raise awareness around the high-quality Malaysian coffee brand	[79]
Agrobazaar Online	Public	This is an agrofood virtual marketing platform that finds manufacturers, suppliers, and users. It provides world-class e-commerce infrastructure and operations to provide new and sustainable markets for agro products through the growth of online communities; and helps improve the quality of life of farmers and communities	[80]
External Market Promotion Activities	Public	The objectives of these activities are, strengthening existing markets; and new market exploration, in line with the intent of setting up the Food and Agro Council for Export (FACE) Council	[81]

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Initiative	Initiative Type	Summary	Source
Ladang Merdeka	Public	The program is based on the concept of rice farming on a commercial scale under centralized management, based on modern technology. The Ladang Merdeka (farm) is a commercial and large-scale farm management concept with an interest to liberate the target group, design farms with appropriate sizes, and help increase the income of participants Objectives are to address poverty issues through increased rice and non-rice yields; make use of abandoned paddy fields; liberate the paddy field owners and tenants; Increase productivity through estate-based management, efficient use of labor force, use of farm machinery, and effective and economical usage of agricultural inputs; and establish manufacturing operations	[82]
"Mini Estet Padi" or Plantation Estates Group	Public	This program is a collaboration of farmers cultivating rice in an integrated manner under the guidance of KADA	[83] [84]
Project 10 tons	Public	This initiative includes intensive counseling to a group of farmers to achieve production of 10 tons per hectare to be emulated by other farmers	[85]
KADA National Key Economic Area (NKEA) Project	Public	KADA NKEA is a Rice Estate Project with centralized management. KADA's goal in the management of NKEA project is to manage the pattern of rice plants more efficiently. Uniform activity will reduce expenses and also make it easier to carry out any activity of rice such as (1) distribution of irrigation; (2) use of plowing machine; (3) purchase of rice seeds; (4) purchase of inputs such as fertilizers and pesticides; (5) activities of spraying of herbicides and insecticides; and (6) harvesting The government's aims are (1) to increase the average yield from 4.0 tons/ha to 6.5 tons/ha; and (2) to increase per capita income from RM24,000 per year to RM48,000 per year by 2020	[86]
Non-Paddy Program	Public	This initiative manages 13 area farmers organizations in KADA that provide the ease of input supplies, marketing services, and other aid for the benefit of the local community in the area Objectives include (1) increasing the production of basic food through optimal usage of land and rejuvenating and reutilizing idle or problematic land; (2) producing entrepreneurs who utilize the latest technologies and are capable of managing commercial-level agricultural production activities; and (3) increasing value-added resources for downstream industries	[87]
KADA Baloh Negara	Public	The introduction of the KADA Baloh Negara concept was the main agenda of KADA under RMK9 aimed at making KADA the nation's center of food production. Goals include increasing production of rice, vegetables, fruits, livestock, aquaculture, and agro-based industry products, in addition to increasing the incomes of farmers, livestock herders, and agropreneurs within KADA. This program focuses on improving production, product quality, diversity of value-added products, management technology, and farmer participation	[88]
National Agro-Food Policy	Public	The objectives of the NAP 2011–20 are to (1) ensure adequate food supply and food safety; (2) develop the agrofood industry into a competitive and sustainable industry; and (3) increase the income level of agricultural entrepreneurs. In order to achieve these objectives, the NAP introduced seven strategic directions: (1) ensure national food security; (2) increase the contribution of the agrofood industry to GDP; (3) complete the value chain; (4) strengthen human capital; (5) strengthen R&D activities, innovation, and technology usage; (6) create private-sector-led business; and (7) strengthen the service delivery system	[89]

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Initiative	Initiative Type	Summary	Source
MyAgric	Public	Malaysian Agricultural Information Portal (MyAgric) is a portal that contains information on Malaysian agricultural science and technology, including forestry, animal husbandry, fisheries, food science, environment science, and natural resources. This portal is a concept for websites and union catalogues that serve as gateways to Malaysian agricultural information	[90]
National Agribusiness Terminal	Public-Private	National Agribusiness Terminal (TEMAN) is a modern food-supply center linking production and consumption. It does consist of a central trade area for collecting and redistributing agricultural products that contribute to satisfy the national food demand	[91]
Prima Halal Food Park	Public	The food park offers advisory services in processing, manufacturing, distributing, and marketing halal delicatessen; over 522 commercial delicatessen recipes; customer accreditation for its products and premises; 68 factory units for 68 SMIs; and storage and packaging centers. By commercializing research and promoting halal foods, Prima Halal Food Park aims to be the production hub of the halal delicatessen and meat products for the world	[92]
Halal Industry Development Corporation (HDC)	Public	To facilitate investment in halal-related manufacturing sectors, HDC was established as a one-stop agency in the development of the halal industry. HDC will work closely with potential investors and government bodies to position Malaysia as the most attractive place in the region to invest when halal-related manufacturing is concerned	[93]
Melaka Halal Park	Private	Its mission is to offer high-quality development services to become a leader of competitive entrepreneurs at the global halal level in 2030	[94]
POIC Lahad Datu	Private	POIC is a halal park operated by a palm oil industrial cluster. It offers opportunities for investment in downstream palm oil industries such as oleochemicals; nutraceuticals; phytonutrients; transfat free food products; biomass (palm pellets, fiber, biofuels, bioethanol, biobased chemical, wood composite, etc.); ship repairs; logistics; oil and gas; petrochemicals; furniture; machinery; halal products; food; and SMEs Some objectives are to, (1) fully develop and realize the upstream and downstream potentials of the palm oil industry; (2) add higher value in both the upstream and downstream production chains; and (3) strengthen Sabah's competitive edge in the palm oil industry through research and development and technology inputs	[95]
Tanjung Manis Halal Food Park	Public-Private	Tanjung Manis Halal Park is the first one-stop halal park in east Malaysia for upstream and downstream halal food and manufacturing activities	[96]
Halal Penang	Public-private	Its objective is to serve the growing global consumer demands for halal products, services, and solutions. Some of its functions include facilitating investment, managing capacity building, assisting in marketing strategies, R&D, assisting with efficient sourcing, production, and distribution, and more	[97]
ECER Pasir Mas Halal Park	Private	Pasir Mas Halal Park is an industrial park designed to produce high-value downstream halal food products such as nutraceuticals, herbs, spices, and meat-based products. The park is developed on around 44 ha land consisting of an Entrepreneur Business Complex (EBC) which caters to small and medium enterprises and also bigger players	[98]
Nusajaya Tech Park	Private	Nusajaya Tech Park offers a pro-business environment with cluster-oriented customer base where companies can co-locate and derive synergies with their customers and suppliers in a single location. Its goal is to be a mecca for businesses with its ultramodern developments and unparalleled growth opportunities	[99]

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Initiative	Initiative Type	Summary	Source
Malaysian Global Innovation and Creativity Center (MaGIC)	Public	MaGIC hosts a number of programs, accelerators, and incubators to advise and develop a variety of startups from tech to food. Its goal is to build a sustainable entrepreneurship ecosystem and to catalyze creativity and innovation for long-term national impact	[100]
Putra Science Park	Public-private	Putra Science Park offers a number of services in high-tech facilities, including IP services, innovation promotion, innovation training, research clusters, business incubator labs, and microcredit development. Its mission is to make meaningful contributions towards wealth creation, nation building, and universal human advancement through the exploration and dissemination of knowledge	[101]
Agrobank	Public-private	This initiative's objectives are to (1) promote Malaysia's agricultural development; (2) coordinate and supervise the grant of credit from public funds for agricultural purposes by various persons or bodies of persons whether incorporated or not; (3) provide financing, advances, and other credit facilities for the development of the agricultural sector and agriculture-related businesses; (4) mobilize savings with particular regard to the agricultural sector and in furtherance of the objective to accept savings and time deposits; (5) uplift the wellbeing of the agricultural community; and (6) carry on the general business of a modern and progressive financial services institution catering to the total financial needs of its customers	[102]
Farmers' Organization Authority	Public	The Farmers' Organization, established under the 1973 Famers Organization Act, is an institute owned by the farmers. The objective of the establishment is to improve the social and economic standard of farmers, increase their knowledge and skills, increase their revenue and income, improve the lives of its members; and create a progressive, independent, prosperous, and integrated farming community	[103]
MUDA Agricultural Development Authority (MADA)	Public	MADA was founded to operate and maintain the Muda Irrigation Scheme, the largest rural development scheme launched under the First Malaysia Plan. MADA was given the responsibility of designing and implementing agricultural development programs to improve the standard of living for family farmers in the Muda area	[104]
Agrotourism Sites and Programs	Public-private	The objectives of this initiative are to increase the added value to farmers and producers and to improve their wellbeing by enhancing opportunities for tourism in Malaysia	[105]
Malaysian Pineapple Industry Board (MPIB)	Public	The objective of this initiative is to strengthen the country's pineapple industry globally via technical services and physical assistance up to the marketing level in a more creative and innovative manner MPIB offers a diverse set of services under different governing divisions, including a crop expansion and development division, a strategic planning division, a marketing and agro-based division, a management services division, a licensing and inspecting division, a technology division, and more. In general, its roles include conducting research on agronomy programs; discussing the pricing and grading of pineapples to factories, and providing marketing and financial assistance	[106]

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Initiative	Initiative Type	Summary	Source
Malaysian Palm Oil Board	Public	MPOB is a research and development institution that strives to provide leadership and impetus for the development of a highly diversified, value-added, globally competitive, and sustainable oil palm industry Its mission is to enhance the well-being of the Malaysian oil palm industry through sustainable development, value addition, and higher income. It promotes technology transfer for commercialization, engages in R&D efforts from biotechnology to product development and from integration to extension services, organizes human resource development and training programs, coordinates with national and international bodies to strength the palm oil industry, and carries out licensing and regulation enforcement	[107]
Malaysian Rubber Board (MRB)	Public	The primary objective of MRB is to assist in the development and modernization of the Malaysian rubber industry in all aspects ranging from cultivation of rubber trees and extraction and processing of raw rubber to manufacturing of rubber products and marketing of rubber and rubber products. MRB established the Academy Hevea Malaysia (AHM) to provide skills training and expedite technology transfer, and it provides Global Testing and Consulting for Rubber (G-TACR), as well as other kinds of product certification schemes. It also conducts research and continues to develop standards for the rubber industry	[108]
Malaysian Cocoa Board (MCB)	Public	MCB's main objective is to develop the cocoa industry in Malaysia to make it well-integrated and competitive in the global market. Emphasis is given to increasing productivity and efficiency in cocoa bean production and increasing downstream activities. It offers the following services: technology R&D and product development, regulatory and quality control, target groups development, extension and transfer of technology, and technical and advisory services	[109]
Soil Management, Soil Survey and Mapping Services	Public	The objective of this initiative is to accurately map spatial soil data to maximize the use of certain lands for the production of agricultural products and to foresee potential soil threats that would affect productivity	[110]
Malaysia Quarantine and Inspection Services (MAQIS)	Public	The objectives of this organization are to (1) ensure that the nation's agricultural industry is free from the threats of pests, diseases, and contaminations through quarantines, inspections, and effective enforcement; (2) ensure that the plants, animals, agricultural produce, food, etc. imported into and exported out of Malaysia abide by the mandatory standards at entry points, quarantine stations, etc.; (3) help exporters in all issues related to marketing access and comply with the requirements of the exporting country through an integration service; and (4) improve the service delivery system for customers by using a more efficient and integrated source. It has a number of functions, from issuing licenses, certificates, and permits, to enforcing laws, establishing quarantine facilities, and providing advisory services	[111]
TEKUN Nasional	Public	TEKUN Nasional is an institution that provides business opportunities as well as income generation opportunities, business capital financing, and guidance and support services as well as providing a networking platform for entrepreneurs. Its mission is to become a leading micro financing institution	[112]

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Initiative	Initiative Type	Summary	Source
Federation of Livestock Farmers Association of Malaysia (FLFAM)	Private	FLFAM's primary role is to provide a forum for discussions and collective actions seeking solutions for the common problems of pig and poultry farmers so as to safeguard their common interests. The organization has 14 official subject-specific associations on livestock breeding, animal husbandry, poultry, etc. The objectives are to (1) accelerate the liaison among various livestock associations for common efforts striving for the benefits of members as well as the betterment of the livestock industry; (2) provide a channel of communication with the government agencies to ensure that the interest of the industry is considered in policy decisions; (3) safeguard the welfare and legitimate interest of the livestock farming community; and (4) advance the technical knowhow of the livestock industry	[113]
Technofund	Public	TechnoFund is a grant scheme, which aims to stimulate the growth and successful innovation of Malaysian enterprises by increasing the level of R&D and its commercialization. The scheme provides funding for technology development, up to pre-commercialization stage, with the commercial potential to create new businesses and generate economic wealth for the nation It has the following objectives: to undertake the development of new or cutting-edge technologies or further develop/value-add existing technologies/products in specific areas for the creation of new businesses and generation of economic wealth for Malaysia; to undertake market driven R&D towards commercialization of R&D outputs; to encourage institutions, local companies and inventors to capitalize their intellectual work through intellectual property (IP) registration; and to stimulate the growth and increase capability and capacity of Malaysian technology-based enterprises, Malaysian Government Research Institutes (GRI) and Institutions of Higher Learning (IHL) through both local and international collaborations. Agro-based industries and food are priority research areas	[114] [115]
ScienceFund	Public	ScienceFund is a grant provided by the government to carry out R&D projects that can contribute to the discovery of new ideas and advancement of knowledge in applied sciences, focusing on high impact and innovative research The objectives of ScienceFund are to support research that can lead to the innovation of products or processes for further development and commercialization; and/or to generate new scientific knowledge and strengthen national research capacity and capability. 'Agricultural sciences' is listed as a priority area	[116]
The Organic Malaysia Mark Scheme	Public-private	The Organic Malaysia mark is a label scheme operated by Organic Alliance Malaysia in collaboration with the Crop Quality Control Division, Department of Agriculture, Malaysia. The mark is for use by registered operators on certified organic products (domestic and imports) that comply with the Malaysian organic standard MS1529 and whose certification is approved by the Department of Agriculture. The Organic Malaysia mark scheme includes training support, audit visits of participating operators as well as market surveillance against unauthorized use or misuse	[117]

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Initiative	Initiative Type	Summary	Source
Domestic Certification and Imports	Public-private	Domestic farm operators and processors, including re-packers of bulk products, have to be certified to label their products as organic. Importers have to register for verification that certification of their imported organic products meet the Malaysian organic labeling regulation The Crop Quality Control Division, Department of Agriculture, Malaysia operates an organic certification program called Skim Organik Malaysia (SOM) for farm production and on-farm packing. Farm operators should contact the Department of Agriculture for certification under SOM to market their products as organic	[118]
Export Certification	Public-private	For exporting operators, OAM can arrange for export certification to the European Union, the USA, Japan, and other markets. Export certifications are facilitated through OAM's partnership in Certification Alliance (CertAll). Depending on the need, OAM can arrange for inspection and certification by one or more OAM partners in CertAll. Export certification can be coupled with domestic certification. Export-certified operators can register products to use the Organic Malaysia mark for the domestic market	[119]
Geographical Indications Act 2000 (GIA)	Public	Similar to IP, this act aims to protect the 'brand' of a 'geographical indication,' defined as an indication that identifies any goods as originating in a country or territory, or a region or locality in that country or territory, where a given quality, reputation, or other characteristic of the goods is essentially attributable to their geographical origin, whereby 'goods' are defined as including agricultural products. This creates added value through regional branding and marketing	[120]
The Malayan Agricultural Producers Association (MAPA)	Private	The principal objectives of MAPA, among others, are to (1) secure the complete organization of all agricultural employers in Peninsular Malaysia so that a common front is presented on labor and trade union matter; (2) promote, protect, and defend the interests of members and employers in general; (3) promote or oppose legislative or other measures affecting or likely to affect the interests of its members or of employers generally; (4) communicate with and make representations to public and similar authorities on all matters affecting the interests of members and other employers; and (5) cooperate with other associations, societies, or similar bodies in all labor and related matters As a trade union, the main roles and functions of the association are largely governed by its own rules as well as the provisions of the Trade Unions Act, 1959 and the Industrial Relations Act, 1967. This is reflected in the whole range of services provided to cater to the needs and interests of agricultural employers	[121]
Exemption from Import Duty & Sales Tax on Machinery & Equipment (MIDA)	Public	The objective of this initiative is to incentivize investment in Malaysian manufacturing plants and technology in key economic areas like agriculture	[122]
Exemption from Import Duty on Raw Materials / Components	Public	The objective of this initiative is to incentivize investment in Malaysian manufacturing plants and technology in key economic areas like agriculture	[122]
Reinvestment Allowance (RA) of 60% for 15 consecutive years	Public	The objective of this initiative is to incentivize investment in Malaysian manufacturing plants and technology in key economic areas like agriculture	[122]

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Initiative	Initiative Type	Summary	Source
Pioneer Status (PS) Income Tax Exemption 70 % or 100 % for 5 years	Public	The objective of this initiative is to incentivize investment in Malaysian manufacturing plants and technology in key economic areas like agriculture	[122]
Income Tax Allowances (ITA)	Public	The objective of this initiative is to incentivize investment in Malaysian manufacturing plants and technology in key economic areas like agriculture	[122]
The Industrial Master Plans (IMP1/IMP2/IMP3)	Public	The objectives of these policies were to promote the development of SMEs. IMP2 addressed several issues that included access to markets; increasing technology capabilities; enhancing the adoption of ICT; and increasing access to finance. In response, considerable attention was given to the provision of industrial infrastructure and amenities (such as SME industrial parks, comprising factory units and incubator facilities) to facilitate the expansion of SME activities at key locations throughout the country IMP3's focus was on upscaling the manufacturing sector towards higher value-added activities and upgrading capacity in the provision of related services. The plan also focused on transforming industrial businesses and complementary services of SMEs into strong knowledge-intensive and value-creating entities. Strategies adopted to achieve these goas included the acquisition of technologies to push SMEs up the value chain in the manufacturing, agriculture, and services sectors. The triple helix concept was implemented to encourage collaborative ventures and research involving transnational companies (TNCs), government-linked companies (GLCs), and SMEs; universities and research institutions; and state agencies to facilitate R&D, technology transfer and skills development as well as marketing	[123]
SME Masterplan	Public	SME Masterplan outlined 32 initiatives across all focus areas to achieve the desired goals, comprising six High Impact Programmes (HIPs); 14 initiatives under four thematic areas to create demand, pool resources, reduce info asymmetry, and build capacity and capability; and macro measures, e.g., trade facilitation system, bankruptcy law, taxation, foreign worker policy, etc.	[124]
SME Competitiveness Rating for Enhancement (SCORE)	Public	SCORE is a diagnostic tool used to rate and enhance competitiveness of SMEs based on their performance and capabilities. It was initially undertaken for companies in the manufacturing sector to gauge the effectiveness of the grants companies received to improve their business performance. It has also been used as a tool for business matching purposes for better market access as well as an initial indicator for purposes of access to finance One of the main objectives of SCORE is to provide comprehensive services in assisting the development of SMEs in Malaysia. With this in mind, SCORE has successfully established strategic partnerships with bodies from various industries that have the potential to assist and support SMEs in building their capacity and capabilities	[125]
SME Bank	Public	The bank plays an important role in supporting the Malaysian Government's economic and development initiatives such as the National Key Economic Areas (NKEAs) (2010–20) and the Financial Sector Blueprint (2011–20) SME Bank's objectives are to drive the nation's economic growth by providing not only financing assistance, but also development expertise to SMEs, allowing those businesses to prosper and grow	[126]

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Initiative	Initiative Type	Summary	Source
National Institute of Entrepreneurship (INSKEN)	Public	INSKEN hosts a variety of business development programs, like INSKEN Business Coaching (IBC), with the objective of developing quality and high-quality entrepreneurial ecosystems in order to drive a sustainable and sustainable national economy. IBC teaches effective business strategy and provides technical training for businesses like cafes, food trucks bakeries, and more	[127]
SME Corp. Malaysia	Public	SME Corp. coordinates the implementation of development programs for SMEs across all related ministries and agencies. It acts as the central point of reference for research and data dissemination on SMEs and entrepreneurs, and also provides business advisory services for SMEs and entrepreneurs throughout the country. It hosts programs from brand development to market access, etc. Its objective is to promote the development of competitive, innovative, and resilient SMEs through effective coordination and provision of business support	[128] [129]
SME Hub	Public	SME Hub aims to equip SMEs with filtered and focused information and knowledge to aid their development. With SME Hub, SMEs can access relevant information online and offline To ensure that this initiative covers SMEs in the rural areas, the SME Hub On Wheels was developed to assist in providing business advisory services to SMEs that are located in rural areas. Information provided in this initiative are not limited to programs that are implemented by SME Corp., but also those under various other organizations and government agencies, such as SSM, MARA, BNM, Telekom Malaysia, and POS Malaysia SME Hub is also the platform for SMEs and entrepreneurs to learn business best practices and obtain essential information on business startup, market access, human capital development, financial resources, industry knowhow, and various other business aspects The range of services offered at the SME Hub include business advisory services; SME Hub Links (collaborations with other government agencies and organizations); Pocket Talks; Info Centre (Info Mail, and Info Line); Resource Centre; SME Product Gallery; and Virtual SME Hub (SME Corp. Malaysia's website, and SME Info Portal).	[130]
National SME Development Council (NSDC)	Public	Among the strategic functions of NSDC are to (1) formulate broad policies and strategies to facilitate the overall development of SMEs across all sectors; (2) review the roles and responsibilities of the M&As tasked with SME development; (3) enhance cooperation and coordination of programs to ensure effective implementation of SME development policies and action plans; (4) encourage and strengthen the role of the private sector in supporting the overall development of SMEs; and (5) emphasize the development of Bumiputera SMEs across all sectors of the economy The NSDC's main goal is to ensure a comprehensive and coordinated development of SMEs across all sectors. The NSDC has made significant inroads in shaping the growth of SMEs in Malaysia, including creating the SME Credit Bureau, and establishing a periodic census for statistical updates	[131]
National Farmers Organization (NAFAS)	Private	The mission of this initiative is to build a competitive farmers' organization at global level based on effective farmer participation and to form a self-sustaining, prosperous, and united farming society. NAFAS has been involved in various business and investment activities, particularly in agriculture. At the beginning of its establishment, NAFAS has run retail, fertilizer marketing, and agricultural machinery businesses. One of its subsidiaries, NAFAS Bajakimia Sdn, is responsible for importing, transporting, and distributing supplies of sole and compound fertilizers to farmers throughout Malaysia, especially in rice cultivation	[132]

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Initiative	Initiative Type	Summary	Source
Malaysian Institute of Food Technology (MIFT)	Private	MIFT is a nonprofit professional body of food technologists and educators in the field of food science and technology, and other individuals involved in areas of work closely related to food technology. It is the only nongovernmental organization in Malaysia that brings together food scientists and technologists MIFT has the objectives to (1) stimulate scientific and technological research in various aspects of food technology; (2) provide a medium for exchange, discussion, publication, and dissemination on various aspects of food technology; and (3) promote the profession of food technology through raising educational standards, promoting the scientific approach to food, and increasing public awareness of the basic role of food technologists in industry All these objectives have the ultimate goal of promoting the application of science and technology toward improved production, processing, packaging, distribution, evaluation, and utilization of food in order to provide better and more adequate foods for mankind	[133]
Kuala Lumpur Commodities Exchange KLCE	Public-private	KLCE is a Malaysian commodity exchange for trading futures in crude palm oil, crude palm kernel oil, tin, rubber, and cocoa	[134]
Bursa Malaysia Commodity Derivatives	Public-private	Bursa Malaysia's objective is to secure trade in agricultural commodities like palm oil, kernal oil, etc. by facilitating future contracts	[135]

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APPENDIX A

MONGOLIA

Initiative	Initiative type	Summary	Source
National Livestock and Agriculture Commercialization Program Support	Public	The objective of this initiative is to improve efficiency and effectiveness of selected government programs for enhancing livestock and crop productivity and commercialization	[1]
Healthy Food Healthy Mongolian program	Public	The government has set an objective to create a condition for citizens to use healthy and guaranteed foods and become an exporting country of foods. This initiative aims to provide citizens with healthy and safe foods constantly, put potential reserves of agricultural raw materials into economic circulation, and develop an exports-oriented food industry	[1] [2]
Livestock and Agriculture Marketing Project (LAMP)	Public	LAMP has piloted several innovative ways to deliver services (hay production, genetic improvement, linkage to markets, and agroprocessing) to herders, women farmers, and their cooperatives with satisfactory outcomes	[1]
SME Leasing Policy Initiative	Public-private	The objective of this initiative is to improve the performance of Mongolia's financial sector in serving SMEs. By leasing or leasing-to-own durable goods such as vehicles, equipment, and appliances, these small-business owners can focus on their operations and sales without having to pledge precious collateral such as their homes	[3]
Industrialization 21-100 National Program	Public	The objectives of this initiative are to (1) promote production by financial and investment policies; (2) create favorable legal environment, introduce quality and standards of raw materials, and bring them to international and regional levels; (3) improve the raw material preparation system and increase the utilization of raw materials; (4) increase the capacity of processing plants, introduce environmentally friendly advanced technologies, build local plants, develop SMEs by clusters, and increase productivity through competitive value and market demand; (5) create conditions for human resource preparation, qualification, capacity building, retention, and creating and maintaining the workplace in line with the development trends and needs of the processing industry; and (6) improve transportation logistics of products to target markets, develop marketing activities, and increase domestic and foreign trade turnover A few proposed activities to carry out these objectives include (1) tariffs to improve domestic competitiveness; (2) setting up of centers for quality protection or raw materials; (3) creating infrastructure for industrial parks; (4) building warehouses; and (5) providing technical training	[4]
Chandmani Agro-park	Public-private	Its aim is to provide fresh and organic products to the population of Ulaanbaatar, and it is planning to supply its products to military units in future. The agricultural and technological Chandmani Agro-park is working to establish shopping centers and factories to manufacture final products of milk, meat, fruits and berries, and vegetables on its 80 hectares of land in Bayanchandmani soum within the framework of the Food Production project. The agropark owns a total of 1,900 ha of land	[5] [6]

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Initiative	Initiative type	Summary	Source
The Rural Agribusiness Support Program (RASP)	Public-private	This initiative is implemented in eleven aimags in central and southern Mongolia that present an opportunity for greater agribusiness development. Program objectives are to increase the production and sale of marketable animal products and crops, and to create a more market-oriented agricultural production and marketing system Program activities include (1) training and technical assistances; (2) access to commercial bank loans to herder groups and rural agribusinesses to stimulate business development; (3) local capacity building; product development; (4) sound environmental practices and innovative processing methodologies to expand and strengthen agricultural value chains such as dairy, meat, camel, yak wool, and vegetables; (5) establishment of relationships between local suppliers and regional and international producers and buyers through trade fairs and market days; (6) improvement of communications between remote producers and buyers; ; (7) loan guarantees for rural businesses to diversify and scale up their agribusinesses; (8) promotion of business development service providers through capacity building and strengthening the linkages with market; (9) training and pharmaceutical/equipment support for rural veterinarians and vet technicians; (10) development and institutionalization of a broad producer-based animal nutrition monitoring system; (11) development and institutionalization of a dairy food-safety quality assurance system; and (12) development of sector support for agribusiness through promoting enabling environment for rural businesses in collaboration with government and application of agricultural innovations	[7]
National IT Park (and NITP incubator)	Public	NITP supports information technology business and innovation with its information technology incubator, through various projects, by conducting e-governmental statistics, supporting information technology development by providing human resource development and training, providing information technology consulting services, and conducting high-technology R&D Its objectives are to (1) determine the products and services of incubator companies and prepare internationally competitive companies in order to form a technology-based, safe, reliable, and progressive society in Mongolia; (2) prepare content developers based on mobile communication technology and support their product exports to foreign and domestic markets; (3) evaluate and re-train internationally accepted IT human resource skills and create a skills standard system that meets international standards; (4) enhance the cooperation between universities, research organizations, and private sectors; (5) establish comfortable environment and conditions that provide entities operating in the IT sector with opportunities to carry out productions and services; and (6) establish centralization of the IT sector	[8]
Green-Gold Project	Public-private	The Green Gold Project aims to contribute to improved livelihoods of herder households by ensuring sustainable management of rangelands and securing better access to technological knowledge management and markets Activities related to the increased herder's income are implemented in the framework of the four components: strengthening herders' primary collective institutions and organizations, applied research and experimentation, development of demand-based extension services, and promotion of value-added production of yak down and torom wool	[9]

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Initiative	Initiative type	Summary	Source
National Food Security Program	Public	The program has an overall goal to provide the entire nation with secure supplies of accessible, nutritious, and safe food to enable healthy livelihoods and high labor productivity, founded on the participation of people, government, and public and private sectors Its four objectives are (1) to create enhanced enabling legal, economic and organizational environment for ensuring food supply, quality, and safety; (2) to ensure stable supply of nutritious, secure, and accessible foods and to increase the proportion of the industrially processed food in overall consumption; (3) to improve monitoring and information network to secure hygiene and safety of food products and drinking waters; and (4) to improve nutritious quality of food, supporting adequate, healthy diets, and to reduce nutrition deficiency, preventing from risk factors of non-communicable chronic diseases. Its activities and strategic plans are divided by phases	[10]
Community Development and Knowledge Management for the Satoyama Initiative Program (COMDEKS)	Public	COMDEKS was launched in 2011 to support local community activities that maintain and rebuild target production landscapes and seascapes, and to collect and disseminate knowledge and experiences from successful on-ground actions so that, if feasible, they can be adapted by other communities throughout the world to their specific conditions The program provides small-scale finance to local community organizations in developing countries to support sound biodiversity and ecosystem management as well as to develop or strengthen sustainable livelihood activities planned and executed by community members themselves. The target landscape selected as the focus for COMDEKS projects in Mongolia is the Central Selenge area. Located in Central Mongolia, the landscape stretches from the southeast towards the north, covering 628,856 ha of mostly forest steppe and mountain territories, as well as cultivated lands	[11]
National Production	Public	The objectives of this imitative are to (1) implement the industrialization program '21:100' and create favorable taxation, legal, and business environment for priority export-oriented sectors to substitute imports as well as for SMEs, cooperatives, trade and services to increase the share of value-added products in the GDP; (2) create a commodity price regulatory legal framework for agricultural goods and products; (3) implement flexible long-term investment and financial/loan policy for light industries, SMEs, and cooperatives; (4) create a system for stacking and transporting wool, cashmere, and rawhide in order to secure a sustainable supply to national industries and set up a raw materials reserve; (5) promote the development of trade and manufacturing at both the international trade zones and the border port areas of the neighboring countries; (6) develop capacity-building, training and re-training systems for light industries and SMEs and implement a 'qualified worker' program; (7) support setting up of information and incubator centers in collaboration with relevant professional associations to provide counseling, information sharing, and training to promote the development of light industry sectors; (8) promote putting up 'development model' factories in light industries and SMEs through franchising and adapting foreign industries with advanced technologies; (9) strive to regularly host in Mongolia international exhibitions on leading and advanced techniques and technologies in light industries and support manufactures' participation in exhibitions organized abroad on machinery, goods, and products; (10) offer policy support by setting up a light industry park and promoting collaboration among the manufactures and registering clusters; and (11) increase the variety and volume of raw materials and goods traded at the Agricultural Commodity Exchange and upgrade its operations	[12]

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Initiative	Initiative type	Summary	Source
First Campaign of Meat and Milk Production	Public	The mission of this initiative is to stabilize the food provision and reduce seasonal dependence on strategic food stock. This will be obtained through the following objectives: (1) creating a favorable legal and economic environment for the sector; (2) development of cows, meat, and dairy-intensive farming and reducing the relationship of the raw material season; (3) creating an optimal system for livestock and milk procurement; (4) development of domestic production of meat and milk processing; and (5) support domestic consumption of meat and meat products, milk, and dairy products and exports	[12] [13]
Third Crop Cultivation Campaign	Public	The objectives of this initiative are to (1) improve the cropland usage and determine regions suitable for agriculture and intensified animal husbandry, ensure 100% self-sufficiency in crops, potatoes, and other key vegetables, and 50% supply of planted fodder through domestic production; (2) supply the population with nutritious fruits and berries by increasing their varieties and production, establish a consolidated sea-buckthorn production network, and increase the export revenues; (3) increase per hectare crop outcome through comprehensive development of soil fertility, soil yield, and plant-seed procreation industries, and improving the quality and variety of seeds; (4) develop comprehensive plant protection measures and prevent crop land from soil erosion and degradation, gradually introduce the zero-tillage technology, improve suitable plantation rotation, and improve soil fertility; (5) construct new irrigation systems and renovate existing ones based on hydro survey and research, promote the introduction of advanced irrigation techniques and technologies, and annually increase the size of irrigated land; (6) develop a model green-house complex for winter and summer, and sustainably supply urban residents with newly cropped vegetables; (7) promote imports of advanced agricultural techniques and technologies, equipment, fertilizers, and plant protection chemicals through a suitable taxation policy and financial leasing methods; (8) increase storage, warehouse, grain elevator, and barnyard capacities and provide support for setting up of a comprehensive system for storing and marketing; and (9) create a legal environment for agricultural insurance	[12]
Law on Agricultural Products and Commodity Exchange	Public	The purpose of this law is to regulate the establishment of agricultural commodities and raw materials, providing a legal basis for its organizational structure and operations, and regulating relations arising from the supply, storage, transportation, and sale of agricultural commodities and raw materials	[14]
Law on Inspection and Restrictions on Flora, Fauna and Their Originated Products	Public	The purpose of this law is to enforce the conduct of veterinary and phytosanitary inspections during the introduction of animals, plants, and their raw materials. This includes legislation on quarantine inspection at state borders and the import of raw materials	[15]
The Law on Disaster Protection (revised version)	Public	The purpose of this law is to regulate (1) efficient management of disaster protection activities; and (2) the relations pertaining to the disaster management system, organization, and operations of disaster protection organizations	[16]

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Initiative	Initiative type	Summary	Source
State Approval Policy on Herders	Public	The government policy on herders is to increase the employment of herders, improve their health and social protection, improve their social insurance system, increase their knowledge and skills, and strengthen their cooperation, to improve pastoral livestock breeding, intensify livestock production, and provide comfortable living conditions for herders by supporting herders and developing a secure livestock husbandry This will be achieved through the establishment and development of herders and herding households, increasing productivity of herders, improving product quality, and developing collaborative efforts by government, legal entities, nongovernmental organizations, and herders in establishing product sales networks locally	[17]
National Water Program	Public	This program has the objectives to (1) protect the water resources of Mongolia; (2) establish a network based on constant, continuous, and advanced technologies of water resources and quality monitoring and analysis to ensure speedy information exchange and management; (3) create water resource savings, provide water that meets the hygienic standards of the population, create conditions for improving water supply for industrial and agricultural development, and provide sustainable development; (4) adopt a comprehensive range of measures to prevent water from harmful use and save water; (5) recycle and use advanced technology for wastewater treatment and sanitation; (6) implement initiatives aimed at flood protection; (7) upgrade the management of water resources and their utilization; (8) upgrade the legal environment, management, and organization to regulate water utilization for various uses, and empower the human resources; (9) promote and disseminate scientific information, innovative methods, and technologies for the use of water resources; and (10) use water resources in conformity with traditional practices and moral standards	[18]
Provide incentives based on the quality of certain products to the domestic industries and the origin of the products	Public	Wool incentives: As the use of woolen raw materials has increased, the number of camels has increased by 24.8% as wool-promotion incentives led to a better understanding of the importance of wool among herders, which led to a change in their attitudes. The incentives are considered the most appropriate alternative to the quality of wool and welfare. As a result, herders have increased wool and wool-breeds initiatives, thus increasing the proportion of livestock breeds as well as the proportion of livestock in the wagons, in line with sectoral policies Leather and fur incentives: A procedure on granting cash incentives to herdsmen on hides and skins made in the national processing plant was approved by the Government of Mongolia in order to implement Resolution No 74 of the State Great Khural of Mongolia on 30 November 2013	[19]
Selection of Milk and Milk-Meat Nutrient Livestock Breed Breeding Farm	Public	The objective of this initiative is to support SMEs in the areas of meat and milk cattle	[20]
Intensive Livestock Farming Policies	Public	These policies introduce a system of intensive livestock farming; provide measures to ensure normal functioning of dairy cows and benefits; provide discounted loan support to business entities engaged in livestock breeding; provide soft loan support to bee farmers; and provide discounted loan support to dairy-cow entrepreneurs	[20]

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Initiative	Initiative type	Summary	Source
Livestock Feed Policies	Public	The Government of Mongolia pays 50% of the fuel required for cultivation of fodder to citizens and business entities in order to increase fodder cultivation and cultivate fodder crops for crop rotation, to pay for the seeds after harvesting, and to pay for the elite seeds. In future, the government is in the process of establishing a fodder factory	[21]
Water Supply and Rehabilitation Policies	Public	As of 2017, around 43,800 wells had been provided for water supply for rural population and livestock breeding, of which 90.0% were in winter, spring, and summer grazing areas. Of the total, 28.3% (13,600) of the wells were engineered while 71.7% (30,200) were hand wells.	[22]
Plant Protection initiatives	Public	This initiative aims to combat rodents, grasshoppers, and other pests grazing in herders' pastures	[23]
Law on Crops	Public	The purpose of this law is to regulate the relations pertaining to the cultivation of land, establishment of agricultural land, rational use of arable land, protection of soil, and improvement of crop and intensive livestock production	[24]
Law on Seed Farming	Public	The purpose of this law is to regulate the relations arising between the insurance companies and citizens, business entities, and organizations connected with the formalization of seed crops in the territory of Mongolia	[25]
Law on Seed Plant Varieties	Public	The purpose of this law is to regulate relations concerning the protection of genetic diversity of plants in the territory of Mongolia, testing of varieties, assuring quality control of seeds and seed generation, and expenditure of seed reserves	[26]
Delivering new value-added tax	Public	The purpose is to provide value-added tax exemption on agricultural tractors, combines, machinery, fertilizers, crop protection chemicals, etc.	[27]
Law on VAT exemptions	Public	This policy provides value-added tax exemptions on import of wheat in order to promote consumption of processed foods and domestic food innovation with enriched flours	[28]
Agricultural Technology Policies	Public	The objective is to promote advanced farming techniques, fertilizers, and plant-protection products with tax policy and financial leasing tools Measures to be taken include development of technical services and technical and technological renovation to improve the efficiency of the park and to improve the technological efficiency of potatoes and vegetables	[29]
'Third Trip' Program	Public	The Laboratory of Plantation and Research Institute of Laboratories produced 157 samples from 5,742,300 hectares of 1,942 businesses and citizens. Based on the results of the analysis, the nutrient supply of soil was determined by each entity and citizen who calculated the nutrients needed to produce soil fertility as per the nutrient soil agrochemical analysis and its usage guidelines	[30]
Industrial Policy Target 2	Public	This policy aims to introduce advanced technologies for food production, enhance competitiveness, promote core-food production domestically, and provide citizens with conditions to use healthy and safe food. To do this, the following phases have been outlined: Phase I/2016–20: Provide domestic sources of cereals, potatoes, and vegetables; develop agricultural clusters in urban areas; and process 30% of the meat and 40% of the milk supplied to the population by industrial methods Phase II/2021–25: Provide healthy food supply for population needs; introduce advanced scientific technologies; produce 'Mongol brand' food products; and process 50% of the meat and 60% of the milk supplied to the population using industrial methods Phase III/2025–30: Ensure full supply of healthy food for human consumption; increase the number and variety of 'Mongol brand' in the international market; and process 70% of the meat and 80% of the milk supplied to the population using industrial methods	[31]

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Initiative	Initiative type	Summary	Source
National Packaging Program	Public	The objective of the program is to create a favorable legal and business environment for sustainable development of packaging, and to reduce the use of non-destructive packaging in the interest of human health and the environment	[31]
The Mongol Dry Milk project	Public	The objective of this initiative is to replace imported milk with export-oriented products using local milk reserves	[32]
Mobile Holder Program	Public	In order to provide dairy processing plants with raw materials and support intensive dairy farms, this program provides a favorable condition for intensive cow farming through the Livestock Protection Fund	[32]
Additional Financing for Agriculture and Rural Development Project	Public	The objective of this initiative is to provide additional financial services for the delivery of dairy products to herders	[32]
Organic Food Certification	Public	According to the Organic Food Law, three levels of organic food certifications have the right to operate in Mongolia: (1) an authorized certification body of SRA; (2) certified body of an international accreditation body; and (3) confirmation of participation by the manufacturer, user, and other parties based on mutual trust	[33]
Small and Medium Enterprise Development Fund	Public	Objectives are to provide long-term soft loans for SMEs; support the use of factory equipment for SMEs in financial leasing; organize activities to publicize and promote SMEs; organize and provide training for SMEs; and provide loan guarantee services	[34]
The Credit Guarantee Fund	Public	The Credit Guarantee Fund is a nonprofit organization that provides collaterals for SMEs with a lack of collateral. Its objectives are to (1) increase the financial resources required for SMEs; (2) support employment; (3) ensure sustainable sources of income; and (4) focus on efficient operation of the fund	[35]
Genetic Assessment System	Public	After a systematic evaluation of an integrated livestock genetic assessment system, information on livestock breeding and registration is delivered promptly to the local specialists, herders, and livestock owners, who are encouraged to pay attention to the breed and quality of their livestock The integrated livestock herd assessment system focuses on evaluating three different breeds of livestock, namely cattle, sheep, and goats, with scope for further expansion	[35]
Licensing System for Genetic Resources, Seed Production, Import-Export, etc.	Public	The purpose is to promote transparency by requiring licenses for the use of genetic resources, seed production, and importing and exporting	[36]
National Livestock Program of Mongolia	Public	According to Resolution No 23 of the State Great Khural (Parliament) of Mongolia in 2010, the 'Mongolian Livestock' National Program has been implemented in two phases (2010–15, and 2016–21) The purpose of the program is to (1) develop livestock breeding in accordance with climate change and social development trends; (2) create conditions for competitiveness in the market; (3) create economically productive sectors; (4) provide healthy and safe food to the population; (5) provide quality raw materials for processing industries; and (6) increase exports	[37]
National program on Animal Health	Public	The objective of the program is to (1) implement measures to limit the spread of infectious and infectious diseases of animal and spread awareness on the causes and conditions of a disease; (2) ensure the survival against infectious diseases; (3) provide healthy and safe food to the population; (4) provide quality raw materials to processing plants; and (5) increase the possibility of exporting raw animal products	[37] [38]

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Initiative	Initiative type	Summary	Source
National Vegetable Program	Public	This program aims to develop vegetable production through promotion of family farmers and vegetable specialty enterprises and cooperatives, and to ensure sustainable domestic demand throughout the year. Some activities to support this program include providing loan support, introducing advanced technology, upgrading farmer cooperative facilities and infrastructure, training, and human resource development	[39]
National Fruit Program	Public	The objectives of this initiative are to (1) create a favorable legal and business environment for the development of fruits and berry farms, for increasing crop and product diversity and production and enhancing their competitiveness; (2) diversify crop varieties, seed production, and seedlings, and increase supply of seedlings resistant to drought, cold, and diseases; (3) increase the development of human resources in an integrated manner based on innovation, advanced technology, and scientific research on the production of fruits and berries; and (4) develop a marketing strategy and define the needs of domestic and foreign users	[40]
Cashmere Program	Public	This program is aimed at enhancing the level of full processing of cashmere to 60%, increasing the production and export of environmentally friendly final products, and increasing the competitiveness of cashmere products internationally The objectives of the program are to create a favorable legal, investment, and taxation environment for the production and export of final products; provide goat breeding and raw material preparation to ensure the quality of cashmere; step up the overall processing level of cashmere, thus increasing the production and export of finished products; introduce eco-friendly advanced techniques and technologies into production in order to develop competitively oriented products; and increase productivity through training of human resources	[41]
The 'Sustainable Agriculture' project of the German-Mongolian Cooperation, (Phase II)	Public	Implementation period: 2016–18 Total budget: EUR1 million Project goal: Intensify cooperation between the Federal Republic of Germany and Mongolia in the framework of sustainable agricultural development	[42]
Market and pastoral management project	Public-private	Implementation period: 2017–21 Total budget: USD9.06 million The project aims to invest in harmonization with the implementation of 'Cooperative Development' and 'Mongolian Livestock' programs, to improve the livelihood of poor households in aimags and soums and reduce poverty	[42]
Household Livelihood Improvement by Combined Vegetable Farming project	Public-private	Implementation period: 2018–22 Total budget: USD3 million The project aims to strengthen the productivity of vegetables, support citizens and legal entities with holdings up to 5 ha; mechanize crop production; introduce drip irrigation technology; reduce imports, unemployment, and poverty; increase domestic production; and increase production of mechanized cellars, and winter and summer greenhouses	[42]

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Initiative	Initiative type	Summary	Source
Development of 'Livestock Products and Vegetable Production Networks with the Involvement of Private Sector' project	Public-private	Implementation period: 2016–19 Total budget: EUR4.5 million The main objective is to contribute to sustainable development by promoting quality employment in non-mining sectors, and contributing to the creation of new jobs in the private sector based on Mongolia's resources and advantages The project objective is to improve the capacity of the private sector to create value chain in the livestock and vegetable industries	[42]
'Agriculture and additional funding' projects for rural development projects	Public-private	Implementation period: 2016–20 Total budget: USD50 million Project objectives: To support agriculture and rural development by investing in private entrepreneurship in agribusiness, to diversify the Mongolian economy, and to reduce poverty The following four outcomes will be facilitated through increased livestock and other agricultural resources and value-added benefits as a result of the project: (1) development of a value chain for agricultural product-based enterprises and cooperatives; (2) increased production capacity raw material producers, herders, and farmers; (3) improved marketing, skills, and capabilities of agricultural products-based enterprises; and (4) brand development of Mongolian products	[42]
Mongolian Food Industry Association	N/A	Some activities include raising public awareness on food-safety issues and promoting the adoption of international food-safety practices and standards among Mongolian food business operators. These will boost consumer confidence in their products and improve their products' export potential	[43]
Khan Bank	Private	It provides a variety of financial and business development services, including a business incubator, to support SMEs in sectors ranging from the agriculture to industry	[44]
Mongolian State University of Agriculture (MSUA)	Public	MSUA offers degrees and diplomas in several agricultural disciplines, but is not responsible for providing direct extension services to farmers. It has, however, several programs that strengthen agricultural extension in Mongolia. For example, the university conducts research and technology advancement studies on key issues of rural development, ecology, and agricultural production. It offers specialized training in technical and professional aspects for rural producers and business people. The institution also conducts extension-based activities for technology transfer and introduction of modern scientific achievements The university has an extension training center, established in 2006 under a CIDA-funded Training for Rural Development Project. The center's main activities are training of farmers, provision of advisory services to farmers and investors, organization of events, and preparation and distribution of extension publications. The center also collaborates with relevant institutions in the implementation of donor-funded projects in agricultural and rural development	[45]
Mongolian Development Gateway	Private	Its extension-type projects cover distance education, distance diagnosis of rural people's health, and SME technology transfer	[45] [46]

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Initiative	Initiative type	Summary	Source
National Association of Mongolian Agricultural Cooperatives (NAMAC)	Private	NAMAC aims to increase agricultural production efficiency, improve living standard of rural population, and develop educational and cultural welfare Its mission is to be a national body to support cooperation and mutual trust among rural producers and to promote the favorable environment for cooperative development Some key objectives are to (1) upgrade the management of cooperative organization; (2) develop the human resource for cooperative organizations; (3) expand the number of cooperatives and strengthen their economic viability; and (4) extend international relationships of cooperative organizations	[45]
National Agricultural Extension Center (NAEC)	Public	NAEC) is responsible for operating and managing the public extension services for farmers in Mongolia	[45] [47]
Mongolian Commodity Exchange	Public	MCE is the only commodities exchange in Mongolia. It began its operations in 2013 In the list of commodities traded there are eight types of commodities including cashmere, sheep wool, camel wool, yak wool, wool and goat farms, wool, fatty acids, and wheat. The main criterion for trading is that the license to engage in intermediary services is obtained from an authorized organization. Since 2015, the stock index has been calculated and publicly announced as the 'Mongolian Agricultural Price Index' or MAPIX	[48]

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APPENDIX A

NEPAL

Initiative	Initiative type	Summary	Source
Rural Access Program	Public-private	The program addresses lack of access and social exclusion through rural road construction that targets the poorest and most disadvantaged groups in Nepal. This phase of the project places greater attention on road maintenance, while continuing to target short-term job creation, poverty reduction, and market-led economic development Some sample activities include supporting the revision of local and national guidelines for community asset management; using information communications technology to support income generation and market systems programs; and minimizing the impact and losses from frequently occurring shocks	[1]
Nutrition Collaborative Research Support Program	Public-private	Tufts University, DAI, and Right Direction Nepal are assisting a Kathmandu-based cottage industry that produces foods complementing breast feeding The goal is to help this cottage industry produce processed weaning food of higher quality and nutrition for infants and toddlers, in higher volumes and at lower costs Sample activities include assisting the cottage industry in auditing its production, packaging, and distribution systems; training in business planning; improving development of processed, fortified, and complementary foods; and conducting market analysis of complementary foods in the Kathmandu area. A forthcoming report and recommendations will guide DAI's and Right Direction Nepal's work with the cottage industry group	[2]
Nepal Tree Crop Development Alliance (NTC-GDA)	Public-private	The mission of this program is to enable poor smallholders to escape poverty through commercial agricultural opportunities. This is one of Winrock's two projects to develop business development services for tea and coffee, and nontimber forest products such as spices and high-value crops	[3]
Nepal Non-Timber Forest Products Project (NTFPP)	Public-private	The mission of this program is to enable poor smallholders to escape poverty through commercial agricultural opportunities. This is one of Winrock's two projects to develop business development services for tea and coffee, and nontimber forest products such as spices and high-value crops	[3]
Nepal's Smallholder Irrigation Market Initiative (SIMI) project	Public-private	This project developed the supply chain for private-sector provisioning of micro-irrigation technologies. Through its value chain approach, Winrock strengthened input, output, and service markets, and created linkages between these markets and smallholder producers. Winrock helped establish 91 marketing and planning committees and 76 collection centers designed to facilitate marketing at the local, regional, and international levels. In all, Winrock increased the incomes of 72,760 households by an average of USD209 annually and helped generate over USD30 million in high-value agriculture sales	[3]

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Initiative	Initiative type	Summary	Source
Agriculture Development Bank (ADB)	Public	With the main objective of providing institutional credit for enhancing the production and productivity of the agricultural sector in the country, the Agricultural Development Bank, which merged with the Land Reform Savings Corporation in 1973, works as a premier rural-credit institution. The bank extends credits to small farmers under group liability and has expanded the scope of financing to promote cottage industries. Several amendments also permitted the bank to engage in commercial banking activities for the mobilization of domestic resources. The bank contributes more than 67% of institutional credit supply in the country. Rural finance is the bank's principal operational area	[4]
The Gobar Gas and Agricultural Equipment Development Company Pvt. Ltd. (GGC)	Private	GGC provides research, development, and dissemination of the technology throughout the country. Research on various designs of biogas plants such as floating drum, concrete-fixed dome, precast tunnel, plastic biodigester, ferro-cement gas holder, and brick-mortar dome was carried out	[5]
Commercial Agriculture Development Project	Public-private	This project aims to reduce rural poverty in 11 districts of the Eastern Development Region of Nepal from 44% to 40% by 2020 through equitable and sustainable commercialization of agriculture. The expected outcome is improved efficiency in the marketing and processing of high-value crops such as vegetables, fruits, tea, and spices	[6]
Community-Managed Irrigated Agriculture Sector Project	Public-private	The project aims to improve the agricultural productivity and sustainability of existing small- and medium-farmer-managed irrigation systems suffering from low productivity and poverty in Central and Eastern Development Regions, thereby enhancing the livelihoods of the poor. This is achieved through (1) providing improved means for WUA empowerment, irrigation infrastructure, agriculture extension, and targeted livelihood enhancement to build the human capital of the poor; and (2) strengthening policies, plans, and institutions and their operations for more responsive service delivery and sustainable impacts	[7]
Decentralized Rural Infrastructure and Livelihood Project (DRILP)	Public-private	DRILP was designed to reduce rural poverty in 18 conflict-affected, remote-hill, and mountain districts to increase access to economic opportunities and social services. The primary focus of the project is to enhance the social and financial capital of the poor, dalits, ethnic minorities, and women, estimated to constitute 70% of the subproject area's population DRILP puts a strong emphasis on community involvement and support for livelihood restoration activities instead of just focusing on infrastructure development	[8]
The Rural Reconstruction and Rehabilitation Sector Development Program (RRRSDP)	Public-private	RRRSDP in Nepal was designed to accelerate poverty reduction and socially inclusive development in the hill, mountain, and Terai districts to support the government's post-conflict development priorities The program grant aims to support greater inclusion, good governance, and accelerated service delivery in rural infrastructure by adopting and implementing legislations, policies, and institutional capacity development programs in financial and procurement management Some key points of its development goals include opening up economic opportunities; providing access to key services (health, education, markets, credit, and information); and designing sustainable community-managed infrastructure schemes such as water supply and sanitation facilities and micro-irrigation systems	[9]

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Initiative	Initiative type	Summary	Source
National Agricultural Research Council (NARC)	Public-private	The objectives of NARC are to conduct qualitative studies and research on different aspects of agriculture; identify the existing problems in agriculture and find out the solution; and assist the government in formulation of agricultural policies and strategies NARC conducts qualitative agricultural research required for national agricultural policies; coordinates, monitors, and evaluates the agricultural research activities in Nepal; and provides research and consultancy services to the clients. Among its research topics and programs are the development of farm machinery and agricultural equipment, irrigation technology, soil management, maize shellers, rice husk stoves and other processing technologies, and a number of commodity programs that increase farmer productivity	[10] [11]
International Development Enterprise/ Nepal (IDE/N)	Public-private	The objective of this program is to reduce rural poverty by promoting the use of low-cost micro-irrigation technologies. Some achievements include the installment of over 80,000 treadle pumps in Terai; over 16,000 low-cost drop and micro-irrigation technologies in hills for scale-vegetable cultivation; and a network of seven treadle pump manufacturers and three drop assemblers	[11]
Center for Rural Technology, Nepal (CRT/N)	Private	The objective of this initiative is to develop and promote rural technologies like cook stoves and water mills for the improvement of rural communities	[11]
Small Irrigation and Market Initiative (SIMI)	Public-private	To address productivity, growth, and development in Nepal, USAID's SIMI is aimed at improving smallholder farmer's income through the production and promotion of high-value goods, such as vegetables, spices, nontimber forest products, small livestock, fisheries, coffee, and tea. The project utilized locally appropriate and affordable micro-irrigation technologies; improved value chains; built capacities of all value-chain actors; and engaged in a range of public-private partnerships	[11]
Micro-Enterprise Development Programme (MEDEP)	Public-private	MEDEP continually works to support uplifting the rural poor by motivating them to engage in enterprises. To do so, MEDEP (1) provides skill and business training and other support, especially for women, poor, and disadvantaged people to set up microenterprises; (2) assists to establish business support services and representative organizations for micro-entrepreneurs; and (3) works with the government to improve the policy environment	[12] [13]
Business Development Service Providing Organisation (BDSPO)	Private	BDSPO offers various types of services such as providing skill-oriented training, facilitating to establish enterprises, identifying sources of raw materials and other equipment, and establishing market linkages. Major activities of BDSPO include social mobilization of potential microentrepreneurs; formation of Micro Enterprise Group (MEG), House-Hold (HH) survey, and participant selection; conduction of Entrepreneurship Development Training (EDT) programs; skill training and appropriate technology support; help for establishing marketing linkages and product promotion; need assessment of entrepreneurs; identification and provisioning of scale-up activities; facilitation of micro-credit accessibilities; facilitation for formation of cooperatives and product associations; facilitation for construction of new Common Facility Centers (CFCs), and examination as well as assessment of the uses of existing technologies	[14]

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Initiative	Initiative type	Summary	Source
The National Micro Entrepreneurs' Federation Nepal (NMEFEN)	Public-private	This initiative's primary purpose is to ensure the business success of micro-entrepreneurs (MEs). It helps them by providing the tools entrepreneurs need to grow their businesses. These include marketing support to enable MEs to access markets beyond their local district; training and advice to enable MEs to access microfinance for their businesses; information and advice about an appropriate technology that can improve their business processes; and training in skills relevant to business and organizational management	[15]
Industrial Enterprise Development Institute	Public	Its objectives are to (1) support organizations, institutions, industries and enterprises through need-based services such as training, entrepreneurship and management development, feasibility studies, and consultancy and training of trainers; (2) provide quality support services for industry/enterprise development; (3) carry out need-based action research in providing quality services for enterprise promotion and development; (4) conduct need-based programs in developing technical, entrepreneurial, and management-related knowhow and skills; (5) carry out research and development-related activities, and (6) establish and develop projects and organizations for enterprise development One of its projects, Rural Enterprise Assistance Program (REAP), intended to reduce poverty in certain districts, through the promotion and sustainable development of micro and small enterprises. The program stressed upon the need for increasing benefits to micro and small entrepreneurs by enhancing the capacities of stakeholders and partners in promoting micro and small enterprises. In its second phase, REAP focused on sub-sector/value-chain development and social inclusion	[16]
Nepal Agribusiness Innovation Center (NABIC)	Public-private	NABIC is Nepal's first agro-focused business incubator and innovation platform. It provides holistic services to support and enhance innovation, growth, and competitiveness of agribusinesses. Its objectives are to (1) nurture start-ups and SMEs and innovators in the agribusiness sector through business incubation involving conceptualization, implementation, and scaleup; (2) contribute to the commercialization and industrialization of the agribusiness sector in Nepal; and (3) foster collaboration among ecosystem actors to promote agribusinesses in Nepal	[17]
Project for Agriculture Commercialization and Trade (PACT)	Public	The objective of this program is to improve the competitiveness of smallholder farmers and the agribusiness sector in selected commodity value chains. The project intends to achieve this by assisting agroenterprises, commodity associations, cooperatives, and registered farmer groups in integrating with emerging and competitive commodity value chains. The PACT uses competitive matching grants as a core instrument to achieve this goal by co-financing beneficiaries' innovative proposals. The project has also been helping to reduce existing obstacles to agriculture and food trade, thereby increasing the ability of farmers and agribusiness to respond to sanitary and phytosanitary (SPS) measures and food-quality standards to meet domestic and international market requirements	[18]
Seed Bijan Quality Control Center	Public	Its main objective is to implement a seed-quality control system across the country, for ensuring high-quality seed availability to farmers	[19] [20]

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Initiative	Initiative type	Summary	Source
National Tea and Coffee Development Board (NTCDB)	Public	NTCDB is a commodity board that has the following objectives: (1) assist to formulate and implement the Tea and Coffee Development policy; (2) identify problems and ways to solve them for the development of tea and coffee sectors; (3) manage import of tools and equipment for tea and coffee production processes; (4) establish Tea & Coffee Training and Research Center and provide technical knowledge and skills to people and organization involved in tea and coffee sectors; (5) conduct research and studies for the development of tea and coffee sectors; (6) establish coordination and networking with all the stakeholders of tea and coffee sectors; and (7) support tea and coffee industries It also has the following functions: policy formulation and feasibility study of tea and coffee cultivation in possible areas; supporting farmers of tea and coffee industries; capacity development of tea and coffee professionals; conducting market surveys at national and international levels; tea and coffee quality management; branding and marketing of 'Nepal Tea' and 'Nepal Coffee'; and extension of tea and coffee plantation	[19] [21]
National Seed Company Limited	Public	Its objectives are to (1) produce, procure, process, store, and sell seeds of all classes from foundation to improved cereals, vegetables, and other seeds on commercial basis for agricultural production; (2) aid in the import and export of improved seeds; (3) conduct trials, experiments, studies, and training programs, and provide advisory services for betterment of the seed business; (4) launch seed multiplication programs of cereals, vegetables, and leguminous crops in prevailing geographical conditions of the country; (5) sell improved seeds in bulk to private seed companies in its own name; (6) produce breeder seeds in coordination with related agencies; (7) commence production, distribution, and sales promotion activities either with its own resource or in joint venture; and (8) handle insecticides and fungicides needed by the agricultural sector	[19] [22]
Krishi Samagri Company Limited (KSCL), changed from Agriculture Inputs Company Limited	Public	The objectives of AICL as set out in the memorandum of association are to (1) produce, procure, and import different types of mineral fertilizers and distribute them across the country on the basis of local demand; (2) import raw materials for the production of different product mix of fertilizers and distribute and export them as well; (3) maintain buffer stock of fertilizers received under grants/aids from the government, donor countries, and organizations to control supply interruptions and to procure and distribute the subsidized fertilizer across the country; and (4) conduct other business and service oriented activities to ensure reasonable profit KSCL is also the sole agency to import fertilizers under the government's fertilizer subsidy scheme	[19] [23]
Kalimati Fruits and Vegetables Market Development Committee	Public	Its objectives are to (1) increase production and productivity of fruits and vegetables in Nepal by creating market facilities; (2) develop backward and forward linkages for sustainable development of agricultural marketing; (3) develop satellite markets outside Kalimati market and collection centers; (4) make adequate arrangements for market intelligence; (5) establish a system of standard market conduct and trade practices; and (6) operate Kalimati market in a financially self-sustainable way To accomplish these objectives, it arranges market facilities for wholesalers and retailers of fruits and vegetables; strengthens the marketing information system; manages staff arrangement and fixes price ceilings; formulates and enforces rules and regulations concerning the operation of the market; and performs other activities necessary for the management of the market	[19] [24]

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Initiative	Initiative type	Summary	Source
Dairy Development Corporation (DDC)	Public	The objectives of DDC are to (1) provide a guaranteed and fair-price market for milk to rural farmers; (2) supply pasteurized milk and milk products to urban consumers; (3) develop an organized milk collection system to meet increasing demand for pasteurized milk and milk products; and (4) develop an organized marketing system for milk and milk products in urban areas It has implemented a number of projects, such as the Kathmandu Milk Supply Scheme (KMSS), the Biratnagar Milk Supply Scheme (BMSS), and others	[25]
National Dairy Development Board (NDDB)	Public	NDDB is an apex-level policymaking body for dairy development in Nepal. Its functions are to (1) formulate and recommend policies on import and export of goods necessary for production and promotion of milk and milk products as well as animal feeds, and accelerate the implementation of approved policies; (2) formulate and recommends pricing policy of milk to HMG/N; (3) recommend HMG/N on the wellbeing of dairy professionals and consumers; (4) encourage development of dairies through the medium of cooperatives; and (5) register dairy industries It also provides grassroot services, training and extension services, cooperative strengthening, and infrastructure development, among others	[26]
Irrigation and Water Resources Management Plan (IWRMP)	Public	The main objective of IWRMP is to improve irrigated agricultural productivity and management of selected irrigation schemes, and enhance the institutional capacity for integrated water resource management. This is to be achieved through the following four components: (1) irrigation infrastructure development and improvement: (2) irrigation management transfer; (3) institutional and policy support for improved water management; and (4) integrated crop and water management	[19] [27]
Climate Disaster Management Project (PPCR)	Public	The main objective is climate-change risk management in development planning, policies, and programs. The expected outcome is that the Government of Nepal's infrastructure development programs, policies, and projects incorporate safeguards to address the effects of climate change. It is expected that (1) risk screening tools/methods are applied for projects in irrigation, flood protection, roads, water supply and sanitation, and urban development; (2) climate-change risk and vulnerability assessments incorporating climate information are performed for 50% of approved projects determined at risk in those sectors, and (3) there are trained focal points in charge of climate-change risk management in the government infrastructure agencies	[19] [27]
High Mountain Agribusiness and Livelihood Project (HIMALI)	Public	The major objective of this project is to assist mountain farmers with downstream businesses by strengthening the linkages. For this, the project has envisioned the demand-driven approach for mobilizing interested producer groups by putting the provision of support for quality improvement, value addition, and product aggregation in sufficient quantities to attract demand-side businesses, stimulate private-sector agribusiness development, and reduce risk exposure to businesses investing in the high-mountain districts The major support will be in (1) organized production of high-value products through contract or supply agreements; (2) establishment of collection, post-harvest quality grading and storage facilities; (3) processing and value adding; and (4) quality certification to access high-value markets	[19] [28]

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Initiative	Initiative type	Summary	Source
Small and Medium Farmers Revenue Growth (RISMFP)	Public	ADB is helping Nepal's poorest farmers shift to high-value commodities. The project will help reduce market and business risks for small and medium farmers in 10 districts in the less-developed western region of the country. It will build supply-chain links with buyers and markets, improve postharvest facilities, and provide agribusiness support	[19] [29]
The Community Managed Irrigated Agriculture Sector Project-Additional Financing (CMIASP-AF)	Public	CMIASP-AF is expanding project outputs and activities to additional areas and continues to support the government's development objective. The project aims to enhance the productivity of 150 existing Farmer Managed Irrigation Schemes (FMIS) in the eastern and central development regions, covering a total command area of 19,920 ha. Of these, 145 are traditionally FMIS, and five are Agency Managed Irrigation Systems (AMIS) that have been constructed by the government and have been receiving minimal government support for operation and maintenance After successful rehabilitation, the management responsibility in the five AMISs will be transferred to the respective water users' associations (WUAs). The expected impact of the project will be increased food security for farmers. The expected outcome is that participating farmers will increase agricultural production to the full potential. Productivity will be measured through (1) yields of major crops increased by at least 30% in the Terai and 45% in the hills; and (2) cropping intensity increased by at least 30% in irrigated areas To achieve the expected outcome, the project will have four outputs: (1) farmers in subproject areas have improved irrigation infrastructure; (2) WUAs manage irrigation systems in a socially inclusive, sustainable, and equitable manner; (3) farmers adopt improved agricultural practices; and (4) the project is managed efficiently	[19]
High Value Agricultural Products Development Project (HVAP)	Public	The project's purpose is to integrate the rural poor, especially women and marginal groups in high-value agriculture and nontimber forestry products, and medicinal and aromatic plants value chains and markets; and improve income, employment opportunities, and ability to respond to market demand and opportunities based on marketing agreements with private agribusiness. The project mainly focuses on one dominant intervention, i.e., the development of pro-poor value chains, amounting to Component (1) with the other project initiatives directly in support of this intervention (Components 2 and 3). Component 2 comprises development and strengthening of the value chain of producers' groups, initiatives to promote gender and social inclusion, support for high-value commodity production and postharvest activities, establishment of a grant-based value-chain development fund, and support for district operations and inclusion of remote communities. Component 3 pertains to arrangements for project management	[19] [30]
Advanced Vu Vision Program (KUBK) for Farmers	Public	The objectives of this initiative are to (1) increase production of 'Truthfully Labelled' improved seeds that are marketed within and beyond the target area for increasing the productivity of crops; (2) strengthen capacity of a broad range of rural institutions to provide sustainable services to smallholder farmers; and (3) improve productivity of livestock systems, which are more closely linked to markets To achieve this, it will provide support to the extension of the formal seed sector; improve smallholder livestock development through breed improvement, livestock business development, and marketing linkages as well as nutritional management; strengthen local entrepreneurship and institutional development; and provide monitoring and evaluation services	[19] [31]

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Initiative	Initiative type	Summary	Source
Agriculture and Food Security Planning (AFSP)	Public	AFSP is designed to enhance the food and nutritional security of targeted communities through a holistic set of interventions. The project aims to improve the livelihoods of crop and livestock farmers, women engaged in household/kitchen-garden production, and households with pregnant and nursing women To achieve this, AFSP has four components, namely, (1) technology development and adaptation; (2) technology dissemination and adoption; (3) food and nutrition status enhancement; and (4) project management	[19] [32]
Home Garden Phase IV	Public	The project has aims to ensure food security for families through the following objectives: (1) to have smallholders and disadvantaged groups (SHDAGs) adopt home gardens for improved family nutrition and increased income from surplus production, and (2) to have government agencies and nongovernmental organizations internalize the home garden as a targeted program to SHDAGs for nutritional improvement	[19] [33]
Agro Enterprise Center (AEC)	Public	AEC creates and/or provides support in a number of projects to expand and strengthen market-oriented private-sector-driven agroenterprises in order to increase the value and volume of high-value products sold domestically and internationally. Examples of projects it has carried out in the past include One District One Product (ODOP), which focuses on market and brand promotion of local products; One Village One Product (OVOP); and High Mountain Agribusiness and Livelihood Improvement (HIMALI). Its roles often include business planning and implementation support, assistance to prepare grant applications, input and output market information, agribusiness promotion, networking value-chain linkages, technical advisory services, and monitoring and evaluation	[34]
Rastriya Banijya Bank (RBB) Ltd.	Public	The objectives include (1) focus on providing innovative financial services; (2) increase in capital base of the bank by meeting the minimum capital requirement; (3) business growth and increase in market share; (4) enhancement in operational efficiency; (5) sustainable increase in profits; and (6) focus on empowerment of deprived class. RBB provides agricultural loans and credit support for many agricultural subsectors	[35]
Prabhu Bank	Private	One of the bank's primary objectives is to reach out to common people with a host of helpful products and services that will assure their future prosperity. Personalized service, prompt transactions, wide networks, mobile banking, and real-time account credit are some of the core strengths of the bank It has been undertaking activities such as a variety of deposit schemes, loans and advances, foreign exchange facilities, trade financing, inward/outward remittances, market maker for government securities, non-fund-based services like issuing guarantees, letters of credits, etc. It also provides agriculture loans to finance the short/long-term financing need of an individual/firm/company to purchase tractors, seeds, fertilizers, insecticides, etc. and to carry out farming of coffee, herbal products, poultry, vegetables, cereals, rainbow trout, etc.	[36]
Nepal Agricultural Cooperative Central Federation Ltd. (NACCFL)	Private	NACCFL aims at providing appropriate financial and nonfinancial services to all member organizations for their institutional development and for the socioeconomic development of the deprived small farmers across the country. NACCFL has three objectives: capacity building, policy advocacy, and cooperative network expansion	[37]

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Initiative	Initiative type	Summary	Source
Department of Food Technology and Quality Control	Public	The main aim is to ensure and enhance the quality and safety of food and feed products in the country. Further, the department has a paramount role in augmenting appropriate food processing and postharvest techniques to promote agribusinesses. Similarly, the department has been implementing various food and nutrition activities for the reduction of various forms and types of malnutrition in the country Some of its activities and certification services include food safety and quality control; food inspection (industry and market) and compliance; licensing of food industries; food standardization and harmonization; export-import certification of food; food technology development and training; research and development activities in food processing technologies; providing consultant services to food industries; analysis of feeds and feed ingredients; and creation of awareness on food and nutrition through radio and television programs	[38]
Delivering Genetic Gain in Wheat (DGGW) Seed System Initiative	Public-private	The objective is to maintain and eventually increase the annual rates of genetic gains. DGGW will engage in more targeted crossings and rapid cycling of segregating populations through two-generations-per-year field selection for spring bread and durum wheat; single-seed descent method for winter/facultative wheat; application of molecular markers; and new approaches in conjunction with testing of larger number of progenies for yield performance and precise characterization at phenotyping platforms for key traits The approach is broken into nine objectives: (1) advocacy; (2) surveillance; (3) breeding pipeline; (4) genomic selection (GS) & high throughput phenotyping (HTP); (5) phenotyping platforms; (6) seed; (7) data management; (8) talent pipeline; and (9) project management	[39] [40]
Derivative and Commodity Exchange Nepal (DCX)	Private	DCX holds as its priority the following mission statement: "To deliver an open, transparent, cost-efficient and compliant route to market for derivatives & commodities trading products, where exchange practices provide true and fair price discovery, material standards and trade integrity across all listed instruments." DCX hopes to continually provide a level-playing field for all stakeholders ranging from the primary producer to the end consumer. It trades six agricultural commodities, namely, sugar, corn, wheat, coffee, cotton, and soyabean	[41]
Nepal Derivative Exchange Ltd. (NDEX)	Private	NDEX trades coffee, soyabean, soyabean oil, corn, and wheat. Its mission is to achieve excellence in commodities and derivative trading with focus on customer delight and satisfaction through NDEX; bring new and creative ideas to operate both in its local product offering and for larger marketplace; create harmonious environment for derivative trading with the enforcement of regulatory regime where it is working; develop proper market education and research system; set up complete commodity derivative eco-system in Nepal in five years' time; and enforce zero-tolerance policy towards unethical trade practices	[42]
Mercantile Exchange Nepal Limited (MEX)	Private	MEX is the only Exchange in Nepal to have technical and business-related support from the market participants. Since its inception, MEX has been constantly contributing to the upgradation and enhancement of Nepal's commodity ecosystem. MEX conducts futures and spot trading in precious metals, energy, base metals, and agrocommodities, based on pure order matching system Its objectives are to (1) facilitate electronic derivatives trading through a robust and tested Automated Trading System (ATS) platform; (2) establish fair price discovery mechanism; (3) stand for market integrity and price transparency; (4) help exporter, importer, processor, and grower by providing a risk minimization system; (5) establish a global standard in exchange trading; (6) establish an efficient clearing and a guaranteed settlement system; (7) develop and implement hedging needs; and (8) observe anti-money-laundering laws	[43]

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APPENDIX A

PAKISTAN

Initiative	Initiative type	Summary	Source
Nuclear Institute for Agriculture and Biology (NIAB)	Public-private	NIAB conducts research on applied problems in the fields of agriculture and biology using nuclear techniques	[1]
Nuclear Institute for Food and Agriculture (NIFA)	Public-private	NIFA researches crop production and protection, soil fertility, water management and conservation, and value addition of food resources	[2]
Small and Medium Enterprises Development Authority (SMEDA)	Public-private	It provides an enabling environment and business development services to small and medium enterprises	[3]
Pakistan Mercantile Exchange	Public	Product types include precious metals, agricultural products, energy, interest rate future, FX, and metals	[4]
Business Incubation Center at University of Agriculture, Faisalabad	Public-private	Business development services include training, consultancy, and advisory services; marketing assistance (brand development, sales strategies, marketing plans, etc.); technology transfer and development; and business linkage promotion	[5]
Agriculture Policy Institute	Public	It conducts studies on emerging policy issues. It periodically examines the processing, storage, and marketing costs of agricultural commodities, and recommends policies and programs to reduce such costs and improve the competitiveness of commodities	[6]
Agricultural Engineering Institute	Public-private	It promotes farm mechanization through development, performance evaluation, and commercialization of appropriate agricultural mechanization technologies by involving both public- and private-sector organizations	[7]
Pakistan Agricultural Research Council	Public	It conducts, supports, coordinates, and promotes agricultural research throughout Pakistan	[8]
National Agricultural Research Centre (NARC)	Public-private	NARC conducts research on crops, natural resources, livestock, socioeconomics, and agricultural production resources. In addition, it tests and disseminates germplasm from various food grains, vegetables, and fruit crops. The research activities are organized into 11 institutes grouped by five sectors: crop sciences, animal sciences, natural resources, social sciences, and scientific information	[9]
National Tea & High Value Crops Research Institute	Public	It conducts research on all aspects of tea production and processing	[10]
The National Sugar Cane Research Institute	Public	It conducts research on the breeding and testing of improved sugarcane varieties. It also implements trainings and workshops	[11]
The Karakoram Agricultural Research Institute for Northern Areas	Public	It conducts research on food grains, vegetables, and fruit crops for high-altitude arid areas	[12]
The Arid Zone Research Centre	Public	The center researches crops and livestock problems that are related to Pakistan's arid zones	[13]

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Initiative	Initiative type	Summary	Source
Southern Zone Agricultural Research Centre	Public	It conducts research on grain storage, pesticide use, and control	[14]
Federal Seed Certification and Registration Department	Public	This is a third-party department with the mandate to regulate quality of seeds of various crops under the legal provisions	[15]
Ayub Agricultural Research Institute		The main objectives of the institute are research in genetic improvement of crop varieties for economic traits, upgradation of production technology, regulatory aspects, dissemination of knowledge, and provisioning of new seeds and fruit plants to end users	[16]
Science and Technology for Economic Development (STED) program	Public-private	The program initiates joint projects on technology-based production of high-value-added goods between research institutions and private-sector companies	[17]
Agricultural Innovation Program	Public-private	The purpose is to increase agricultural productivity and incomes in the agricultural sector through promotion and dissemination of modern technologies/practices in livestock, horticulture (fruits and vegetables) and cereals (wheat, maize, and rice) sectors	[18]
Agricultural Linkages Program	Public-private	The purpose is to promote and support agricultural research and development activities, and to promote cooperation between Pakistan and the USA in the agricultural sector	[19]
Strengthening Markets for Agriculture and Rural Transformation	Public	The focus is on activities contributing to increase in on-farm productivity and value of crops and livestock; increase in value addition and competitiveness of crops and livestock; and enhanced resilience of smallholder farmers to climate change and natural disasters	[20]

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APPENDIX A

PHILIPPINES

Initiative	Initiative type	Summary	Source
AIM-Dado Banatao Incubator	Public-private	This incubator supports early-stage startups that focus on sectors in need of innovative science-and-technology-based solutions in communications, agriculture, healthcare, artificial intelligence (AI), and internet of things (IoT)	[1]
Central Luzon State University (CLSU) Agriculture and Food Technology Business Incubator (AFTBI)	Public-private	AFTBI aims to facilitate the commercialization of agriculture and food-based technologies developed by CLSU and other government agencies. It also aims to help potential and existing entrepreneurs establish and manage their businesses by technology adoption, new products development, and operations assistance	[2]
Agribusiness clusters and networks		This article lists several agrofood clusters for coconut, sugar, pineapple, banana, rubber, palm oil, broiler poultry operations, fishery, dried mangoes, seaweed, carrageenan, and blue crab	[3]
Manila Commodity Exchange	Private	Product types include commodities, futures contracts, and options contracts on various base metals, agriculture commodities, energy, and currencies	[4]
U.P. North S&T Park	Public-private	Target companies include those in high-technology fields, e.g., telecommunications, telematics, IT, and biotechnology; and high-value business process outsourcing (BPO), e.g., accounting, animation, software development, design, and engineering services	[5]
Tetra-Tech	Public-private	The purpose is to link smallholders to commercial supply chains through mutually beneficial contractual relationships to encourage competitive agribusiness models	[6]
Ifugao Rice Terraces, 2011	Public	The objective of its status as a Globally Important Agricultural Heritage Site, as designated by the UN, is to maintain the survival of the Ifugao Rice Terraces, which had been self-sufficient in food, timber, and water, thanks to an organization of the landscape divided into five components including woodlot and communal forest, swidden farms, rice terraces, settlement areas, and water bodies and irrigation systems. However, the rice terraces are now in a very critical stage of deterioration	[7]
The Freedom of Information (FOI) Program	Public	The FOI Program is the government's response to the call for transparency and full public disclosure of information. FOI is a government mechanism, which allows Filipino citizens to request any information about government transactions and operations, provided that it shall not put into jeopardy matters of privacy and national security (The FOI mechanism for the Executive Branch is enabled via Executive Order No. 2, series of 2016)	[8]
Regional and Provincial Loan Facilitation Teams (LoFTs)	Public	LoFTs are tasked with assisting stakeholders in completing loan documentary requirements to make sure that they can avail the agrofishery credit programs. Secretary Piñol announced the Department of Agriculture's major policy shift from subsidies to easy access financing	[9]
Production Loan Easy Access (PLEA) Program	Public	PLEA is a loan facility of the Department of Agriculture–Agricultural Credit Policy Council (DA-ACPC) designed to address the financial needs of marginal and small farmers and fisherfolk (MSFF). Non-collateralized loans for agrofishery production are provided under PLEA through cooperative banks, rural banks, cooperatives, and nongovernmental organizations (NGOs) as lending conduits. The maximum loanable amount a farmer or fisherfolk can borrow is up to P50,000 for short-term commodities and up to P150,000 for long-gestating commodities. The loan is payable depending on the commodity or the project with a low interest rate	[10]

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Initiative	Initiative type	Summary	Source
Agricultural Training Institute (ATI)	Public	The ATI is the extension and training arm of the Philippine Department of Agriculture, mandated to train agricultural extension workers and their beneficiaries and lead in the delivery of e-extension services for agriculture and fisheries	[11]
Agricultural Competitiveness Enhancement Fund (ACEF)	Public	ACEF-Grant-in-Aid in Higher Education Program (ACEF-GIAHEP) aims to contribute to the development of agriculture and fisheries by increasing the number of graduates in higher education who are trained in scientific thoughts, entrepreneurial skills, and technical competencies in the areas of agriculture, forestry, fisheries, veterinary medicines, and related agricultural education programs	[12]
Machinery Loan Easy Access (MLEA)	Public	MLEA aims to finance acquisition of machinery, equipment and/or facilities ranging from production and harvesting to postharvest. It provides support for standalone (one type of machinery), or combo (set of machinery, equipment, and facilities) requirements	[13]
Capital Loan Easy Access (CLEA)	Public	CLEA aims to finance working capital requirements of trading, marketing, and processing of agrofishery products	[14]
Survival and Recovery Loan (SURE)	Public	The SURE assistance aims to (1) support the government's goal of helping agricultural households in calamity-affected areas regain their capacity to earn a living; and (2) provide immediate relief to small farmers and fisherfolk (SFF) through loan and emergency assistance package	[15]
Sikat Saka Program (SSP)	Public	SSP is an integrated financing program jointly implemented by the Department of Agriculture and Land Bank of the Philippines. The program aims to help more palay and corn farmers access timely, adequate, and affordable production credit and improve the viability of agricultural production by ensuring availability of irrigation services, extension, and links to markets, thus contributing to a favorable economic environment	[16]
Foods Staples Sufficiency Program (FSSP)	Public	FSSP covers rice and other staples, including white corn, banana (saba), root crops such as cassava (kamoteng kahoy) and sweet potato (kamote), and traditional staples in some areas in the Philippines. These are also increasingly recognized as healthy alternatives to rice FSSP is anchored on improving farm productivity and making the Filipino farmer globally competitive. Productivity growth in agriculture, which raises rural incomes, is indispensable to sustainable food security and poverty reduction. It will do this by using three key strategies: (1) raise farm productivity and competitiveness (i.e., expanding irrigation services, encouraging the use of high-quality seeds, fertilizers, and cop management practices, sustaining R&D in new varieties, promoting mechanization, strengthening irrigator's associations, and training of the Palayamanan System); (2) enhance economic incentives and enabling mechanisms (i.e., strengthening price support and domestic procurement, strengthening credit provision, and expanding crop insurance); and (3) manage food staples consumption (i.e., diversifying food staple consumption and reducing food waste)	[17]

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Initiative	Initiative type	Summary	Source
Agrarian Production Credit Program (APCP)	Public	APCP is a program jointly implemented by the Department of Agriculture, the Department of Agrarian Reform, and the LandBank of the Philippines The program caters to Agrarian Reform Beneficiaries (ARBs), whose organizations are not yet eligible to avail loans from Land Bank. Eligible Agrarian Reform Beneficiary Organizations (ARBOs) avail loans under the program and in turn re-lend to eligible ARBs to finance their agroproduction projects and activities. APCP aims to achieve sustainable crop production and increase incomes of agrarian reform beneficiaries (ARBs) and their households through the provision of credit and capacity building assistance	[18]
National Confederation of Irrigators' Associations	Public-private	The objectives of this initiative are to (1) be a model National Farmers Organization in achieving a sustainable irrigation operation; (2) develop a coordinated support of all government institutions and nongovernmental organizations to attain maximum food production; and (3) represent the interest of the irrigation farmers and work with policy-making bodies for their support to attain agricultural development	[19]
Philippine Crop Insurance Corporation (PCIC)	Public	The PCIC's principal mandate is to provide insurance protection to farmers against losses arising from natural calamities, plant diseases, and pest infestations of their palay and corn crops as well as other crops PCIC, as an agricultural insurer, is committed to help stabilize the income of agricultural producers and promote the flow of credit in the countryside by (1) providing insurance protection to qualified farmers and other agricultural stakeholders against loss of their crops and produce, including their livestock, farm machineries and equipment, transport facilities, and other related infrastructure arising from natural calamities, pests, and diseases, as well as other perils beyond their effective control; and (2) extending innovative and client-responsive insurance packages and other services through people's organizations, including farmers' cooperatives, agricultural lenders, and service providers	[20]
The Balikatan Sagip Patubig Program (BSPP)	Public	The Balikatan Sagip Patubig Program (BSPP) was launched in 1999 to assist local government units (LGUs) to be financially and technically capable of implementing community irrigation development, thus, affecting the spirit of devolution. It is jointly undertaken by the Department of Agriculture through NIA, LGUs, and irrigators associations, with the LGUs being primarily responsible for the program BSPP covers both, construction and rehabilitation, of community irrigation systems. LGUs that have the technical and management capacities to undertake pre-engineering and construction activities are left to do these. NIA provides technical assistance and support, as necessary. Otherwise, NIA undertakes these activities at the request of the LGUs	[21]
National Irrigation Administration	Public	The objectives of this initiative are to (1) develop and maintain irrigation systems in support of the agricultural program of the government; (2) provide adequate level of irrigation service on a sustainable basis in partnership with the farmers and local government units; (3) provide technical assistance to institutions in the development of water resources for irrigation; and (4) improve and sustain the operation of NIA as a viable corporation and a service-oriented agency	[22]

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Initiative	Initiative type	Summary	Source
The Adaptation and Mitigation Initiative in Agriculture (AMIA)	Public	AMIA supports the development of new planning tools that consider the challenges of climate change, to assist Filipino farmers and fisherfolks as well as other stakeholders, including the private sector, with climate-ready crop management systems, while ensuring science-based interventions by the government. This supports the President's vision to remove the guesswork in Philippine farming, first by providing color-coded guide maps that identify the areas where crops could ideally be grown based on soil types, climatic conditions, and biophysical requirements. This initiative is also intended to ensure food security and reduce poverty incidence in the agriculture-and-fisheries sector and consequently the whole country	[23]
Benguet Trading Center	Public	Part of Secretary Piñol's priority agenda is the full operation of the Benguet Trading Center, which will later be turned over to the farmers of the Cordillera. CAR, which a major producer of highland veggies and is dubbed as the Salad Bowl of the Philippines was chosen to house the largest trading center of agriproduce to assist the vegetable growers of the highlands. Benguet accounts for 90% of the total production in the region. The objective of this initiative is to encourage the development of a strategic and effective postharvest storage and processing facility	[24]
Philippine Rural Development Project (PRDP)	Public	PRDP is a six-year project designed to establish the government platform for a modern, climate-smart, and market-oriented agrofishery sector. PRDP will partner with the LGUs and the private sector in providing key infrastructure, facilities, technologies, and information that will raise incomes, productivity, and competitiveness in the countryside It is expected to achieve the following development objectives: (1) at least 5% increase in annual real farm incomes of PRDP household beneficiaries; (2) 30% increase in income for targeted beneficiaries for enterprise development; (3) 7% increase in value of annual marketed output; and (4) 20% increase in number of farmers and fishers with improved access to DA services Its four major components are infrastructure development, enterprise development, local planning, and project support	[25]
The Special Area for Agricultural Development (SAAD)	Public	SAAD is a locally funded program of the DA that is intended to help alleviate poverty among the marginalized sectors in agriculture and fishery. The SAAD Program is composed of two major components, 'social preparation' and 'livelihood interventions.' The former will encompass a series of trainings (including need assessments) in order to ensure readiness and empowerment of the SAAD beneficiaries in accepting and managing the interventions being provided by the program. The latter, on the other hand, will entail livelihood projects to be given based on the assessed needs of the recipients. Interventions given to selected beneficiaries are animals, crops, fisheries production and post-production inputs, tools, machinery, facilities, and equipment to improve their farm and fish production practices and productivity.	[26]
Bottom-Up Budgeting (BUB)	Public	This program seeks to increase citizens' access to local service delivery through a demand-driven budget planning process and strengthen government accountability in local public service provisioning The objective of the project is to (1) make the planning and budgeting processes of both local and national governments more participatory; (2) strengthen the convergence of the delivery of national services in the community; and (3) provide a balance in the identification of priorities	[27]

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Initiative	Initiative type	Summary	Source
Socsksargen Area Development Project: Integrated Food Security Program	Public	Consistent with the National Government's thrust on food security and poverty alleviation, the Socsksargen Area Development Project Office has prepared an Integrated Food Security Program with the priority projects converging at strategic agricultural development zones. The program provides for an integrated approach through agricultural and fisheries modernization and provisioning of needed infrastructure support such as farm-to-market roads, irrigation facilities, postharvest/premarketing facilities, fisheries, and aquaculture facilities	[28]
Young Farmers Program (YFP)	Public	The Young Farmers Program (YFP) aims to empower the young people to become competent agripreneurs and inspire them through leadership and value-formation modules	[29]
2nd Technical Cooperation Project of Philippine-Sino Center for Agricultural Technology (PhilSCAT2)	Public	The general objective of the 2nd Technical Cooperation Project (TCP II) under PhilSCAT is to mainstream the adaptable PhilSCAT technologies from the previous TCP and extend the study to other advanced Chinese technologies in agriculture for possible adaptation and adoption in the Philippines	[30]
A Rural Development Project for MIC Zone in the Philippines (MIC)	Public	The project aims to (1) contribute to the increase in household income and improvement of the socioeconomic condition of the rural community, (2) enhance the quality of life and increase agricultural productivity in the rural area, and (3) strengthen the relationship between the Philippines and the ROK. Specifically, the project will provide agricultural and social infrastructure, improve access to production technologies, and enhance the social capacity of the community by utilizing the Korean experience on rural development and agriculture technology transfer	[31]
Accelerating the Genetic Resource Improvement for Beef and Cattle and Small Ruminants (AGRIPBES)	Public	The project addresses the low level of development in beef cattle and small ruminant sector as a result of declining breeder population brought about by poor genetics and technology practices	[32]
AkBayAgrikultura: Kaagapay ng Bayang Pinoy Program Phase II for Typhoon Yolanda Affected Areas (Akbay Agri II)	Public	AkbayAgri is a social intervention program designed to assist the poorest of the poor in the agriculture and fishery sector in 31 identified provinces in Luzon and Visayas, for micro-income-generating projects. It aims to contribute to the national government's recovery and rehabilitation efforts in agriculture and fishing communities in Region VIII by providing crop packages, fishing equipment, and capability trainings	[33]
Better Rice Initiative Asia - Fostering Agriculture and Rice Marketing by improved Education and Rural Advisory Services (BRIA-FARMERS)	Public	Better Rice Initiative Asia was established to improve the rice value chain, including rice-based nutrition component in southeast Asian countries of Indonesia, Philippines, Thailand, and Vietnam. This Philippine component of BRIA aims at building the capacities of municipal agriculture officers (MAO) and agricultural extension workers (AEW) in selected LGUs as well as those of private service providers and lead farmers on methods and tools for the provision of extension services to farmers through education by the FARMERS school. They will function as multipliers for basic agricultural knowledge, entrepreneurial topics, and improved climate-sensitive rice farming techniques to farmers in the supported LGUs	[34]
Development of an Enhanced Production and Risk Management in Agriculture Integrated Decision Support System (EPRiMA)	Public	The project aims to increase resilience against multiple threats to the agriculture sector through a more comprehensive and near-real-time access to crop production and risk-and-damage assessment information and tools. It will support three dimensions of DRR: (1) reducing existing risks; (2) avoiding new risks; and (3) addressing underlying vulnerabilities	[35]

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Initiative	Initiative type	Summary	Source
Dynamic Conservation and Sustainable Use of Agro-Biodiversity in Traditional Agro-Ecosystems of the Philippines	Public	The project objective is to enhance, expand, and sustain the dynamic conservation practices that sustain globally significant agro-biodiversity in traditional ecosystems of the Philippines. The project will consist of three interlinked and mutually reinforcing components: (1) mainstreaming agrobiodiversity considerations into policy and legal frameworks, development strategies, and institutional structures; (2) pilot activities to enhance and expand dynamic conservation practices for agro-biodiversity in three pilot communities; and (3) dissemination of information, awareness raising, and preparations for scaling up, monitoring, and evaluation	[36]
Establishment of Agro-Meteorological Stations in Highly Vulnerable Agricultural Areas: A Tool for Climate Change Adaption and in the Development of Local Early Warning System (Agromet cum Climate Change)	Public	The project aims to reduce the vulnerability of the agricultural sector, specifically the resource-poor upland farmers and communities, to the impacts of climate change and related natural disasters through timely and accurate agrometeorological data monitoring using automated weather stations (AWS)	[37]
Fisheries, Coastal Resources and Livelihood Project (FishCORAL)	Public	FishCORAL will address key issues that contribute to high incidence of poverty among fishermen through sustainable management of coastal and fisheries resources and implementation of community-based enterprises in 1,098 communities of the targeted 11 bays/gulfs	[38]
Goat Production Project for the Accelerated Hunger Mitigation Program (GPP-AHMP)	Public	The project aims to support the Accelerated Hunger Mitigation Program by increasing and upgrading the breeder base of goats. This will be done through breeder stock infusion. The goats will be bred at the nucleus farms to produce genetically superior animals for being distributed to different multiplier farms throughout the country. Priority will be given to the provinces with higher hunger incidence	[39]
Implementation of Sustainable Land Management (SLM) Practices to Address Land Degradation and Mitigate Effects of Drought	Public	The project aims to strengthen SLM frameworks to address land degradation processes and mitigate the effects of drought in the Philippines through the following outcomes: (1) effective national enabling environment to promote integrated landscape management; and (2) long-term capacities and incentives in place for local communities and LGUs for uptake of SLM practices in two targeted municipalities in the Philippines	[40]
Integrated Marine Environment Monitoring System - Phase 2 (PHILO Project)	Public	This project is a continuation of the Phase 1 implementation of BFAR's Vessel Monitoring System (VMS) and integration of various databases including fishing vessel registry, ocean and weather data, stock assessment data, IUUF records, and other regulatory information. The PHILO project aims to set up an integrated operational fisheries and marine environment monitoring center in the Philippines. Through this project, it will be possible to monitor fishing vessels and combat illegal fisheries in order to protect the maritime resource in a sustainable way, support the national fishing industry, and promote seafood products for export	[41]
National Food Consumption Quantification Study	Public	The overall objective of the project is to formulate the Food Production Allocation Strategy that specifically identifies an action plan with measures and policy recommendations for achieving food security This study will primarily provide data and analysis on major food consumption patterns of Filipinos as well as on the country's current production of major commodities to the Department of Agriculture (DA). This will be relevant for DA in its formulation of plans and programs responsive to the needs of the people, particularly in determining the volume of food needed in future to support the growing population	[42]

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Initiative	Initiative type	Summary	Source
Panay Island Upland -Sustainable Rural Development Program (PIU-SRDP)	Public	The project aimed in reviving the 'bayanihan spirit' in rural areas, especially among the upland communities, using the Saemaul Undong approach focusing on self-help and value reorientation toward the important goals of productivity, sustainability, resilience, and equity	[43]
Rehabilitation and Modernization of Livestock 'Oksyon' Markets (LOM) in the Philippines	Public	The project aimed at contributing to the reduction in costs of wage goods through productivity enhancement, more efficient logistics, and improved retailing linkages. It will also ensure the availability, accessibility, and affordability of livestock products	[44]
Restoring Agricultural Livelihoods in Conflict-Affected Communities in Cotabato Province	Public	The project aims to contribute to the attainment of sustainable peace and development in Cotabato Province by providing support to rehabilitation and restoration of agriculture- and fisheries-based livelihoods	[45]
Second Cordillera Highland Agricultural Resource Management Project (CHARMP2) Scaling Up	Public	The project's goal is to help reduce poverty in poor rural indigenous communities in the upland areas of the Cordillera Administrative Region. The objectives are to (1) increase income of farming households; and (2) improve food security and watershed conservation practices The project has five components: (1) social mobilization and participatory investment planning; (2) community watershed conservation, forest management, and agroforestry; (3) agriculture, agribusiness, and income-generating activities; (4) rural infrastructure development; and (5) project management and coordination	[46]
Strengthening the e-Agriculture Environment and Developing ICT-Mediated Agricultural Solutions for Countries in Asia-Pacific (National e-Agriculture Strategy)	Public	The project seeks to address challenges by adopting a holistic approach that focuses on working with governments to not only develop their national e-agriculture strategies but also to support them in developing and implementing some of the high-priority ICT for agricultural solutions and services identified in the strategy (in partnership with other developing partners) These priority services hold the most promising potential impact for improved agricultural outcomes in areas such as researcher-farmer agricultural communication, inclusive financial services, market prices access, and efficient use of natural resources	[47]
The Project for Community Development in Conflict-Affected Areas in Mindanao	Public	The project will construct and rehabilitate farm-to-market roads (FMRs) in three sites in Mindanao (Lot 1 in Bumbaran, Lot 2 in Alamada, and Lot 3 in Datu Paglas). The project focuses on FMRs as an essential economic infrastructure to develop the rich agricultural potential in the Bangsamoro. This will enhance the economic wellbeing of target communities by improving market access through rehabilitation of rural roads	[48]
National Organic Agriculture Program	Public	The program aims to promote, propagate, further develop, and implement the practice of organic agriculture in the Philippines towards a competitive and sustainable organic agriculture industry that contributes to (1) better farm incomes and sustainable livelihood through increased farm productivity, reduced expenses on external farm inputs, better incomes for farmers, and reduction of poverty in the rural sector; (2) improved health; (3) environmental protection through enhanced soil fertility and farm biodiversity, reduced pollution, and destruction of the environment as well as prevention of further depletion of natural resources; (4) disaster risk reduction and resilience to climate change; and (5) social justice through regulatory services, official accreditation of OCBs, and research efforts	[49]

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Initiative	Initiative type	Summary	Source
National Cold Chain Program	Public	The program aims to identify the traditional and alternative trade routes of high-value crops and provide assistance among HVCC growers and traders in the acquisition of cold-chain infrastructures or facilities in the selected pilot areas of the program. The program also promotes the cold-chain technology for HVCC in the country through information support, training, and extension	[50]
The Cold Chain Association of the Philippines, Inc. (CCAP)	Public	CCAP aims to achieve effective handling, storage, and distribution of products in the cold chain, mostly focused on fresh, chilled, and frozen foods, with the consumer in mind by (1) establishing formal linkages with the government and delineating the role of the private business sector in the food security and development program; (2) spearheading the formulation, promulgation, and enforcement of industry standards necessary to ensure efficient performance of all activities within the cold chain; and (3) fostering cooperation and coordination among members in addressing industry concerns, particularly those that pertain to industry development CCAP provides forums, training, and seminars where open discussions are given active representation in the formulation of government regulations and policies	[51]
Agricultural Tramline System (ATS) project	Public	The ATS project aims to reduce postharvest losses and costs in transporting crops by establishing tramlines to serve farmer beneficiaries planting high-value crops. Before the establishment of the ATS, upland farming communities relied on mules or horses, which were an inefficient way of transporting farm produce and resulted in high postharvest losses of up to 25%. In 2013, the Manila Times reported that the ATS reduced the cost of transporting agricultural produce to the nearest road or trading post by as much as 50% compared to the traditional manual hauling using horses or mules. The Department of Agriculture also reported a 5–10% increase in upland farming areas as a result of the ATS project	[52]
The Philippine Center for Postharvest Development and Mechanization	Public	The Philippine Center for Postharvest Development and Mechanization implements programs and projects under the R&D and the Extension Support, Education and Training Services (ESETS) clusters. Each cluster is headed by a cluster director. Both cluster directors see to it that programs and projects are aligned with the priority programs of the Department of Agriculture and the priority agenda of PHilMech Objectives include efficient drying and dehydration for increased farm productivity; appropriate handling, storage, and processing techniques for increased economic value; effective prevention and control of mycotoxin, pests, and diseases toward improved food safety and preservation; agricultural waste and by-product utilization for added value and environmental protection; improved production and postproduction mechanization technologies for increased resource usage, efficiency, and productivity; and empowered stakeholders towards profitable entrepreneurship	[53]

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Initiative	Initiative type	Summary	Source
Fertilizer and Pesticide Authority	Public	The Fertilizer and Pesticide Authority's objectives are to (1) conduct information campaign regarding safe and effective use of pesticides and fertilizers; (2) promote and coordinate all fertilizer and pesticide research to ensure scientific pest control, safety in the use and handling of pesticides, higher standards and quality of products, and better application methods; (3) promulgate rules and regulations for the licensing of handlers and registration of fertilizer and pesticide products; (4) establish and impose appropriate penalties on handlers of these products for violations of any rules and regulations; (5) make continuous assessment of the fertilizer supply and demand situation, both domestically and worldwide; (6) establish and implement regulations governing the import and export of fertilizer inputs and, when necessary, import and/or export such items; (7) regulate and control the quality of different grades of fertilizer and set new grades when necessary; (8) control and regulate all aspects of fertilizer production; (9) do all such things as necessary to maintain an adequate supply of fertilizer at reasonable prices; and (10) restrict or ban the use of formulation of any pesticide	[54]
National Meat Inspection Service	Public	The National Meat Inspection Service, a specialized regulatory agency in the Department of Agriculture is the country's sole national controlling authority on all matters pertaining to meat inspection and hygiene. It offers the following services: plant operation and inspection; accreditation and registration; enforcement and food defense; meat import and export assistance; meat science and technology (MSTD); laboratory services; consumer information, education and assistance; technical assistance on the construction of in-house and meat establishments; and climate change programs	[55]
The Meat Establishment Improvement Program (MEIP)	Public	The Meat Establishment Improvement Program (MEIP) provides technical and financial assistance to LGUs in upgrading their slaughter facilities to 'AA' accreditation standards. The MEIP is a 50:50 cost sharing scheme (the LGUs source 50% of the project cost from their GAA while the NMIS contributes the other 50% from its Meat Inspection Development Trust Fund)	[56]
Small Scale Meat Establishment Project (SSMEP)	Public	SSMEP provides technical and financial assistance to the LGUs in improving their slaughterhouses to ensure food security and assure protection of the meat consuming public. This project was crafted to cater to those municipalities classified by the NEDA as fourth-to-sixth-class municipalities, particularly those in the ten priority (poorest) provinces of the country that cannot avail the Meat Establishment Improvement Program (MEIP) of the NMIS	[57]
National Livestock Program (NLP)	Public	DA-NLP implements the National Abattoir Development Project (NADP) through the NMIS. The DA-NLP, through the NADP, offers a 100% grant financial assistance to those LGUs that do not have the financial capacity to provide slaughter facilities to their constituents	[58]
National Veterinary Drug Residue Monitoring Program	Public	The National Veterinary Drug Residue Monitoring Program was created by virtue of DA-Administrative Order No. 14 s. 2006, wherein NMIS was tasked to analyze meat samples, urine, and edible tissues for the presence of any banned and/or regulated drugs. They undertake quarterly monitoring of antibiotics and unannounced monitoring of banned drugs	[59]
Philippine Carabao Center (PCC)	Public	The PCC's mission is to improve the general well-being and competitiveness of the livestock industry stakeholders through animal biotechnology and technology development, technology dissemination and knowledge resource management, active private-sector participation, livestock-based enterprises, and policy reforms to sustain development of livestock enterprises, thus ensuring socioeconomic empowerment toward nation building	[60]

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Initiative	Initiative type	Summary	Source
The National Carabao Development Program	Public	CDP includes conservation of the water buffalo's genetic biodiversity for long-term and sustainable development and an organized genetic improvement program The program also aims to maximize the genetic gains through crossbreeding of riverine buffaloes with the indigenous swamp buffaloes to optimize performance for milk and meat without disregard for draft medium-term requirements. CDP's ultimate focus is the establishment of buffalo-based village enterprises. It promotes cooperative development to provide small-hold farmers access to resources, allows them to participate in decision-making, and develops their potential for business and viable enterprises. Its R&D efforts help address technology and policy gaps. Essentially, it seeks to overcome the constraints in building more efficient and profitable buffalo-based enterprises. Aside from its contribution to national food security, the program therefore is geared toward the elevation of nutritional status, improvement of income, and betterment of the overall living standard of smallholder farm families	[61]
Philippine Council for Agriculture and Fisheries	Public	The council assumed strengthened functions related to coordination and monitoring of agricultural and fisheries modernization processes, and development of public-private partnerships as advisory special bodies to the Department of Agriculture (DA). Its roles include acting as advisory body to the DA to ensure the success of its programs and activities; and establishing a nationwide network of agricultural and fishery councils to serve as the forum for consultative and continuing discussions within the agriculture-and-fisheries sector	[62]
Philippine Fiber Industry Development Authority	Public	The mission of the Philippine Fiber Industry Development Authority is to enhance the holistic development of the Philippine natural fiber industry through the implementation of appropriate, quality and timely support programs, projects and activities, guided by the following objectives: (1) promote integrated development of the fiber industry in various aspects of research, production, processing, and regulation; (2) promote good agricultural production practices, and enforce fiber standards and other regulatory policies to maintain supply of good quality fibers and ensure worldwide acceptability; (3) improve farm productivity, thereby, increasing farmers' income; and (4) increase domestic processing for employment and higher value-added considerations and increase foreign exchange revenues	[63]
Philippine Rubber Research Institute (PRRI)	Public	PRRI's mission is to initiate and administer research and development programs to improve productivity and quality of rubber in the country	[64]
Herd Build-Up	Public	This program aims to ensure and accelerate the increase in both local dairy stocks and local milk production. Increase in local dairy herd may be realized through import of genetic materials like dairy animals and dairy breeding materials, upgrading of existing local animals to dairy breed, production of replacement stocks through dairy breeding programs like artificial insemination and multiplier farm establishment, and the preservation of existing stocks. Increasing the milking animals will significantly affect overall local milk production in the country The following sub-programs concretize the herd buildup program: herd infusion; improved breeding efficiency; animal financing; Palit-Baka Scheme of Dairy Animal Distribution; upgrading of local animals; breeding/multiplier farm operations; and Bull Loan Program	[65]

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Initiative	Initiative type	Summary	Source
Dairy Business Enhancement	Public	In this program, milk processing plants, collection centers, and processing equipment will be established and installed while existing ones will be upgraded to ensure the flow of the product to the market. The specific objectives of this program are to (1) expand share of local milk in the liquid milk market; (2) install dairy zones; (3) train dairy managers and entrepreneurs; and (4) install cost-efficient milk handling and processing facilities	[66]
Milk Quality Assurance	Public	This program focuses on installation of quality-based milk test and payment systems to all NDA-assisted cooperatives. The farmers are paid not only based on volume but also on the quality of their milk produce These milk payment schemes are changing the dairy producers' outlook, and many producers have benefited from the incentives given to produce clean and wholesome local milk. It also includes activities such as regular laboratory testing of raw milk and finished products, and farm and plant audits. This program will install in-house quality control systems and perform farm and plant audits to ensure higher milk quality	[67]
Milk Feeding Program	Public	This program has continuously served as the base market of the local dairy farmers, especially those who have just started in the business of dairying. It addresses the issues of poverty by rescuing children from malnutrition while providing a steady flow of income to local dairy farmers and their cooperatives This program includes the establishment of (1) an Inter-agency Milk Feeding Committee (IMFC), which oversees all milk programs and ensures the quality of milk delivered meets the requirements; and (2) the Philippine Milk Fund, which is used by the NDA to offer as a counterpart to local governments and other cosponsors. NDA continues to seek new partners in augmenting this fund	[68]
Farmers Option Buy Back	Public	Farmers have the opportunity to buy back the same volume of palay stocks sold to the agency within a period of six months for resale to traders and millers when palay prices are better than NFA's support price	[69]
Grains Exchange Program for Farmers Organizations and Retailers Association (GEPFORA)	Public	Under this program, NFA accredited farmers' organizations can deposit their palay at a specified NFA warehouse and sell it in rice form to NFA-licensed grains retailers' associations in another area using NFA's network and electronic trading system Farmers' organizations that participated in the Farmers as Importers (FAI) program may also utilize the GEPFORA in marketing their imported rice. They can deposit their imported rice at a specified NFA warehouse and sell it to NFA-licensed grains retailers associations in another area in the same variety, if available, or in another imported rice variety available, using the NFA's network of retailers and e-trading system Grains retailers' associations will also benefit from this program since they will have ready and direct access to more supply/source of local and imported rice	[69]
Palay Marketing Assistance for Legislators and Local Government Units (PALLGUs)	Public	LGUs and legislators should enter into a marketing agreement with the NFA, for the purchase of palay from farmers, at a premium. The provision of such premium will entitle the LGUs/legislators to buy the subject stocks from the NFA. Stocks may be stored in any designated warehouse for free for a period of four months. If the stocks are not withdrawn after the four-month free storage period, the NFA will correspondingly charge the buyer with 1.5% carrying cost for the fifth month until the sixth month, which is the maximum period of storage. Further, the NFA will have the right to auction or sell the palay stocks if the buyer was not able to withdraw it after six months of storage	[69]

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Initiative	Initiative type	Summary	Source
Corn Marketing Assistance Program for Industry Producers/ Users - Local Government Units (CMAPIPULGUs)	Public	This program is designed for private buyers with sufficient working capital and for lawmakers and heads of LGUs who may want to buy corn stocks for their constituents and enter into a marketing agreement with the NFA	[69]
Institutionalized Farmers as Distributors (I-FAD)	Public	The farmers' organizations are given the opportunity to directly participate in the distribution of imported rice. Farmers as partners in the implementation of food security and stabilization program of the government will henceforth be allowed to undertake the distribution of NFA rice, subject to certain rules and regulations formulated by the NFA	[69]
Corn Development Fund (CDF)	Public	This is a loan assistance for corn producers and users (up to a maximum of P10 million) and grants (up to a maximum of P0.5 million). The loan can be used for the acquisition, installation, and/or improvement of equipment and facilities for production, transport, warehousing, and marketing. The grant component is for training, seminars, and studies on corn	[69]
Enhanced Electronic Trading System (EETS) for Corn	Public	EETS for corn is a web-based trading system that serves as an information exchange, a clearinghouse service, and a commodity trading system for corn buyers and sellers, through a network of Designated Depository and Withdrawal Sites (DDWS) and Corn Exchange Centers (CEC) linked electronically with each other through the internet It provides the mechanism that can help corn sellers link with their markets at the right place and right time, for better prices. Corn producers can have access to marketing data that will guide them in deriving the highest possible returns on their investments, by making concrete data-based marketing decisions. In the same manner, corn buyers can have direct access to the available supply and pricing information on corn deposits of participating corn sellers, and eventually fulfill their requirements	[69]
National Food Authority	Public	The National Food Authority is vested with functions of ensuring the food security of the country and the stability of supply and price of the staple grain (rice). It performs these functions through various activities and strategies, which include procurement of paddy from individual bona-fide farmers and their organizations, buffer stocking, processing activities, dispersal of paddy and milled rice to strategic locations and distribution of the staple grain to various marketing outlets at appropriate times of the year	[70]
National Tobacco Administration (NTA)	Public	NTA's mission is to enhance capabilities, build synergistic relationship among sectors, and mobilize resources for the development of the tobacco industry, for the benefit of the tobacco farmers and other industry stakeholders. To do this, it has the following functions: (1) promulgate and enforce rules and regulations on the production, standardization, classification, grading, and trading of tobacco products as may be necessary to attain its purposes and objectives; (2) conduct agricultural and industrial research, and establish, operate, and maintain research stations; (3) accept and receive financial and other support from private and other sources for the development and promotion of the Philippine tobacco industry; (4) provide incentives and other financial assistance to tobacco growers and associations, directly or in conjunction with accredited financial institutions; and (5) impose administrative sanctions for violations of the rules and regulations issued by the NTA	[71]

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Initiative	Initiative type	Summary	Source
Kaanib Enterprise Development Project (KEDP)	Public	The project is designed to promote institutionalized coconut-based enterprises through a resource-service convergence approach to increase farm productivity and incomes of the small coconut-farming communities. The project will showcase coconut-based enterprises in organized clusters of coconut farms, owned or operated by the coconut farmers, in selected areas. It will also cater to the economic development of micro, small and medium enterprise (MSMEs) The project involves establishing coco-based enterprises, which may be coconut farmer's organizations (CFOs) or cooperatives, and startups or mature community-based enterprises engaged in coconut processing; intercropping; and livestock raising. It builds on the capacities of the CFOs/COOPs engaged in the agrobusiness.	[72]
Coconut Fertilization Project (CFP)	Public	This is a quick turnaround approach to increase coconut production by using a combination of agricultural grade salt (AGS) at 2 kg per tree and coir-based organic fertilizer (CBOF) at 4 kg per tree. It is widely acceptable by coconut farmers as a cost-effective and environment friendly fertilizer. The project, likewise, aims to promote wider utilization of the available coco peat in the area to provide coir-based processors and producers with alternative market for such byproducts	[72]
Kaanib Coco Agro-Industrial Hub (KCAHP)	Public	The project intends to establish KCAHPs or simply 'coco hubs' in different coconut provinces of the country. It is defined as a strategic partnership and productive alliance between the PCA and CFAs or COOPs, LGUs, and social business enterprises, among others. It constitutes a central business unit (CBU) or 'hub' that will act as a primary or secondary processor, integrator, and consolidator of coconut products into value-added products as well as the source of technology and information; and the 'spokes,' which will form the base for entrepreneurial business operations of the CBU. Initially, they will act as primary processors of coconut products or medium- and large-scale suppliers of raw materials	[72]
Philippine Coconut Authority	Public	The Philippine Coconut Authority aims to carry out the development and implementation of high-value programs for coconut and other palm-oil industries in a transparent, responsible, and accountable manner, and with utmost degree of professionalism and effectiveness It has the following functions: (1) formulate and promote a strategic and comprehensive development program for coconut and other palm-oil industries in all its aspects; (2) implement and sustain a nationwide coconut planting and replanting, fertilization, rehabilitation, and other farm productivity programs; (3) conduct research and extension works on farm productivity and process development for product quality and diversification; (4) establish quality standards for coconut and palm products and byproducts, and, develop and expand the domestic and foreign markets; and (5) enhance the capacities and ensure the socioeconomic welfare of coconut and palm farmers and farm workers	[73]
Philippine Rice Research Institute	Public	Its mission is to improve the competitiveness of the Filipino rice farmer and the Philippine rice industry and transform it to be more profitable, resilient, and sustainable through responsive, balanced, environmentally sound, and partnership-based research, development, and extension. PhilRice also coordinates the National Rice R&D Network (NRRDN)	[74]

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Initiative	Initiative type	Summary	Source
Sugar Regulatory Administration	Public	The objectives of the sugar regulatory administration are: (1) proactive and effective policies and regulations to ensure viability, food safety, environmental sustainability, and global competitiveness of the sugarcane industry; (2) product diversification, development and promotion; (3) responsive technical assistance and extension services to sugarcane industry stakeholders; (4) environment-friendly and innovative R&D technologies for the sugarcane industry stakeholders; (5) sustained development of expertise and human resources in the field of sugarcane industry development and related areas; and (6) empowered SRA supportive of its vision, mission, and goals	[75]
Philippine Economic Zone Authority	Public	PEZA grants incentives to export, IT, medical tourism, agroindustrial enterprises, logistics enterprises, facilities/utilities enterprises, and developers of economic zones which include industrial estates, export processing zones, IT and science parks and buildings, tourism zones, medical tourism parks and buildings, retirement zones, and agroindustrial zones	[76] [77]
Ecofuel Agro-Industrial Ecozone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Candelaria Agri Special Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Cavite Biofuels Ecozone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Brooke's Point Agro-Industrial Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
San Carlos Ecozone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Carmen Cebu Gum Industrial Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Valencia Special Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]

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Initiative	Initiative type	Summary	Source
New Jubilee Agro-Industrial Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Samar Agro-Industrial Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Irasan-Roxas Zanorte Special Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Philippine Packing Agricultural Export Processing Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Balo-I Agro-Industrial Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Bukidnon Agro-Resources Export Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
AJMR Agro-Industrial Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
CIIF Agro-Industrial Park - Davao	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
DADC Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Sarangani Economic Development Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]

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Initiative	Initiative type	Summary	Source
SRC Calumpang Economic Development Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
SRC Allah Valley Economic Development Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Agrotex Gensan Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Kamanga Agro-Industrial Economic Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
Sarangani Agro-Industrial Eco Zone	Public	The objective of these agroindustrial ecozones or special economic zones (SEZs) is to promote entrepreneurship and innovation by providing tax exemptions and other incentives to areas having highly developed (or having the potential to be developed) agroindustrial centers whose metes and bounds are fixed or delimited by Presidential Proclamations	[78]
'Made in PH' Farm Tourism program	Public-private	'It's More Fun in Philippine Farms,' offered 34 farm destinations in 2017. A series of activities were held throughout the country, including consultative assemblies of farm tourism stakeholders and exhibits on diverse farm tourism destinations, farm produce, and pasalubong specialty items. 'It's More Fun in Philippine Farms' aims to provide the potential for creating and expanding SMEs related to promoting rural lifestyle that is 'culture-based.' However, Manila Times reports that farm tourism's non-inclusion in the Investment Priorities Plan (IPP) 2017 and lack of financing for agritourism cooperatives have been identified as major gaps that hinder Philippine agritourism development	[79] [80]
Naga City Agro-Industrial Zone	Public	This area is envisioned as an agroindustrial hub, capitalizing on Bicol's extensive agricultural resources, the market offered by Naga itself, and the city's character as the regional center of trade and services providing access to markets in Metro Naga, Camarines Sur, Bicol, and South Luzon Future projects include (1) establishment of new agroprocessing complexes utilizing locally produced farm products; (2) new feed mills utilizing locally produced agricultural inputs; and (3) establishment and operation of new industrial estates or new industrial communities for labor-intensive or value-extensive enterprises	[81]
Cocochem Agro-Industrial Park Inc. (CAIP)	Public	CAIP is the ideal site for locators who are particularly involved in oleochemical and coconut- or palm-oil-based products. These multilayered complementation and linkages ensure proximity with suppliers and customers. The benefits of an industrial growth such as CAIP are as diverse as the economic gains it would spell for the country. Moreover, CAIP has a stable source of manpower since Batangas is home to hardworking and highly skilled people. Investing locators are assured of adequate infrastructures that include the availability of pier facilities as well as other utilities that meet all their basic needs	[82]

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Initiative	Initiative type	Summary	Source
Carmelray Industrial Park II	Public	Carmelray Industrial Park II at Laguna in the Philippines contains ready-built factories (RBF) that provide companies with low-cost and trouble-free startup facilities. Infrastructure facilities provided include dedicated power plant, water supply system, effluent treatment plant, telecommunication services, professional estate management with supporting amenities, and training center. The park contains industries manufacturing electronic components, computer hardware and software, consumer electronics, home appliances, industrial machinery, machine tools, light supporting industries, chemicals, plastics, foods, and beverages	[83]
New Clark City- Agro-Industrial Park	Public	New Clark City is envisioned to be the country's first and only smart and green city that will feature mixed-use real-estate developments, an agroindustrial park, and a food-processing terminal	[84]
Integrated Agro-Food Park (IAFP)	Public-private	IAFP is also a state-of-the-art agricultural production and processing site that is composed of provisions such as an agroindustrial economic zone (AIEZ); support infrastructures, industries, and communities; leased sites for warehousing of agricultural products and other raw materials, among others; leased sites for industrial farms; business, commercial, and entertainment centers; public transport system and terminals/stations; and road networks and utilities	[85]
FarmCoop	Private	FarmCoop is a not-for-profit organization that helps farmers' cooperatives to serve as effective vehicles in empowering their communities. Their services include (1) legal representation and consultancy, contract negotiation, documentation, and land tenure services; (2) cooperative consolidation services; (3) entrepreneurial services; (4) plantation technical support services; (5) market-linkage services; (6) research and development in organic farming technology; (7) institutional capacity building; (8) credit access; and (9) technology transfer	[86]
The National Association of Training Centers for Cooperatives (NATCCO)	Private	NATCCO is the biggest federation of cooperatives in the Philippines, in terms of geographical reach, membership, financial capacity, and array of services. Its mission is to build the socioeconomic capabilities of cooperatives through the delivery of superior financial products and allied services. The NATCCO Network, in endeavoring to ensure the sustainability of cooperatives, invests heavily in information technology software, hardware, and services that cooperatives can acquire and use at the most reasonable cost. The key idea was to automate and standardize cooperatives' operations. Its core service is financial	[87]
One Network Bank (ONB), a rural bank	Private	ONB operates as a rural bank subsidiary of BDO Unibank, Inc., the largest bank in the Philippines. The bank provides a wide range of financial products and services including loans, deposits, cash management, remittances, and bills payment in areas considered unserved or underserved by banks	[88] [89]
EastWest Rural Bank Inc	Private	EastWest Rural Bank is the second largest rural bank and envisions itself becoming the preferred rural bank of its three chosen markets, namely DepEd teachers, SSS pensioners, and small-scale entrepreneurs, by providing them access to financial products and services bearing the brand that is uniquely EastWest Bank	[90] [91]

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Initiative	Initiative type	Summary	Source
Card Bank Inc (A Mf Rb)	Private	The objective of this and other rural banks is to offer accessible financial services to the rural community. (Other rural banks include Guagua Rural Bank Inc, First Isabela Coop Bank Inc (Ficobank), Gm Bank Of Luzon Inc, Bof Inc, Metro South Coop Bank, Country Builders Bank Inc, Rang-Ay Bank Inc, Rizal Bank Inc, Katipunan Bank Inc, Cantilan Bank Inc, Banco Dipolog Inc, Rb Of Angeles Inc, Summit Bank, Insular Savers Bank Inc, Bangko Mabuhay Inc, Coop Bank Of Cotabato, Marayo Bank Inc, Mindanao Consolidated Cooperative Bank, Ilocos Consolidated Cooperative Bank, Rb Of Cauayan Inc, New Rb Of San Leonardo (N.E.) Inc, Rb Of Pandi (Bulacan) Inc, Mvsm Bank Inc, Peoples Bank Of Caraga Inc, Camalig Bank Inc, Imus Rural Bank Inc, Consolidated Cooperative Bank, Rb Of Barili (Cebu) Inc, Aspac Rural Bank Inc, Bankways Inc, Rb Of Central Pangasinan (Bayambang) Inc, Planbank "Rb Of Canlubang Planters Inc, Mount Makiling Rural Bank Inc, Rb Of Magdalena (Laguna) Inc, Rb Of Digos Inc, Gateway Rural Bank Inc, Lifebank, Valiant Bank Inc, Rb Of San Mateo (Isabela) Inc, Malarayat Rb Inc, Mallig Plains Rural Bank (Isabela) Inc, Highland Rural Bank Inc, Coop Bank Of Palawan, Coop Bank Of Quezon Province, Rb Of Bambang (Nueva Vizcaya) Inc, Rb Of Pola (Oriental Mindoro) Inc, Rbt Bank Inc A Rural Bank, Village Bank Inc, Mactan Rural Bank (Lapu-Lapu City) Inc, Rb Of Maria Aurora (Aurora) Inc, Laguna Prestige Banking Corporation, Rb Of Rizal (Zamboanga Del Norte) Inc, Rb Of Itogon (Benguet) Inc, Rb Of Sta Ignacia Inc, Bhf Rural Bank Inc, Rb Of Rosario (La Union) Inc, Rb Of Gattaran (Cagayan) Inc, Rb Of Pilar (Bataan) Inc, Saviour Rural Bank Inc, Rb Of General Trias Inc, Entrepreneur Rb Inc, Rb Of Tangub City (Mis Occ) Inc, Cooperative Bank Of Nueva Vizcaya, Rb Of Dumangas Inc, Commty Rb Of Catmon (Cebu) Inc, Rural Bank Of San Antonio Inc, Common Wealth Rural Bank Inc, Sugbuanon Rb Inc, Aliaga Farmers Rural Bank Inc, Rb Of Bagabag (N.V.) Inc, Rb Of Solano (Nueva Vizcaya) Inc, Rb Of Bayombong Inc, Rb Of Montalban Inc, Rb Of Lebak (Sultan Kudarat) Inc, Rb Of San Pascual (Obando Bulacan) Inc, Banco Laguna Inc, Rb Of Guinobatan Inc, Rb Of Cardona (Rizal) Inc, Rbg Imperial Bank Inc, Rb Of Jaen Inc, Cebuana Lhuillier Rb Inc, Rb Of Maragondon Inc, Cooperative Bank Of Bohol, Cavite United Rural Bank Corp, Innovative Bank Inc, Sta Maria Rural Bank Inc, Commty Rb Of Dapitan City Inc, Rb Of Paracale (Camarines Norte) Inc, Rb Of Mabalacat Inc, Rb Of Mangaldan Inc (Bangko Rural Ng Mangaldan Ink), Balanga Rural Bank Inc, Opportunity Kauswagan Bank Inc, Zamboanga Del Norte Cooperative Bank, Rb Of Mexico Inc, Rb Of Bay Inc, Guagua Savers Bank Inc, and South Bank Inc)	[92]
Philippine Warehouse Receipts Act of 2019	Public	This initiative aims to improve the country's agricultural productivity and food security, while improving farmers' margins, through the creation of an online and uniform registry system where all electronic warehouse receipts can be registered and accessed. The bill also establishes a warehousing accreditation council, which will institutionalize and operationalize a system of accreditation for warehouses and warehouse operators. A warehouse relief assurance fund will also be established to cover for losses involving warehouse receipts stemming from registry-based failures	[93]

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APPENDIX A

SINGAPORE

Initiative	Initiative type	Summary	Source
Agri-Bio Park	Public-private partnership	Agri-biotechnology is defined as the application of advanced biological sciences such as genetics and cell and molecular biology to the field of agriculture. The Agri-Bio Park activities include R&D in fish vaccines, food safety, and animal and plant health testing	[1]
Innovate 360	Private	Innovate 360 develops the food ecosystem of innovation in the areas of conceptualization, prototyping, R&D, contract manufacturing, marketing, branding, strategy distribution, and sales	[2]
Agribusiness clusters and networks		This article explores strategic considerations in realizing Singapore's objectives of developing a successful urban food cluster	[3]
Singapore Commodity Exchange	Public	Product types include agriculture and rubber	[4]
Singapore Food Agency	Public	It serves to enhance regulatory oversight of all food-related matters, and facilitates partnerships with food businesses to develop new capabilities and more business-friendly regulations	[5]

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APPENDIX A

SRI LANKA

Initiative	Initiative type	Summary	Source
Nano Science Park/ Nanotechnology Centre of Excellence	Public-private	This park implements research and development programs to identify and solve local and international issues in the fields of agriculture, health, and water purification	[1]
Business incubators for agroenterprises	Public-private	These include Ruhuna Business Incubator (University of Ruhuna), Rural Enterprise Network, and SABAH Association	[2]
Centre for Agribusiness Development	Private	It provides agribusinesses with services including company incorporation; investment promotion; advice and facilitation to obtain required licenses and approvals and arranging bank finances; tax and legal advisory services; information, import and export services; farm management; marketing linkages; product development; technology improvements and machinery; and consultancies in farm management	[3]
PASSAsia	Private	PASSAsia provides agribusiness and aquaculture development solutions	[4]
Agriculture Sector Modernization Project	Public-private	It supports increasing agriculture productivity, improving market access, and enhancing value addition of smallholder farmers and agribusinesses in the project areas	[5]
Coconut Research Institute	Public-private	It conducts research toward increasing productivity and profitability of coconut	[6]
Sri Lanka Institute of Nanotechnology	Public-private	It focuses on research and innovation in agriculture, water purification, apparel, healthcare, and mineral resources	[7]
Agro Technology Park Gannoruwa	Public	This is an information dissemination mechanism for farmers, school children, and general public	[8]
Rice Research and Development Institute	Public	The research and development program focuses on increasing farm productivity from current 4.3 ton per ha to 5.0 ton per ha within the next five years while reducing the cost of production and improving the grain quality of rice	[9]
The Horticultural Crop Research and Development Institute	Public	It is involved with technology development concerning vegetables, root and tuber crops, and floriculture	[10]
Seed Certification & Plant Protection Centre	Public	It oversees and coordinates the operational functions of the Plant Protection Act No. 35 of 1999, Control of Pesticides Act No. 33 of 1980 and Seed Act No. 22 of 2003. It facilitates the regulatory and legislative impetus required for the development of the sectors mentioned in the mandate	[11]
Natural Resources Management Centre	Public	It conducts research and development programs on soil conservation and watershed management, land suitability evaluation, agro-meteorology and climate change, geo-informatics and remote sensing, productivity enhancement, soil and water quality assessments, and on-farm water management	[12]
Socio Economics and Planning Centre	Public	It conducts socioeconomic research and policy analysis on global trade liberalization, adoption of modern technology, postharvest and processing, resource utilization and environment, agricultural marketing, and food security issues	[13]
Extension & Training Centre	Public	The focus is on developing human resources through agricultural extension, training, and education with the identification of appropriate technology required for the mandatory crop	[14]

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Initiative	Initiative type	Summary	Source
National Agriculture Information and Communication Centre	Public	It disseminates agriculture technologies to farming communities and other beneficiaries through electronic, print, and social media	[15]
Fruit Crop Research and Development Institute	Public	It conducts research and development activities for the uplifting of the fruit crop sector, and also disseminates technologies in collaboration with state- and private-sector extension organizations	[16]
In-Situ Conservation of Crop Wild Relatives Through Enhanced Information Management and Field Application	Public	This is to enhance the capacity to use information to support conservation and sustainable utilization of crops' wild relatives	[17]
The biodiversity for food and nutrition project	Public-private Partnership	It implements awareness programs, best practices, trainings, and workshops on biodiversity conservation and sustainable use for improved human nutrition and wellbeing	[18]
Vegetable Seed Project	Public	The focus is on improving productivity and quality of domestic vegetable seed production under public-private partnership initiatives	[19]
The Farm Broadcasting Service	Public	The service disseminates information on new agricultural research findings, provides solutions for agricultural problems, and conduct workshops	[20]

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APPENDIX A

THAILAND

Initiative	Initiative type	Summary	Source
Thailand Science Park	Public-private	Food and agriculture companies at Thailand Science Park include Advance Asian, CP Foodlab, Food Innopolis, Green Innovative Biotechnology, InnoFresh, Malee Applied Science, and Mitr Phol Innovation & Research Center, RPD (Thailand)	[1] [2]
Agribusiness clusters and networks	Private	Several agribusiness clusters exist throughout Thailand	[3] [4]
Business Incubation Center (Thailand Science Park)	Public-private	It offers technology business incubates' supporting programs, e.g., Young Technopreneur, New Technopreneurs Creation Pre-incubation, Technology Business Incubation, and Technology Business Post-Incubation	[5]
Global Innovation Incubator	Public-private	The Global Innovation Incubator's primary purpose is to develop innovative research and studies of technology for tuna- and seafood-related products	[6]
Thailand Futures Exchange Pcl	Public	The Thailand Futures Exchange (TFEX) is a subsidiary of the Stock Exchange of Thailand. It offers stock index, interest rate, agriculture, rubber, energy, and precious metals futures and options on futures contracts	[7]
Marketing Organization for Farmers	Public	The objectives of this initiative are to help farmers market their agricultural products, create more value for farmers, supply and sell quality production inputs, ensure that input price is fair for farmers, help farmers to negotiate the distribution, and to provide marketing and storage of agricultural products	[8]
Rubber Authority of Thailand (RAOT)	Public	RAOT is a leading global organization that manages the entire system of rubber on an integrated basis. This includes research and development of rubber, promotion and support of the standards of rubber, and stabilization of the prices of industrial rubber and rubber products. Its mission is to administer and manage the organization in an efficient manner; reduce costs, increase income, and add value; adhere to a good corporate governance; correspond to the changing environment; and fulfill the needs of all stakeholders in the entire system	[9]
The Agricultural Research Development Agency	Public	Its objectives are to promote, support, and develop agricultural research; and to promote the dissemination of agricultural information through its data repository and training	[10]
Highland Research and Development Institute (HRDI)	Public	The objectives of HRDI are to (1) extend and support the research and development activities of the Royal Project; (2) support conservation and sustainable utilization of the biodiversity inherent to the Thai highlands by researching, recording, conserving, and developing local knowledge; (3) support and work with the Royal Project Foundation and related agencies in strengthening highland communities and environmental education, ensuring sustainable coexistence with the environment that is in line with the philosophy of a self-sufficient economy; (4) investigate, research, and disseminate data and information related to highland development, and act as a research and extension coordination center; (5) build up cooperative networks, both domestically and internationally, to exchange best-practice research and development in the highlands; and (6) establish the Royal Park Rajapruek as a learning center of excellence in horticulture and biodiversity and as a tourist attraction for agriculture and culture	[11]

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Initiative	Initiative type	Summary	Source
NSTDA-Rice Program	Public	This initiative aims to increase the rice industry's competitive capability throughout the production chain while reducing the environmental impact. Key operation plans include (1) developing technologies to increase rice production efficiency, i.e., breeding rice varieties that are resistant to pests and can adapt to the climate change caused by global warming; (2) transferring high-quality grain production technology to farmers; (3) developing and transferring agricultural equipment and machine production technology for higher efficiency and lower planting and harvesting costs, and developing ICT to monitor rice disease and pest outbreaks; (4) improving milling and drying efficiency, and reducing energy use and milling waste for SMEs; (5) developing production process technology and rice-based products; and (6) improving logistics efficiency	[12]
NSTDA-The Tapioca Program	Public	This initiative aims to increase the Thai tapioca industry's competitive capability throughout the production chain while reducing the environmental impact. Key operational plans include (1) developing technology to increase tapioca's production efficiency, and managing tapioca varieties, soil, and water; (2) doing R&D work in biotechnology for breeding, and developing agricultural machinery technology to be used in managing, planting, and harvesting tapioca; (3) improving tapioca's starch production efficiency in order to reduce energy usage during production processes; (4) developing technologies and processes involved in the production of modified tapioca starch and tapioca products, particularly focusing on new technologies for tapioca starch modification; and (5) developing processing technologies that create new tapioca products and create new added values for the industry	[13]
NSTDA-The Rubber Program	Public	This initiative focuses on R&D that leads to solutions or new opportunities for the Thai rubber industry Key operational plans include (1) breeding drought-resistant rubber varieties using DNA marker technology; (2) developing natural rubber production technology innovations in order to increase efficiency and reduce energy usage and pollution (examples of such innovations are the block rubber machine innovation, the block rubber production technology innovation, the new rubber milk preservation technology innovation, and the rubber sheet smoking plant furnace innovation); (3) improving Thailand's tyre industry's competitive capability by increasing the efficiency of production machinery, upgrading tyre testing to meet international standards, and doing R&D work to improve the quality of Thai-made tyres; and (4) improving Thai rubber product industries' competitive capabilities, e.g., increasing machine and equipment efficiency in the rubber glove industry, creating a device that uses an electron beam to vulcanize rubber, and creating innovation for safe rubber products	[14]
Food Innovation Cluster	Public	Housed within the Thailand Science Park, the Food Innovation Cluster is a network aimed at enhancing the competitiveness of Thailand's food industry through connecting expertise and capability among manufacturers, research institutes, private and government supporting organizations, as well as entrepreneurs in related industries	[15]

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Initiative	Initiative type	Summary	Source
The NSTDA Investment Center (NIC)	Public	NIC is responsible for promoting investment in science and technology by coinvesting with the ultimate goal of benefiting Thailand's economy and society. The NIC will commercialize breakthroughs achieved by Thais and/or the NSTDA by coinvesting in joint ventures or spinoff companies The NIC is also in charge of educating technology business operators that are looking for technology investment opportunities and managing the NSTDA's investments with transparency. Some joint ventures include (1) Shrimp Culture Research & Development Co., Ltd. (SCRD); (2) Innova Biotechnology Co., Ltd. (INNOVA); and (3) Thai Dairy Research and Development Co., Ltd. (ET)	[16]
NSTDA's Science & Technology Knowledge Services center	Public	The Science & Technology Knowledge Services center is a digital hub for the latest information and knowledge, offering services such as online academic databases, electronic journals (e-journals), a Thai research database, and a Thai thesis database as well as information for research and development purposes. The services are offered to both government and private sectors, as well as to educational institutes and the general public	[17]
NSTDA-The Technology Licensing Office (TLO)	Public	TLO is in charge of managing intellectual property assents for NSTDA and promoting transfer and commercialization of NTSDA's patented technologies. Operating under the concept 'From Lab to Market,' this agency plays an important role in paving the way for economic and social development by helping turn scientific progress into tangible products. The TLO's responsibilities include promoting research and development that leads to the creation of intellectual property, protecting researchers' right to their works and promoting the use of scientific insights	[18]
Industrial Technology Assistance Program (iTAP)	Public	iTAP is an industrial technology support program for SMEs to help them meet the challenges in introducing technology-based products and processes. iTAP services include (1) industrial consultancy services; (2) technical training and seminars; (3) techno-business matching; (4) technology acquisition; (5) provision of industrial and technology information; and (6) linkages with other industrial service organizations	[19]
Genome Institute	Public	The Genome Institute (GI) is the national program for genomic sciences in Thailand. The core values of GI are scientific integration, medical and agricultural focus, and international collaboration. GI aims to keep abreast with leading technologies; undertake genomics related research and development; establish technology platform for genomics, proteomics, and bioinformatics; incubate world-class research and researchers; and publish in high-impact journals	[20]
The Molecular Rice Breeding Program for the Mekong Region	Public	The Molecular Rice Breeding Program for the Mekong Region was launched in 2004 by the Rice Gene Discovery Unit, a specialized lab jointly set up by BIOTEC and Kasetsart University, with the aim to promote the implementation of marker-aided selection (MAS) into the current rice breeding program in the Mekong region, particularly Thailand, Lao PDR, Cambodia, and Myanmar through a comprehensive hands-on training program and sharing of genomic information (genetic data for several traits and the molecular markers for several genes) and research facilities	[21]

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Initiative	Initiative type	Summary	Source
Breeding Management System (BMS)	Public	BMS is a package composed of software applications for breeders to plan, conduct, analyze, and assess the outcomes of their works. BMS is an exhaustive array of interrelated breeding informatics tools and related databases. It helps breeders manage breeding activities in a very user-friendly and efficient way. In order to promote the use of 'Integrated Breeding Platform' in this region, Rice Gene Discovery organizes training workshops and operates helpdesk to provide technical support to interested crop breeders	[22]
Asian Network on Microbial Utilization	Public	The objectives of this initiative are to strengthen ASEAN research community toward sustainable utilization of biological resources, which can only be achieved through an efficient management of microbial resources and research on microbial utilization; and to enhance human resource development through training programs and sharing of resources. AnMicro will do this through a knowledge-sharing web portal and capacity building in the form of scientific seminars, conferences, and workshops	[23]
NSTDA Company Directed Technology Development Program	Public	NSTDA Company Directed Technology Development Program provides financial support in the form of low-interest loans to industrial operators who want to do research and development in order to develop new products, improve manufacturing processes, set up a laboratory, conduct reverse engineering, and commercialize research breakthroughs	[24]
NSTDA-University-Industry Research Collaboration (NUI-RC)	Public	NUI-RC is a program providing graduate scholarships to students whose works are collaborative research between academia and industry	[25]
Introduction of New Rice Varieties and Training on Rice Seed Production	Public	BIOTEC, in collaboration with several partners, utilized a marker-assisted selection technique to improve Thai rice varieties to overcome biotic and abiotic stresses. Two varieties have been widely distributed to farmers: (1) Homcholasit (flash-flooding tolerant rice); and (2) Thanyasirin (blast-resistant glutinous rice). Seed and seed production technology have been transferred to suitable sites throughout Thailand such as Ayuthaya (Homcholasit), Nan (Thanyasirin), and Lampang (Thanyasirin)	[26]
Technology Service for Community Enterprises	Public	BIOTEC, in collaboration with alliances and local organizations, facilitated community enterprises and provided technical assistance through capacity building in agriculture, food processing, business planning, and marketing development. As a result of the training, some communities were able to obtain certification of safe food from FDA on their products, or develop new products	[26]
Capacity Building for Organic Rice Farmers	Public	Launched in 2014 by Ministry of Science and Technology, this project aims to boost organic rice production through science and technology. BIOTEC was tasked to lead the project implementation by working with farmers, sourcing appropriate technologies, and facilitating the technology adoptions. Yasothon province was selected as the project site, which could later be served as a model for other provinces. Seven farmer groups, with a total membership of 4,565 farmers, participates in this project. Training modules included the training on use of software applications to facilitate field inspection, farm management, and organic fertilizer production	[26]
Capacity Building in GMP/GHP for the Royal Project	Public-private	In 2013, BIOTEC, in collaboration with King Mongkut's University of Technology Thonburi, launched a project to build up capacity in (1) good hygiene practice (GHP) and good manufacturing practice (GMP) among staff working in factories under the Royal Project to ensure the safety of produce and products; and (2) 5S process to ensure a safer, more efficient, and more productive operation. The activities include facility inspection, training sessions, and regular follow-ups	[26]

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Initiative	Initiative type	Summary	Source
Promotion of Science Education in Monastic Schools	Public	BIOTEC implements activities to enhance science education in 52 monastic schools situated in Nan, Phrae, Phayao, and Chiang Rai provinces. The activities include workshops for science teachers to improve teaching skills and organizing science contests and science camps. These monastic schools are also integrated with an eDLTV project, a NSTDA distance-learning project that provides a platform and creates learning materials in digital format that are freely accessible through internet and satellite television, and are made available at learning centers in remote areas	[26]
Rural Development Technology Service Unit	Public	BIOTEC has established the Rural Development Technology Service Unit to perform technology assimilation and technology transfer to rural communities in Thailand. The unit works closely with local communities to undertake technology transfer, demonstration, and assimilation, as well as human resource development to improve the standard of living and household earning for villagers	[26]
Food Innopolis	Public	Thailand Food Innopolis is a global food innovation hub focusing on research, development, and innovation for the food industry. It is fully equipped with qualified human resources and facilities to support food producers of all scales, be it local, regional, or global. They provide a platform to strengthen a business and also to innovate in the food industry	[27]
Super Cluster Policy	Public	The Super Cluster initiative is designed to link Thailand's industry cluster assets and strengthen the clusters by adding mission-critical elements that help businesses become more efficient and competitive. The plan calls for an increased integration of research, academic, and public-private assets into core industry cluster ecosystems, as well as adding support in areas of workforce development, infrastructure, logistics, and technology The objective is to create world-class industry ecosystems that will enable companies doing business in Thailand to be more successful and foster innovation. In addition to providing infrastructure and operational elements of the industry ecosystems, the Thai Government is also providing incentives to further support the Super Cluster initiative in the form of exemptions in corporate income tax, import duties, personal income tax for mission-critical staff, and fast-tracked work permits and visas for foreign workers. The industries at the center of the Super Cluster policy include automotive-and-parts cluster; electrical appliances, electronics, and telecommunication equipment cluster; digital-based cluster; eco-friendly petrochemical and chemicals cluster; food innovation cluster; medical tourism cluster; and medical devices and manufacturing cluster	[28]
Thailand Advanced Institute of Science and Technology (THAIST)	Public	THAIST is set up as part of the STI Office. The mission of THAIST is to enhance STI human resource development of the nation by working closely in coordination with academic and research institutes and the private sector, in Thailand and abroad. THAIST plays a key role in initiating, facilitating, coordinating, and managing a network of institutes to develop a course or curriculum for the postgraduate level in selected fields that are chosen in accordance with the national agenda and country strategy. The network includes institutes from abroad to benefit from technology transfer THAIST currently implements the following programs: rail technology; plant breeding and seed technology; rubber product development; robotics and automation; biopharmaceuticals; bioelectronics and biosensors; innovation-based entrepreneurial development system; and center for innovation in design and engineering for manufacturing	[29] [30]

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Initiative	Initiative type	Summary	Source
Agricultural Research Development Agency	Public	Its missions are to promote and support the development of agricultural research and agricultural information. It will do this through high-quality research, knowledge management and communication with IT innovation, and organizational development in agricultural research management	[31]
National Innovation Agency	Public	NIA's mission is to support and develop Thailand's innovation system, both by way of improvement and initiation, to promote economic restructuring and competitive enhancement. NIA functions as the key engine driving national innovation by cocreation, networking, fostering, and partnering different organizations from various fields such as academic, technology, industry, finance, and investment. Its main focus is on utilizing knowledge management to achieve innovation, particularly to foster 'innovation on cluster platform,' which uses innovation as the principal tool in improving quality of life and driving an increasingly competitive economy. In conjunction with its principal strategy of knowledge management, NIA relies on academic and financial support mechanisms to drive and support innovation development	[32]
National Food Institute (NFI)	Public	The NFI's mandate is to promote development of the industrial food sector so as to make it competitive in the global market. It has been continually conducting market surveys and gathering food industry-relevant information NFI has (1) conducted research that contributed to the development and improvement of quality standards; (2) built food safety awareness; (3) organized and conducted seminars and training workshops to improve the competence of the people working in the food sector; (4) provided services in food inspection, laboratory testing, and product certification as well as technical assistance related to implementation of GMP, HACCP, and other food-safety, quality-management, and laboratory-management systems; (5) provided services to help food manufacturers conform to the legislative requirements of the country; (6) promoted cooperation between private and public sectors; (7) facilitated market linkages by providing a platform for networking or organizing activities for the food entrepreneurs to improve and widen their business perspective through information exchanges, networking, or business matching; and (8) fostered cooperation on research and development among the academics, government institutions, and the private sector	[33]
Startup Thailand	Public	Founded as a national agency to support the startup businesses and its ecosystem based on the policy of the National Startup Committee (NSC), Startup Thailand operates under the Ministry of Science and Technology in collaboration with related organizations. It helps startups to utilize local resources for their product and service development, local employment, and revenue distribution, leading to new target industries in driving the country forward	[34]
Bank for Agriculture and Agricultural Cooperatives (BAAC)	Public	BAAC is a financial institution for development. It provides opportunities for people to thoroughly gain access to sources of investment funds; and to gain financial literacy, which will strengthen the local grassroot economy. It aims to improve the competitiveness of the country, and reduce social disparity under the administration of a stable, transparent, and sustainable organization with the application of technology and innovation for administration and financial services. BAAC's overall mission is to be a secure rural development bank with modern management, providing integrated financial services to sustainably enhance the quality of life for farmers	[35]

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Initiative	Initiative type	Summary	Source
Thai Food Processing Industry Club	Public	The Federation of Thai Industries Council resolved to establish a food industry group to help support business development for members of the Federation of Thai Industries and to promote good relations between the members as well as between the members and the government	[36]
The Thai Food Processors' Association (TFPA)	Private	TFPA was established with the key objectives to (1) promote and develop the establishments and processed foods; (2) provide the highest quality of scientific assistance and programs in support of member needs; (3) serve as a communication link between members and government agencies; and (4) represent as a speaker for the collective problems and obstacles in food processing industry	[37]
Rice Knowledge Bank (RKB)	Public	RKB received support from the International Rice Research Institute and Asian Development Bank in the preparation of the project implementation of 'Linking Extension and Research Needs through Information Technology' (LEARN-IT) by collaborating between the Rice Research and Development Department, Rice Department, Khon Kaen University, and Chamnian Sarasin Nak Foundation The objective of this initiative is to provide knowledge of rice diseases, cultivation techniques, and other information to farmers	[38]
Thailand Rice Science Institute	Public	The objectives of this initiative are to promote, support, and increase the production efficiency and rice yield; develop strong farmers' organizations; develop rice production infrastructure and promote the use of agricultural machinery; promote rice value-added processed products and byproducts from rice; and research and develop integrated forms of production, processing, and rice packaging	[39]
"Thai Rice Field" version 2.5	Public	The objective of this initiative is to develop a rice database with area cultivation information, rice variety information, land suitability, and other kinds of statistical information to provide farmers and researchers with adequate information	[40]
Rice Inspection and Product Inspection Division	Public	This initiative has the following roles: (1) study, research, and develop standards; (2) develop a system for inspection and certification of rice production, rice seed products, and rice mills; (3) examine and certify rice production standards, seed products, and rice mills; (4) coordinate on the certification of rice production standards, preparation of joint acceptance agreements, fever remedies, and problems related to hygiene; (5) develop the process of analyzing rice quality and products; (6) disseminate and transfer knowledge on standardization and inspection of rice production standards, rice seed products, and rice mills; (7) implement the database creation, network development, and application of information related to the inspection and certification of rice production standards, rice seed products, and rice mills; (8) examine, supervise, and control the production and distribution of rice seeds; and (9) work with or support the work of other related agencies	[41]
KMUTT Industrial Park	Public	The objectives of this initiative are to (1) provide an opportunity for technical entrepreneurs lacking investment resources to commence small-to-medium-scale processes and pilot-plant operations through the provision of site facilities, technology, equipment, data access, and advice; (2) provide training in all relevant fields, especially in the introduction of innovative and leading-edge technologies for industry; (3) provide an environment conducive to hands-on training and experience for both students and researchers	[42]

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Initiative	Initiative type	Summary	Source
National Bureau of Agriculture Commodity and Food Standard (ACFS)	Public	ACFS is a governmental agency under the Ministry of Agriculture and Cooperatives. It works in partnership with government departments; local authorities; and national, regional, and international organizations to achieve its goals. Its core functions are (1) setting standards for agricultural systems, commodities, and food items, and food safety; (2) accreditation of certification bodies; (3) dialogue and negotiation with international trade partners on disputes concerning SPS/TBT issues; (4) food standard control; and (5) promotion of standard compliance for farms and food establishments	[43]
Organic Agriculture Certification Thailand	Public	The purpose is to strive for being a symbol of high-quality international organic certification that contributes toward a livable society and environmental sustainability The mission is to offer certification services according to a variety of international organic standards; offer certification services according to other agricultural, social, and environmental standards; provide training services and disseminate knowledge about organic agriculture and certification for those interested as long as these activities do not compromise the impartiality in carrying out inspection and certification; support organic agriculture movements in Thailand and abroad; and continually develop organizational innovation	[45]
Smart Farmer Development project	Public	The main objective of the development project is to improve the livelihoods of farmers through improvement of their skills and competencies in agricultural production. This is done through training programs and sharing of knowledge and information. Farmers are given the following incentives: (1) the government supports the training costs for the farmers; (2) the farmers who participate in the training will receive a certificate after they are trained; (3) trained farmers are now considered as smart farmers; (4) based on their learning through their training course, some smart farmers make an improvement in their crop production efficiency; and (5) some smart farmers are enlisted to assist in the projects given by the Rice Department and Department of Agricultural Extension and an honorarium is paid to them once a month	[46]
Community Rice Centers (CRCs)	Public	CRCs were established as direct information channels from the government to rice farmers. Lead farmers will be trained as multipliers for sustainable rice production. They learn to decrease postharvest losses through postharvest management strategies, such as optimized storage and drying techniques. The project also supports the processing of byproducts in rice production	[47]
AgriSource	Private	AgriSource is a Thailand-based food and agribusiness consulting company. Since 1989, its experienced team of market development and advisory professionals has offered clients on-ground representation in southeast Asia; food marketing and agribusiness expertise; innovative market and business development strategies; quantitative and qualitative market research; extensive local contacts; and knowledge of government regulations and agencies. AgriSource and its team of local associates serve client needs across Asia, with a focus on southeast Asia, including Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam	[48]
Agribusiness Terminals	Public	To encourage agroexports, Thailand developed agribusiness terminals on a one-stop service basis. These terminals are equipped with cold storage and grading facilities. The objective of this initiative is to facilitate the meeting of producers with potential buyers	[49]

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Initiative	Initiative type	Summary	Source
The Central Intellectual Property and International Trade Court (CIPITC)	Public	CIPITC, located in Bangkok, is a specialized court with exclusive jurisdiction over all intellectual property disputes, including but not limited to patents. The objective of this initiative is to support the development of SMEs and promote innovation	[50]
The Cooperative League of Thailand (CLT)	Public	The CLT plays a major role in the area of cooperation, promotion, and development of the cooperatives in Thailand. It has affiliates of 7,448 cooperatives at all levels, serving over 9.8 million households	[51]
The National Co-operative Development Board (NCDB)	Public	NCDB has been set up to advise the government concerning policies and guidelines for promotion and development of cooperatives. NCDB has assigned a steering committee mainly from CPD, CAD, and CLT to design framework and policy for development of cooperatives	[52]
Agricultural Crop Zoning System	Public	This system began in 2012 with the objective of dealing with Thailand's severe drought. Six major crops were selected: palm oil, sugarcane, maize, rice, cassava, and rubber. NESDB was assigned to implement the business model for each zoning crop	[53]
Revenue Assurance Measures	Public	The government provides an income assurance program for farmers as a way to alleviates losses due to productivity declines, which will help stabilize prices. Farmers register household crops with BAAC and are then compensated based on the difference between the actual price and reference criteria	[54]
Rice Pledging Scheme	Public	In the Rice Pledging Scheme, participants pledge their crops with the government and opt to sell the crops for a later, higher-value sale. In exchange for higher sales, they pay interest and storage fees. The program extends to cassava, maize, tiger shrimps, and white shrimp	[54]
Agricultural Cooperative Federation of Thailand, Ltd.	Private	ACFT is an organization formed by the gathering of provincial cooperatives across the country, with member agricultural cooperatives and farmers. Its purpose is to encourage cooperative members to conduct business together, provide technical assistance to farmers, and facilitate other kinds of activities	[55]
"Twelve Hidden Gems Destinations"	Public	The three-phase agrotourism master plan for 2015–17, with four piloted projects in the Tourism Authority of Thailand (TAT), designated 12 Hidden Gems destinations due to their uniqueness and readiness to welcome tourists as well as the potential to spearhead the number of tourists from key destinations. Using a business-to-agriculture strategy, this initiative provided a platform for businesses, such as, hotels and restaurants, to purchase goods directly from farmers. The agrotourism content development project highlighting products such as homestay, Thai rice routes, Thai silk routes, ecotourism, corporate social responsibility (CSR), and community-market development emphasized on income generation for community-based markets, fresh markets, morning markets, and farmer markets	[56]
One Tambon One Product (OTOP)	Public	OTOP is a local entrepreneurship stimulus program, which aims to support the unique locally made and marketed products of each Thai tambon all over Thailand. It selects one superior product from each tambon to receive formal branding as a 'starred OTOP product,' and provides a local and international stage for the promotion of these products	[57]
Swine Raisers Cooperative Federation of Thailand	Private	The association consists of both swine farmers and representatives of delivering industries like feed mills and feed-additive companies. They aim to develop the knowledge and management at these farms, but they also address important actual matters, e.g., those around food safety	[58]

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Initiative	Initiative type	Summary	Source
Public Warehouse Organization (PWO)	Public	PWO has rice barn and warehouse in various provinces for purchase and storage of both rice and other agricultural products. PWO is a state enterprise under the authority of Ministry of Commerce, with the purpose of flexibility in operations and efficiency as in case of the private sector. The objectives of the organization are to carry out all activities related to rice, agricultural, and other products to ensure that their quantity, quality, and price are appropriate for the public	[59]
Skimmed Milk Powder Processing Association	Private	Skimmed Milk Powder Processing Association was established by private-sector companies to promote cooperation among skimmed milk dairy processors	[60]
Dairy Farming Promotion Organization of Thailand	Public	Its mission is to (1) expand dairy farming networks and alliances to serve raw milk for a ready-to-drink milk production; (2) uplift commercial basis of businesses to increase market share; and (3) aim to manage the organization with international standards	[61]
Thai Dairy Board	Public	Thai Dairy Board was established by the Thai Government for issuing policies and coordinating all government dairy committees and private associations	[60]
18 Provincial Clusters	Public	The government has set a strategic economic position of the 18 provincial clusters as follows: (1) Upper Northern Region 1: Creative Cluster and Agricultural and Food Innopolis; (2) Upper Northern Region 2: Gateway to GMS and ASEAN+3 and Green Tourism Destination; (3) Lower Northern Region 1: Indo-China Trade and Service Center and Gateway to Myanmar; (4) Lower Northern Region 2: Rice Business Center and Heritage Tourism Destination; (5) Upper Northeastern Region 1: GMS Trading Center and Gateway to Eastern ASEAN & China; (6) Upper Northeastern Region 2: Agricultural and Livestock Center and Northeastern Green Tourism Destination; (7) Middle Northeastern Region: Northeastern Agricultural Food Innopolis and Logistics Hub; (8) Lower Northeastern Region 1: Khmer Civilization and Sport Creative Cluster and Agricultural Trading Center; (9) Lower Northeastern Region 2: World Jasmine Rice Production Center and Gateway to Eastern ASEAN; (10) Upper Central Region 1: Cultural Heritage Tourism Hub and Food Innopolis; (11) Upper Central Region 2: Organic Food Production Base; (12) Middle Central Region: Green Industry Hub, Green Tourism, and Gateway to ASEAN & Global; (13) Lower Central Region 1: Western Creative Tourism and Trade Destination; (14) Lower Central Region 2: Seafood and Agricultural Trade Center and Global Tourism Destination; (15) Eastern Region: Organic Fruits & Clean Industry, and Medical Tourism Destination; (16) Southern Region (Gulf of Thailand): Southern Agricultural Trading Center (Rubber, Oil Palm, Fruits); (17) Southern Region (Andaman Coast): World Class Tourism, and Creative Cluster – City of Gastronomy; and (18) Southern Border Region: Agricultural and Food Innopolis (Rubber, Fishery, Halal Food)	[62]

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Initiative	Initiative type	Summary	Source
Innovation Hub for Agriculture and Food	Public	Innovation Hub for Agriculture and Food aims at the development of 'advanced bio-based economy,' shifting from basic food industry, basic petrochemical industry, and biofuels to neutraceuticals industry, bio-based medicines, specialty chemicals, and bio-based plastics with high value in future	[62]
Advanced Info Service Public Company Limited (AIS)	Private	AIS offers a variety of startup services including a design center and a digital marketing laboratory; AIS Playground, which offers startup advice and workshops; and 'AIS the Startup,' which offers technological support, market access services and business development services. 'AIS the Startup' invests in many types of businesses, including agritech and foodtech. The objective of this initiative is to provide support to SMEs and fuel innovation	[63] [64]
InVent Program--Intouch Holdings PLC	Private	Intouch is a holding company with investments in the telecom, media, and technology (TMT) sector. The principal business units are currently divided into three main areas: wireless telecommunication business, satellite and international businesses, and other businesses. As Intouch believes in the innovation and creativity inherent in young entrepreneurs, the InVent Program was set to support and promote high-potential startups by facilitating the capital needed for business expansion	[65]

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APPENDIX A

VIETNAM

Initiative	Initiative type	Summary	Source
The Agricultural High-tech Park (AHTP)	Public-private	This park makes high-tech agricultural products, incubating high-tech agricultural businesses, conducting research and demonstration production models, and consulting about and transferring technology, as well as promoting models of hi-tech agriculture. So far, 28 organizations and businesses have participated in the park's incubation program	[1]
Root crop processing cluster	Private	This is a root crop processing cluster in Dong Lieu, Vietnam	[2]
The Hà Nội Business Incubator (HBI)	Public-private	HBI provides support for startups and young businesses in the food processing and packaging sector. More specifically, this incubator provides workshops, facilities, support in technologies, consultation, business networking and office services, and support in training and improving the quality of human resources	[3]
AgriBusiness Booster (Incubator)	Public-private	This incubator provides capacity and capital to SMEs and farmer cooperatives	[4]
Vietnam Commodity Exchange	Public	Product types include coffee, rubber, and steel	[5]
Saigon Hi-Tech Park	Public-private	It currently provides services including hi-tech manufacturing, hi-tech and commercial services, R&D, and training and incubation in four sectors: microelectronics; IT and telecommunication; precision mechanics and automation; and new advanced materials, new energy, and biotechnology applied in pharmaceuticals and environment	[6]
Quang Trung Software Park/City (QTSC)	Public-private	QTSC is the first and largest software park in Vietnam. It has begun to support organizations participating in research and application of IT in agriculture	[7]
AgriSource	Private	AgriSource is a Thailand-based food and agribusiness consulting company. Since 1989, its experienced team of market development and advisory professionals has offered clients (1) on-ground representation in southeast Asia; (2) food marketing and agribusiness expertise; (3) innovative market and business development strategies; (4) quantitative and qualitative market research; (5) extensive local contacts; and (6) knowledge of government regulations and agencies AgriSource and its team of local associates serve client needs across Asia, with a focus on southeast Asia, including Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam	[8]
Circular 120/2011/ TT-BTC	Public	According to Circular 120/2011/TT-BTC, freed from agricultural land-use tax are (1) agricultural land serving research and experimental production, and land on which annual crops are planted including at least one rice crop per year; (2) land used for salt production, and agricultural land that the state has allocated or earmarked for poor households; 3) agricultural land allocated to farmers and farmer households to which the state allocates land (including inherited, presented, and transferred land-use rights) for agricultural production; (4) households and individuals as members of agricultural production cooperatives that have received land from cooperatives, state-owned farms or plantations for stable agricultural production according to law; (5) households and individuals as members of farms and plantations that have received land from state-owned farms and plantations for stable agricultural production according to law; and (6) agricultural production households and individuals with agricultural land-use rights that contribute land to establish an agricultural production cooperative according to law	[9]

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Initiative	Initiative type	Summary	Source
Decision 1921/QLCL_CL1	Public	According to the decision, exporters must identify scientific names and trade names of tra and basa fish from the importers. The Decision was sent to processing and export businesses as well as agroforestry-aquatic product-quality centers. The objective of this decision is to use branding to better market Vietnamese products	[10]
Circular 02/2010/TT-NHNN	Public	Farmers purchasing mechanical machinery and equipment for agricultural production and processing, below five-ton trucks, will receive interest rate support. People enjoying interest-rate subsidies are farming households, individuals, cooperatives, and enterprises that are taking short- and medium-term loans in Vietnamese currency to buy machinery, equipment, and materials for agricultural production	[11]
Vietnam Food Association (VFA)	Public	VFA is a social organization of enterprises operating in the fields of food producing, processing, and trading. Members of VFA, applying modern technology, can produce different varieties of high-quality rice including fragrant rice and are well-experienced in implementing large-scale contracts with diversified ways of trading and forwarding to meet their buyers' requirements The annual quantity of rice exported by the members of Vietnam Food Association constitutes over 90% of the total volume of rice exported by the country. Before 2018, it was responsible for issuing rice quotas and regulating rice exports. In 2018, Deputy Minister of Agriculture and Rural Development Tran Thanh Nam requested the VFA to organize production and cooperative development, especially in areas of specialized rice cultivation, and initiative export quantity to specific markets, while maintaining quality assurance and food safety	[12] [13]
National Trade Promotion Program	Public	The state provides financial support for enterprises participating in the program, in which enterprises fly to Johannesburg City, South Africa to partake in trading activities with importing partner enterprises. The objective of this initiative is to promote rice export and improve trade relations with South Africa	[14]
Irrigated Agriculture Improvement Project (IAIP)	Public	IAIP will be implemented in the three northern mountainous provinces of Ha Giang, Phu Tho, and Hoa Binh, and in central provinces of Thanh Hoa, Ha Tinh, Quang Tri, and Quang Nam up to 2020. It aims to enhance irrigated agricultural productivity and competitiveness, and improve the sustainability of agricultural production through adaptation to climate change in the benefiting localities	[15]
MimosaTEK Co. Ltd.	Private	MimosaTEK provides farm management solutions for both smallholder farmers and large agricultural companies in different parts of Vietnam and for different crops. For instance, its solutions are applied for short-day plants such as vegetables and perennial plants such as black pepper, maca, and citrus trees. MimosaTEK collaborates with reputed partners in irrigation infrastructure supplies and greenhouse construction to provide complete solutions for its customers. As an agtech company, MimosaTEK keeps enhancing its solutions and listening to customer's needs. Optimizing the solution is always at core of its strategy	[16]
The Vietnam–Finland Innovation Partnership Programme (IPP)	Public	The Vietnam–Finland IPP is an Official Development Assistance (ODA) program jointly financed by the governments of Vietnam and Finland. IPP supports Vietnam's overall goal of becoming an innovation-driven knowledge economy. The program's objective is to generate lasting impact in the Vietnamese innovation ecosystem by supporting the scale-up of practices tested on the ground for entrepreneurship and innovation training in universities, financing innovative companies, and creating cross-border businesses	[17]

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Initiative	Initiative type	Summary	Source
The Saigon Innovation Hub (SIHUB)	Public	SIHUB will prioritize projects in four key industrial sectors of the city, which are food processing; electronic-information technology; mechanical manufacturing; and chemistry (rubber, plastic, pharmaceuticals). The center will serve as a dialog channel among businesses, local officials, and policy makers to discuss development opportunities. The objective of this imitative is to make Ho Chi Minh City a 'startup city'	[18]
Chu Lai agro-forestry industrial park	Public	The 450 ha agroforestry industrial park will develop a material farming area for the central provinces, Central Highlands, and neighboring countries of Lao PDR and Cambodia. It will be built from 2019 to 2022 at a total cost of over VND8.1 trillion (USD352 million). It will also double up as a research center for seedlings, agricultural materials, biotechnology, harvest, preservation, and processing. Model farms will grow grapefruit, mango, jackfruit, and forestry trees using modern technology	[19]
Binh Dien Fertilizer Joint Stock Company	Public	Binh Dien Fertilizer Joint Stock Company has become a leader in NPK production and has significantly contributed to Vietnamese agriculture and rural development. Its objectives are to conduct research and apply advanced technologies into Binh Dien's products manufacturing in order to bring increased value to farmers; and to supply farmers with excellent support services to provide the greatest possible benefits Its business fields include the following: manufacturing and trading of numerous types of fertilizers, cattle feeds, and aqua products; producing, processing, and packaging of insecticides; import and export of fertilizers, fertilizer production equipment and technology, agricultural machinery, and varieties of plant and agricultural products; and trading of real estate (housing and office) and leasing of warehouses (with approved projects)	[20]
GrowTech Vietnam	Public	As the exclusive trade exhibition sponsored by authorized ministries of Vietnam to promote agriculture, forestry, and fishery of the country, GrowTech Vietnam is an ideal platform for international manufacturers and traders to approach key Vietnamese buyers such as traders, distributors, production enterprises, associations, cooperatives, and farmers who come to look for new machinery, equipment, technology, and products	[21]
Agro Processing and Market Development Authority (AgroTrade)	Public	The department will advise the concerned minister on the implementation of laws on developing markets of agroforestry, seafood products, and salt. It will coordinate the activities to expand markets; and organize the management, processing, and preservation of agroforestry and seafood products and salt, as per the minister's instructions	[22]
Vietnam Trade Promotion Center for Agriculture (Agritrade)	Public	Some functions of Agritrade include (1) organization of exhibitions, fairs, seminars, and meetings; 2) organization of activities to promote trade in agriculture and rural development; and 3) support of business building, brand promotion, and goods	[23]
Building Software for Trade Promotion in Agriculture	Public-private	The objective of this initiative is to support market information for enterprises, producers, and traders of Vietnamese agricultural products	[24]
Vietnam Food Administration (VFA)	Public	VFA assists the Minister of Health in implementation of the state management on safety of the domestic as well as imported food in the market across the country. Its objective is to regulate food safety, carry out licensing and certification for packaging and food items, and inspect food hygiene to ensure consumer safety	[25]

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Initiative	Initiative type	Summary	Source
The National Agro-Forestry-Fisheries Quality Assurance Department (NAFIQAD)	Public	NAFIQAD is an institution assisting the concerned ministry in carrying out the monitoring of quality and safety of agricultural, forestry, fishery products, and salt nationwide. Some responsibilities include proposing projects, programs, and plans to the ministry; conducting a national monitoring program on food safety of fishery products; propagating national standards and regulations; inspecting and certifying fishery sites and products; and recognizing testing laboratories for the safety of products	[26]
Vietnam Standards and Consumers Association (VINISTAS)	Private	VINASTAS's mission is twofold: to promote standardization and product safety, and to improve consumer protection in Vietnam. As many as 28 province- and city-based consumer associations are members of VINASTAS. Its main activities are contributing to national legislation and policies, consumer information, handling individual consumer complaints and campaigning for consumers in areas such as competition, fair trade, anti-fake goods, tobacco control, and energy saving	[27]
Decree 15/2018/ND-CP Guidance on the Implementation of a Few Articles of the Food Safety Law	Public	Companies who manufacture and trade in packaged food products, including food additives, processing aids, food packaging materials, and packaging materials in direct contact with food must self-declare that these products meet safety product standards. These forms must be submitted to the competent authorities designated by the Ministry of Health. Once a company has self-declared the product, the company will be liable for any safety issues relating to the product but will be permitted to manufacture or trade the particular product. Food products which are produced for children under 36 months, health or dietary supplements, foods for special medical purposes, medical foods, and foods for special dietary uses must also be registered with the Ministry of Health. Food products must contain all relevant labeling requirements as issued by the Ministry of Health and other agencies. The new decree also provides requirements for advertisement and claims and provides that all of the required registered products must be notified to the Ministry of Health for the claims regarding the product prior to the product's advertisement	[28]
Vietnam Farmer's Union (VNFU)	Private	Some of VNFU's activities include participating in formulation, dissemination of policies, laws, and legal support for farmer members; organizing the transfer of scientific and technological progresses to farmer members; creating capital for farmer members, especially the poor ones, to develop production or business; guiding and supporting the development of collective economic forms such as cooperatives and cooperative groups among farmers; providing vocational training and job assistance for farmer members; organizing activities to introduce and promote products for farmers to get access to markets; participating in building rural infrastructure; participating in rural environment protection; improving awareness, knowledge of environmental protection, and adaptation to climate change for staff and farmer members; and providing training for staff at all levels	[29]
Vietnam Bank for Agriculture and Rural Development (Agribank)	Public	Agribank provides credit and financial services, primarily to Vietnam's agricultural and rural areas. Agribank has a stable structure of liabilities comprising a large proportion of Vietnam's public mobilization, which is invested in the country's programs and agricultural development priorities. These include the lending programs for the food industry, aquaculture, coffee, husbandry, rubber, pepper and cashew planting, the national targeted program for New Rural Development, the supporting programs to reduce the loss of agricultural production, the lending program for social housing, the pilot lending to association models in the agricultural value chain from production to consumption and from models of hi-tech application to agricultural production	[30]

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Initiative	Initiative type	Summary	Source
Vietnam Association of Seafood Exporters and Producers (VASEP)	Private	VASEP members include leading Vietnamese seafood producers and exporters with companies providing services in the seafood sector. Based on mutual support, the association was established on 12 June 1998 to coordinate and link enterprise operations; improve value, quality, and competitive capacity of Vietnamese seafood; enhance source of raw material for seafood export; and represent and protect legal interests of members. Some objectives of VASEP are to enhance the relationships between members, provide updated market information, provide training courses to members, and provide criticism and advice on state policies	[31]
The Institute of Water Resources Planning (IWRP)	Public	IWRP is a part of the Ministry of Agriculture and Rural Development (MARD). IWRP is among the most important institutions in Vietnam dealing with studies related to river systems. IWRP specializes in policies, planning, engineering, and consultancy. Its function is to operate within MARD and at other provincial levels in formulating water resources (water supply and sanitation, drainage, flood, and drought prevention), energy, climate, and environment across Vietnam to facilitate socioeconomic development. Major tasks include regulating the use of water resources, as well as protecting and developing water resources and the environment in a sustainable way	[32]
Vietnam National Administration of Tourism (VNAT)	Public	VNAT manages and develops tourism activities in Vietnam. It trains producers in business development, planning, and public relations; conducts research on the impact of agritourism; and inspects and implements regulations in the tourism industry	[33]
The Northern Key Economic Zone	Public	The Northern Key Economic Zone consists of eight municipalities and provinces focusing mainly on agricultural products. These include Hanoi, Hai Phong City, and the provinces of Bac Ninh, Ha Tay, Hai Duong, and Hung Yen. Economic zones have incentives in place that encourage both domestic and foreign investment. Tax incentives include exemptions or reductions of corporate income tax (CIT), value-added tax (VAT), and import tariffs for specific periods and are granted based on the business lines and location of the foreign investment enterprises. Regulated sectors that are encouraged include education, healthcare, sports, culture, high technology, environmental protection, scientific research, infrastructural development, and software manufacturing	[34]
Export Processing Zones (EPZ)	Public	The objective of this initiative is to encourage and develop export industries and attract investment, particularly foreign investment with potential for transfer of technology. Each EPZ is supervised and run by a Management Committee, on which are representatives of the Ministries of Finance, Trade and the Interior, the State Bank, the Customs Department, and People's Committee It has the responsibility, broadly, to establish a scheme for the development and operation of the EPZ, and to promote investment and construction within the zone. Favorable conditions apply to infrastructure development companies (either domestic enterprises or enterprises established under the Law on Foreign Investment) set up for the purpose of constructing and operating infrastructure projects within an EPZ	[35]
Hoa Lac Hi-tech Park	Public-private	Hoa Lac Hi-tech Park is a National Hi-tech Park with an area of 1,586 ha and is dedicated to becoming a science city. It attracts investors in fields of R&D; training and incubation; manufacturing hi-tech products in biotechnology, information and communication technology, new material technology, and automation technology. It contains a high-tech industrial zone for manufacturers; an education and training zone; a research and development area, and more	[36]

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Initiative	Initiative type	Summary	Source
Danang Entrepreneurship Support (DNES)	Public-private	As a business incubator in Danang, DNES recognizes that its mission is to help early-stage startups. It provides direct support through training courses, office space, consulting, and entrepreneurship mentoring as well as creating networking opportunities. Startups participating in DNES's incubation program will be equipped with successful startup knowledge such as product development, market research, human resources, and capital calls. DNES is an incubator operating in the only public-private partnership in Vietnam. Since 2016, DNES has organized four nursery courses with more than 30 supported startups	[37]
Vietnam Rice Brand Logo	Public	The objective of this initiative is to improve the transparency of Vietnam's food safety and to promote higher rice quality. Since only rice products that meet the quality standard can use the logo, with the approval of WIPO, the branding of this product is also intended to improve rice exports	[38]
Training Center--Technology University of Hanoi	Public	The first project, amounting to EUR1,063,049 in aid credit, will supply machinery and equipment for the laboratories of the Biology and Food Sciences Institute at the University in Hanoi. Training and research projects in the field of food industry technology are also envisaged. The machinery provided will make it possible to carry out teaching and experimental activities in numerous food-industry technologies (dairy, juice, and concentrate production; nut and seed toasting, etc.). The aim of the initiative is to help improve training in Vietnam's agrofood sector and applied research, with the aim of increasing crop yields for the agrofood and food packaging industries	[39]
Research and Training capacity in the Agriculture and Forestry Faculty of the University of Thai Nguyen	Public	The second project is to supply equipment to enable the biochemistry and biophysics labs at the University of Thai Nguyen, located near Hanoi, to be modernized. The project also envisages providing a teaching and experimentation greenhouse where various environmental parameters (irrigation, insolation, chemical composition of the atmosphere, nutrients, etc.) can be changed using a computerized system. Training courses in biochemical and biophysical soil analysis and micro-propagation will also be set up. The total aid credit being provided is EUR1,228,238	[40]
Topica Founder's Institute	Private	Topica Founder's Institute provides a training course that enrolls new startups in a 15-week program and invites leaders from successful startups in Vietnam to come and train the newbies. It had graduated 11 startups as of 2012	[41]
5Desire	Private	5desire is an incubator and consulting firm that is focused on accelerating startups in various sectors in terms of business and resources. It chooses startups to participate in its program and is also running a coworking space.	[41]
Hatch.vn	Private	Hatch.vn organizes monthly events, attempting to connect startups across various sectors and is working on a big startup fair	[41]
FPT	Private	Vietnam's biggest technology company also hosts an incubator called FICO, which targets students	[41]
The Start Center and Saigon Hub	Private	Originally launched as just the 'Start Center,' this coworking space has overflowed to necessitate opening up Saigon Hub, where workshops are given along with mLab. The vision is to get more events and support for startups that need space, acceleration, and possibly funding	[41]
Egg Agency	Private	Egg agency, located outside of Saigon's city center, is a growth-hacking incubator that brings in new entrepreneurs and runs them through laps of real business to build experience for their own projects	[41]
mLab	Private	mLab, with support from The World Bank, is attempting to unite the startup scene in Ho Chi Minh city with events connecting all the right people together. It is also running hackathons and competitions to incubate in coworking spaces, in coordination with others in the sector	[41]

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Initiative	Initiative type	Summary	Source
Skynet	Private	Skynet specializes in building a network of experts and managers within the company while incubating and accelerating companies that come to it	[41]
Quang Trung Software City	Private	This industrial park is dedicated solely to fostering the Vietnamese tech industry and hosts several technology universities as well as big outsourcing companies. It has also got an active incubator	[41]
FoodAlfa project: KissStartup	Private	The objective of this initiative is to help Vietnamese food startups to overcome challenges to thrive, by leveraging its business development services for food startups and the group of investors interested in food industry that KissStartup has developed. The activities include funding for startups in food industry that includes but is not limited to food, farming, food processing, and biotechnology; incubating through training, coaching, and mentoring to help startups find product-market fit and validate their business models; and accelerating through intensive coaching, mentoring, and matching with potential investors	[42]
Innovation with Purpose (IPN)	Private	IPN is a network of innovation ecosystem builders, universities, institutions, and businesses joining hands for innovation-with-purpose ideas and projects to flourish and positively impact the community. Activities include (1) connecting talented and passionate individuals from universities and institutions with the business world; (2) enabling innovative ideas to take shape via capacity building programs including design thinking and lean startup (training, coaching, and mentoring); (3) helping corporates and SMEs to get closer to quality human resources and potential investment in innovation from early stages	[43]
Hi-Tech Konec	Private	The aim of Hi-Tech Konec is to create a real and valuable connection corner among leading experts, along with SMEs who have been finding a chance to adopt high technology in innovating business model in order not to be left behind, as well as startups who provides solutions for above problems. Hi-Tech Konec is where SMEs and startups meet, share, and connect, but it also provides workshops for businesses	[44]
Innovation Land Tourism: Pre-Acceleration and Acceleration	Private	It supports startups before and during acceleration through mentoring with experienced mentors in the tourism and hospitality industry; and coaching one-on-one with lean startup tools, as well as investment matching	[45]
KissStartup	Public-private	Our vision is to make valuable contribution toward increasing innovation efficiency for ASEAN and Asian startups and enterprises, right from their business model generalization and market validation stages to assist them in realizing the innovation and startup dreams in the region as well as globally. KissStartup carries out its mission through a series of activities, e.g., training; providing knowledge and tools to validate ideas and business models, complete the business models, and market the products; provide leaders with the right mindset and tools to innovate, and develop products/services/project in the spirit of lean startup; training of the trainers; training of innovation coach; and training of ecosystem player	[46]

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APPENDIX B: CASE STUDY

DOMESTIC CHOCOLATE INDUSTRY IN INDONESIA

Appendix B was prepared by Anshuman Gupta, Cynthia Istanto, Darren Tsai, Helena Lam, Mahrusah Zahin, and Sheren Winarto, with support from Iwan Azis, Ralph Christy, and Lin Fu, as part of Cornell University's Student Multidisciplinary Applied Research Team (SMART) Program.

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Introduction

Indonesia, one of the largest economies and emerging markets in the world, is witnessing a transition from an agriculture-based economy to manufacturing and services. A growing young population with increasing disposable income provides huge opportunities for expanding the country's economy. At the same time, the agriculture sector has been witnessing declining productivity and reducing farm incomes, forcing the youth to look for alternatives in other sectors. Poor processing facilities and lack of profits for local manufacturers have further exacerbated the problem, making it almost infeasible for farmers to continue with agriculture in the present form.

On the other hand, promoting localized processing of agricultural produce presents a big opportunity for the country. Like many developing nations, Indonesia exports many of its raw products abroad to be manufactured into finished goods, which are then sold back to the country at premium prices. Cacao is a prime example of this dichotomy. Even though Indonesia is the third-largest producer of cacao in the world, most of it is exported to western countries either in raw form or as powder and butter. Thus, the major value addition in cacao, i.e., manufacturing of products such as chocolates and beauty products, takes place outside the country.

Based on primary research conducted for the SMART Program under the Emerging Markets Program at Cornell University's Charles H. Dyson School of Applied Economics and Management, this study examines the cacao industry of Indonesia. The various actors, including farmers, primary processors, intermediaries, and chocolate manufactures, are also discussed. The final section of the report analyzes these stakeholders, using Porter's Five Forces model, to understand the role played by each in determining the country's chocolate industry's overall structure and profitability.

Cacao Production in Indonesia

Indonesia is the largest economy in southeast Asia, and its gross domestic product (GDP) is largely based on the services and manufacturing industries. Agriculture contributes only 14% to the GDP but employs 32% of the total labor force. With a per capita income of USD3,540 (2017 estimates), Indonesia is ranked a low 127th among all countries. However, with increasing industrial and agricultural production, Indonesia has become a major exporter of goods, with total exports valued at USD168 billion (2017 estimates). Palm oil and natural resources, e.g., coal, natural gas, and

petroleum, make up the majority of goods exported. Indonesia's main trading partners are PR China, Singapore, Japan, and the USA [18].

Although Indonesia has rapidly transitioned to a manufacturing- and services-based economy, agriculture continues to remain the major source of livelihood for 32% of its 125-million labor force. Rubber, palm oil, and cacao plantations employ the largest chunk of this labor force, with the contribution of other (traditionally subsistence) crops like rice, maize, and groundnut continuously declining. Thus, in recent times, the country is seeing a clear transition from food crops to cash crops.

Indonesia is the world's third-largest producer of cacao behind Cote d'Ivoire and Ghana [5]. One of Indonesia's largest foreign exchange earnings is from exporting raw cacao beans to Malaysia, the USA, and Singapore. Indonesian farmers cultivate about 1.5 million hectares of cacao plantations [7]. However, productivity has greatly declined over the past decades. In the 1990s, Indonesia yielded between 1,000 to 2,500 kg per hectare, depending on the plantation's location. By the late 2000s, yield was about 600 kg per hectare [2]. It has not improved much since [13].

Like most large producers of cacao beans, Indonesia exports nearly all of the beans in raw form, which is then processed in other countries. This prevents Indonesia itself from benefiting from the value addition. To counteract this, the government has made an economic push in the last decade to encourage processing of raw products within the nation, as an attempt to contribute to economic growth. It has introduced several policies, ranging from export bans on raw materials to export taxes on unprocessed goods, to increase the contribution to the domestic economy from processed goods [10].

Beginning in 2010, there has been an export tax on cacao beans [17]. However, the Indonesian government has been careful not to deter the production of cacao by fluctuating the tax depending on the world price of cacao. It has upheld 0% tax when the price is under USD2000 per ton; 5% when the price is between USD2,000 and 2,750 per ton; 10% when the price is between USD2,750 and 3,500 per ton; and 15% when the price is beyond USD3,500 per ton [1]. In 2010, the national production of cacao was 575,000 tons, with a dip in the next year to 435,000 tons, and a rise to 500,000 tons the year after. By 2013, it had once again reached 575,000 tons [7]. The statistics show a decline in production following the tax but a recovery within three years to the pretax level. Since then, however, cacao production has again been on the decline [6].

Smallholder farmers produce over 90% of cacao in Indonesia, with large private estates or state plantations accounting for the remaining production. Thus, while cacao production supports the livelihoods of a large section of the poorest farmers, fragmented landholdings prevent optimization of production processes. Individual farmers often do not have the financial means to invest in the latest production technologies and suffer from poor economies of scale. Poor efficiency affects other steps of production as well. Cacao must be grinded before it can be turned into cocoa powder, cocoa butter, and a host of other products. Although Indonesia has steadily increased its grinding capacity, a large portion of this capacity is not utilized because local cacao bean production has not caught up with the grinding capacity [1]. The export tax imposed by the government has helped local grinding facilities to stay in business by encouraging cacao producers to grind their beans domestically.

Due to the uncertainty associated with cacao production and sales, many farmers are switching to palm oil and rubber. Cacao plantations have steadily been replaced by these crops as they provide more secure sources of income [7]. Other factors that also contribute to the instability of the cacao business, are pests and diseases as well as natural calamities like droughts. Farmers are often not

sufficiently equipped with knowledge and techniques to maximize production from aging cacao plants [6]. Additionally, beans can be rendered unusable by the cocoa pod borer, an insect whose larvae feed off the cacao beans [13]. Although the Indonesian government has spearheaded the National Cocoa Movement to utilize state funds to help farmers rejuvenate their cacao farms, the focus has only been on providing new seeds and fertilizers. The lack of training on best practices in cultivating the new seeds, along with a steep cut in the state budget for cacao development in Indonesia, has limited the results [6]. While the government has taken some steps to promote cacao production, farmers have been unable to harness the benefits as the problem lies heavily in the lack of relevant training.

In considering the cacao industry conditions in Indonesia, this report highlights the key components of the chocolate industry in Indonesia, namely, farmers, primary processors, intermediaries, and product manufacturers; and analyzes the industry using Porter's Five Forces model to understand each of these components and their effects on the overall structure of the industry. The next section discusses the challenges and limitations in the current production and processing practices, followed by a discussion on farmers and primary processors in Indonesia.

Value Addition to Cacao

Cultivation of Cacao

Cacao is a long-duration tropical crop, whose saplings take three to five years to start bearing fruits. Once mature, a cacao tree can continue to bear fruit for 25 to 30 years, based on upkeep and maintenance by farmers [4]. Ensuring the best-quality beans requires following the right methods of cultivation, irrigation, pruning, harvesting, and fermentation, which are time-consuming and cumbersome. Moreover, cacao requires a delicate balance of high humidity, weather variation, and sun to ensure optimal harvest. Yet, most farmers lack knowledge of best practices and typically practice high-intensity farming. While this method can increase production in the short term, there is often a greater risk of pests and diseases, thus leading to higher use of pesticides and damage to natural ecosystems in the long run.

Most cacao farms occupy areas less than a hectare and so, many farmers practice multicropping with crops such as coconut trees and vegetables. While multicropping reduces risks and ensures a steady supply of produce all through the year, it also results in improper management of crops. Irregular fertigation, irrigation, and pruning can further reduce productivity and reduce incomes. Thus, a lack of awareness and training has resulted in smallholder farmers following a set of unproductive and unviable cultivation practices with continuously decreasing returns [4].

Some skilled intergenerational cacao farmers have overcome these barriers by organizing themselves into cooperatives and obtaining support from local processors who prefer quality products. These farmers often practice improved techniques such as agroforestry, processing cacao pod waste to manure, and minimal use of chemical fertilizers. The cooperatives have helped these farmers obtain economies of scale, as well as gain better access to training in improved practices and climate-change management. Some farmers have even customized their cacao varieties to prevent monocultures and ensure greater resistance against pests and lower yields [4].

Harvesting and Fermentation

Once the cacao pods have been harvested, they can be stored for a month. However, once the pods have been cracked open, the seeds must be processed within a day. At this stage, proper fermentation

is key to producing good-quality beans and therefore, good quality chocolates. The process develops the precursors of flavor and aroma that vastly improve chocolate quality.

The process of fermentation starts when farmers break the pods open and remove the flesh-covered beans from inside. The beans are typically placed into two-tiered fermentation boxes and covered with banana leaves. Different facilities use crates of different woods, such as durian, which can facilitate fermentation. After about three days, the beans are mixed and moved into the second crate so they can be fermented thoroughly. After about a week of this process, the beans are dried under the sun for several days. The dried beans are then supplied to industries for manufacturing various products.

Even though good-quality fermented beans are in great demand, especially from premium chocolate makers, they are only produced by a few progressive farmers. Low supply has ensured that prices of these high-quality beans can increase up to three times the market prices of unfermented beans. The primary reason is that fermentation, even though a simple process, can take up to a week, depending on the quantity of beans. Immediate needs for cash often force farmers to sell the beans as soon as they are harvested, mostly by drying the beans directly [14]. Organizing farmers into cooperatives can create the incentive to take up fermentation by providing farmers the credit in advance and procuring beans to be processed at a centralized processing and storage facilities.

The Cacao Bean Market, Chocolate Processing, and Production

While the section above highlights key issues in the production and primary processing of cacao, the supply chain from the farm to manufacturers is also complicated due to the presence of multiple actors with varied interests and motivations. The following subsections explain the most common and dominant supply-chain model from the perspective of local chocolate manufacturers. We will also discuss how producers are changing the norms of the supply chain to make it more remunerative for themselves as well as the farmers.

The Dominant Model

The fermentation process is usually skipped by farmers for multiple reasons. However, a complementary supply chain that values the unfermented beans to be shipped to international manufacturers creates the necessary demand for these poor-quality beans, thus further reducing farmers' incentives to process their beans themselves. This supply chain is mostly operated by small intermediaries and middlemen who gain margins from the low prices. The middlemen typically ship and sell the beans to international markets for further processing into products like chocolates. These intermediaries are the primary threat to local chocolate manufacturers seeking to procure high-quality beans from farmers. The dominant model (see Figure B1) also means that most of the value addition takes place outside of Indonesia and only benefits foreign manufacturers and processors based in western countries like Switzerland and Belgium, who often sell their premium chocolates back in Indonesia.

Another threat facing value addition for Indonesian cacao beans is local low-quality chocolate makers whose products only require unfermented cacao beans. The cheaper and sweeter low-quality chocolate attracts a large majority of Indonesia's population, thus creating stronger demand for unfermented beans. Since farmers have easy access to buyers for unfermented beans, many forgo the additional income from fermented cacao beans. On the other hand, if the beans are fermented and sold to domestic manufacturers, the highest margin of the value addition process

FIGURE B1

THE DOMINANT SUPPLY-CHAIN MODEL FOR CACAO IN INDONESIA.

stays within the country, thus creating benefits for both farmers and manufacturers, and consequently for the country's economy.

The cosmetics industry presents the third threat to local chocolate manufacturers. Many cosmetic products use cocoa butter, which can be extracted from unfermented cacao beans. Since these companies ensure that farmers are paid right away, many farmers are paid a significantly lower price, rather than the price for fermented beans. There may also be difficulty in finding a premium chocolate maker to buy their fermented beans.

The Emerging Model

For many emerging premium chocolate makers in Indonesia, the key to high-quality chocolate is to establish an assured and reliable supply chain of high-quality beans, ideally directly from the farmers. So, they often invest in farmers through training programs and providing credit for tools and equipment while requiring consistent supply. Thus, under the emerging model (see Figure B2), local manufacturers ensure that most of the value-addition processes are performed by Indonesian producers and manufacturers, rather than foreign entities. This enables farmers to receive high profits and allows local chocolatiers to have access to the best-quality beans. Also, local chocolatiers benefit from avoiding the import taxes and selling the finished chocolate goods at premium prices to international and domestic markets. Many of these local Indonesian chocolate manufacturers invest in progressive farmers to train other farmers in best cultivation practices.

Even with the recent emergence of Indonesian premium chocolatiers, there are often insufficient skilled farmers to produce quality beans. This is due to the lack of awareness regarding the fermentation process as well as the lack of financial stability from cacao farming [8]. Since cacao production can differ dramatically by month and by weather conditions, many of these emerging chocolate companies lack a consistent supply of quality beans. This is often a major challenge for chocolate manufacturers and might lead to operational issues as these companies continue to expand. With this new segment of premium chocolate manufacturing looking for quality beans, the question remains whether more farmers are likely to adopt sustainable practices that will lead to a higher quantity of quality beans, or switch to cultivating palm oil to mitigate the unstable and low prices for cacao beans.

The Production Process

Premium chocolate manufacturers use various equipment to produce their chocolates. These include roasters, grinders, and mixers, based on the scale of operation. While the technology is fairly simple, maintaining correct temperatures and having the right ingredients is critical to making good-quality chocolates.

FIGURE B2

THE EMERGING SUPPLY-CHAIN MODEL FOR CACAO IN INDONESIA.

The primary machine is the roaster that helps make whole beans safe for direct consumption. After roasting, most of the beans are put through a winnowing machine that separates the nibs from the outer shell. The nibs are then ground to make chocolate mass. The mass is separated into cocoa powder and cocoa butter. To produce premium chocolate, cocoa butter is added to chocolate powder in exact proportions and the paste is then tempered at 82°F. Finally, the chocolate is ready to be packaged and sold to consumers. In some cases, chocolate manufacturers also sell intermediary products, like cacao nibs, butter, and cocoa powder to diversify their product portfolio.

The next part of the report introduces some of the major domestic chocolate manufacturers in Indonesia, their business models, unique selling propositions, and industry outlooks.

Chocolate Manufacturers in Indonesia

Cau Chocolates

Established in 2015, Cau Chocolates is the result of the hard work and passion of Alit Artha and his son, Surya Wiguna. With a vision of promoting sustainable growth in the cacao subsector in Bali, Cau Chocolates emphasizes on producing organic bean-to-bar chocolates sourced from nearby farmers. In addition, Cau Chocolates has combined agriculture and tourism to offer a unique agritourism experience to tourists visiting Bali. These agritours provide visiting tourists with a hands-on opportunity to experience organic farming systems. Artha hopes that by doing so, he can spark an interest in agriculture in the younger generations.

Artha's initial experiments with cacao to produce chocolate suggested that there was a potential to supply premium chocolates, especially organic, in Bali's young market, and he decided to enter the niche market. As of now, Cau Chocolates is the only certified organic chocolate manufacturer in Indonesia. With this certification, he was able to differentiate his chocolates from others and attract more consumers. Artha emphasized on the quality of his chocolates, sparing no expense in obtaining the best fermented cacao beans from his local supplier, the Koperasi Kerta Semaya Semaniya (KSS Cooperative). Among the first products, the 63% organic dark chocolate was well received by visiting tourists. Over the next two years, the father-and-son team worked to turn Cau Chocolates into what it is today. Artha runs the research and development (R&D) and production departments, and has created over 20 different types of products that target the tastes of locals and tourists alike. Wiguna, on the other hand, runs the marketing and sales departments, and has forged supportive relationships with local and international retailers. In addition to producing chocolate bars, Cau Chocolates processes roasted cacao beans, butter, and powder. They have also begun expanding into desserts and bakery products, like cookies.

Pod Chocolate

Toby Garritt, an Australian chef, established Pod in 2010 with the intention of producing chocolates to cater to foreign tourists in Indonesia while also supporting the local communities. Garritt spent over two years refining his chocolate recipes, using only natural and local ingredients. He sourced raw materials, such as cacao powder, from Bali and Sulawesi. Once he perfected his recipes, Garritt opened Pod Origin in 2013, located at the Bali Elephant Camp, to educate visiting tourists on chocolate production from bean to bar. However, Garritt also knew that if he had to sell his chocolates to locals, he would have to educate them on the culture and history of consuming chocolates. Therefore, he began offering chocolate-making experiences to schoolchildren and corporate employees.

With his business taking off, Garritt opened a cafe in 2014 on one of the most popular roads in Bali, offering free tasting of his 20 different flavors of chocolate bars. He added drinks and pastries, in hopes of further attracting locals and visiting tourists. Pod also supplies couverture chocolates and customizable products for special occasions to local hotels, resorts, and restaurants. Outgrowing the production capacity at the then existing location in Bali Elephant Camp, Garritt moved his production lines to a bigger location with state-of-the-art processing facility in Mengwi, Bali, in 2016. Here, it also hosts a shop and a cafe. Garritt hopes to expand his business into neighboring countries in the near future.

Monggo Chocolates

Thierry Detourney, a Belgian expatriate, founded Monggo in 2005. His passion for chocolates led him to start a chocolate selling business off the back of a pink Vespa in Indonesia. He hoped to share with Indonesian locals the taste of chocolates he had been exposed to in Belgium. Knowing that he would also have to cater to local palettes, he created many different flavors of chocolates using local ingredients, such as chili and ginger. As his business grew, he established a chocolate store and museum in Yogyakarta, Indonesia, attracting locals and tourists alike.

At the chocolate museum, Detourney aims to educate visitors on the history of chocolate, from the period of ancient Meso–Americans, who enjoyed chocolate as a thick and bitter drink, to Europe, where it evolved into the decadent chocolates that are still enjoyed. The museum also features the process of chocolate making, from cacao beans to bars. It also displays the history of Monggo, from the development of its packaging design, to its journey from a pink Vespa to the establishment that it is today. Similar to Pod, Monggo also offers chocolate-making and tasting experiences to families, schools, and corporate offices. In its chocolate stores, Monggo has recently also diversified to include products such as truffles and pralines.

nDalem Chocolates

In 2013, Wednes Ari Yuda and Meika Hazim, a husband-and-wife team, founded nDalem Chocolates in Yogyakarta, Indonesia. Driven by their profound love for chocolates, they started producing chocolates mainly as souvenirs, targeting locals and foreign tourists. They found themselves in the niche market for premium chocolates in Indonesia, together with Monggo, the long-time favorite of both locals as well as tourists from western countries. However, nDalem Chocolates differentiates itself by incorporating Javanese stories and cultures on the packaging of their chocolates, hoping to educate their consumers on the roots of Indonesian chocolates.

nDalem Chocolates initially produced only compound-milk chocolates, from 2013 to 2014. It was not until 2015 when nDalem was introduced to cacao farmers through a government seminar, that it added a bean-to-bar premium chocolate line. Fostering close relationships with farmers, it was

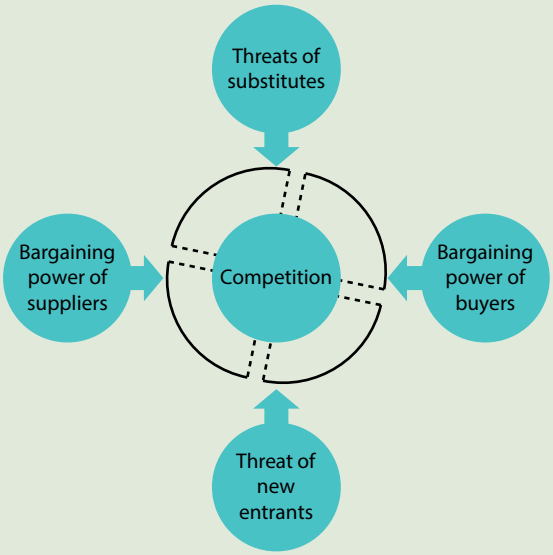
able to obtain a supply of high-quality fermented cacao beans that would be used to produce exceptional premium chocolate bars. Wanting to differentiate from competitors such as Monggo, nDalem decided to focus on consumers with keto diets. This move was considered successful when sales increased by 18% in 2017 compared to 2016. nDalem Chocolates is continuously exploring opportunities to expand to other Indonesian cities such as Surabaya and Jakarta. One such initiative is to cater to local tastes by incorporating local flavors such as chili, ginger, and cinnamon.

With knowledge of these different manufacturers, this report aims to discern broad patterns within the industry. The Porter's Five Forces Model (see Figure B3) is one such framework that differentiates the stakeholders to determine the industry's structure and its profitability [11]. The next section explains each component of the framework with reference to the cacao industry in Indonesia.

Porter's Five Forces Model

FIGURE B3

PORTER'S FIVE FORCES MODEL AND ITS COMPONENTS.



Porter's Five Forces model breaks down the industry into several components: the suppliers and buyers often exert opposing forces, while substitutes and new entrants push the industry towards greater efficiency. The middle ground comprises competitors who have the same goods but often competing strategies to differentiate their products. Porters' Five Forces model helps analyze each of these factors and the interactions between them, which in turn helps understand the overall structure of the industry.

The term 'suppliers' often refers to primary producers and processors of the raw material required for a company to manufacture the product. A company usually deals with multiple suppliers simultaneously, and suppliers of niche or rare raw materials often have greater bargaining power than other suppliers. According to the Porter's model, having multiple suppliers for raw materials often helps companies reduce the bargaining power and exert greater influence on suppliers, thus ensuring greater profitability.

On the other hand, the buyers are often individual consumers or other companies that procure the finished goods. Here too, serving individual consumers, with their own unique choices and preferences, reduces the influence that a company has. Therefore, companies often look for larger institutional bulk buyers, especially in the initial growth phase.

The third component is represented by the substitutes, defined as goods that can easily replace the primary product and have a positive cross-price elasticity [12]. This implies that the demand for a substitute good increases as the price of the primary good increases. It is a constant challenge for companies to be on the lookout for substitute goods that may challenge their products in the market.

Similar to the threat of substitutes is the threat of new entrants who manufacture products similar to those produced by other players in the industry. New entrants are classified as separate from other competitors. This is because continuous innovation and improvement in technology allows new entrants to serve their customers more efficiently and effectively, thus posing a bigger challenge than existing competitors.

The four components, together with the existing competitors, define the competition that a company in the industry faces. It is often complicated because each component exerts opposite forces and in a dynamic and fast-moving industry, the forces vary continuously. However, a thorough analysis of the stakeholders can help define the broader patterns witnessed within the industry and help companies define their own strategies in accordance with these patterns.

The next five subsections explain each of these forces as applied to the cacao industry in Indonesia. The analysis is based on interactions with stakeholders from farmer groups (suppliers), existing competitors, and chocolate consumers in Indonesia.

The Suppliers

Cacao forms the primary raw material and the major cost component for chocolate manufacturers. Other raw materials used in smaller quantities are milk, sugar, and sea salt. It is thus imperative that cacao producers and suppliers hold considerable bargaining power. This is especially true in the manufacture of high-quality couverture chocolates, which require that only the best-quality fermented beans are used.

Most bean-to-bar chocolate manufacturers in Indonesia have an unofficial contract with farmers or farmer groups to supply fermented beans to them. This ensures that they have a regular and reliable supply of beans. Prices for the best-quality fermented beans provided by these manufacturers can be up to three times the market price of unfermented low-quality beans, which is an indication of the bargaining power held by the suppliers. With dwindling production due to climate-change effects, coupled with increasing demand for chocolates, this bargaining power is only set to increase in the near future.

One possible mechanism to ensure supplier buy-in is to provide suppliers with ancillary services such as equipment for upkeep of cacao plants, training, and assured buy-back. Some manufacturers also provide cash in advance to farmers for saplings, equipment, and certifications. This is often paid back by the farmer by supplying the cacao beans to the manufacturer. This ensures a consistent supply.

Discussions with chocolate manufacturers revealed that other raw materials such as milk, salt, and sugar are relatively easy to find, as multiple suppliers operate out of the large islands of Java and Sulawesi where these commodities can be procured. Other smaller milk-chocolate manufacturers

obtain cacao powder from middlemen and do not deal with farmers directly. The relative bargaining power of suppliers, in that case, is low as multiple channels are available to buy cacao powder locally produced from low-quality cacao beans.

The Buyers

The primary consumers of couverture chocolate in Indonesia are foreign tourists from western countries. Since most bean-to-bar chocolate manufacturers directly supply to retail customers having varied preferences, the bargaining power of buyers is relatively large. The manufacturers normally have a contracted network of agents, who in turn supply packaged chocolates to retailers like supermarkets and confectionary shops. With multiple brands sold in these retail stores, consumers have a wide variety of options to choose from, and hence, manufacturers must innovate constantly to better serve their customers.

One way that manufacturers have ensured consumer buy-in is by creating a chocolate experience and not just a product. While some manufacturers like Monggo have a chocolate museum that explains the history of chocolate and Monggo in Indonesia, Cau Chocolates organizes agritours where visitors can learn about the chocolate-making process right from the cacao beans to the finished product. These methods have ensured that consumers associate the brand with a much richer experience, thereby creating a greater brand awareness.

A second possible mechanism these manufacturers have put in place is to sell cacao powder and butter to institutional buyers like restaurants and bakeries. Cau Chocolates has diversified into multiple chocolate-based products such as cookies and has its own cafés at multiple locations in Bali. These mechanisms have helped such brands differentiate themselves from others and cater to a larger market than just the foreign tourists, and hence, reduce the bargaining power that buyers hold. They have also helped create awareness about high-quality chocolate among the Indonesian population, especially the youth, thus resulting in a growing demand for these chocolates among the local population.

Threat from Substitutes

While chocolate manufacturers have successfully catered to foreign tourists thus far, they have faced considerable challenges in reaching out to domestic customers, especially because of the substitutes available to customers. While an average Indonesian consumes a sizeable amount of snack foods almost three times a day, there are multiple substitutes like chips, biscuits, and cookie products that better meet current consumers' tastes and preferences [9]. Generally, eating chocolate is not part of the traditional culture and chocolate is often seen as a foreign food product. Even populations who regularly consume chocolate mostly consume cheaper compound chocolates whose taste profiles resemble sweet candies. In fact, the annual consumption of premium chocolate bars per capita in Indonesia is 0.3 kg, much lower than that of the two leading countries, Switzerland (9 kg) and Germany (7.9 kg) [9].

Besides tastes and preferences, the price of a product plays a huge role in determining snack choices of the local populace. Across socioeconomic levels, price is the second-most important factor in deciding which packaged food item to purchase [3]. Premium chocolate bars are more expensive than available substitutes, priced two-to-three times higher than other snacks. The same amount of money can be used to buy a hearty meal, even in big cities like Jakarta or Surabaya. Hence, even if people are willing to try this new taste, the higher price prevents a sizeable number of consumers from actually buying it. However, as the Indonesian middle-class population grows, this challenge might be reduced. With higher incomes, the purchasing power and the ability to procure premium chocolate bars increases [19].

Lastly, substitutes are more readily available to consumers across Indonesia. Snack food revenue in Indonesia is mostly derived from offline sales channels [15]. More specifically, Indonesians purchase their snacks from minimarkets or neighborhood convenience stores, as opposed to bigger supermarkets [16]. Meanwhile, premium chocolate bars must be stored and transported under very specific conditions, such as a certain temperature range. Smaller stores do not have the equipment to meet these requirements, and hence premium chocolates are often sold in bigger stores, supermarkets, or through a company's own flagship stores. So, consumers need to take extra steps to find and buy these chocolate bars, compared to other snacks that are very easily accessible.

Looking forward, small chocolate manufacturers are betting on changing preferences of the young Indonesian population, as well as on the growth of online sales channels. Various chocolate makers are implementing educational programs to introduce the taste of real chocolates and the culture of eating chocolates to the young population. Additionally, with growing internet penetration and e-commerce platforms in Indonesia, some chocolate manufacturers have attempted to sell their products through online channels. While the overall amount is still much lower compared to the revenue generated by compound chocolates, there is a promising sales growth through this channel.

Potential New Entrants

Typically, an analysis of the barriers that a new entrant is likely to face is used by a company to gauge the competition it is likely to face in the future. Low barriers to entry are hence seen as unfavorable for a firm. This case study, however, is measuring the structural attractiveness of the cacao industry in general. Since the industry is still in its infancy, the ease of entry actually increases its structural attractiveness. On one hand, new players can induce stronger competition in the market for the limited number of high-quality cacao suppliers. On the other hand, they can boost the product's availability in the market and increase the local population's exposure to the taste of refined chocolates.

The low barriers of entry are attributed to various factors. While many Indonesians are not familiar with premium chocolate-making process, there are resources available and a moderately flat learning curve for entrepreneurs who are willing to put in the effort to learn the procedure. Some international organizations are known to send experts in chocolate-making from various European countries to Indonesia, funding most of the expenses. While the chocolate-making process is not simple, some business owners were able to obtain the necessary knowledge in 1–1.5 years, while perfecting the techniques even after they started producing and selling the chocolates.

Another strategy that Indonesian chocolate producers have followed to enter the premium chocolate market is first introducing compound chocolate products to lure consumers, and then diversifying into premium chocolate production. It is relatively easy to enter the compound chocolate market. Manufacturers only need to procure readily available blocks of pre-made chocolate from other companies, then melt and mold them into the desired shapes and sizes. As they get more experience and expertise in the chocolate industry, they can enter the premium chocolate market more easily.

This ease of entry is also supported by increasingly available credit options and stable borrowing costs, coupled with relatively low initial capital requirements. The amount of domestic credit to the private sector, measured by percent of GDP, has also seen a steady, increasing movement since 2010. Meanwhile, the costs of borrowing have both reduced and become predictable since the

current government has focused on maintaining a conducive domestic financial market for foreign investors [20]. Another contributing factor to the financial viability of the premium chocolate industry is that most of the production machinery is vertical, hence manufacturers do not require a huge area of land to build the factory.

Competitors

The four competing forces (buyers, suppliers, new entrants, and substitutes), coupled with existing businesses, define the competition that a chocolate company faces. The chocolate industry in Indonesia is fragmented by a few bean-to-bar local manufacturers, some local low-quality milk-chocolate producers, and a few multinational chocolate companies. While the milk-chocolate manufacturers, both local and international, have a definite upper hand in catering to the local Indonesian population, foreign tourists that visit Indonesia in large numbers prefer the high-quality couverture chocolates. Thus, market segmentation in terms of customer demographics is the most important way in which chocolate manufacturers have been able to differentiate themselves from other competitors and substitutes. The strategy has worked well as reflected in the fact that all chocolate manufacturers have seen growing revenues and sales in the recent years. With growing preferences for chocolate among the youth, the market size is set to increase, which indicates continued growth potential for the manufacturers.

However, changing consumer preferences is a slow process, so local manufacturers are looking to increase their footholds in international markets. Expanding supply to developing countries like India and PR China, which have similar growing demands for high-quality chocolate, provides these manufacturers an opportunity for further diversification to untapped markets with potentially fewer international players. Indonesian chocolate manufacturers are well placed to establish their brands in these countries as Indonesia is strategically placed on an international trade route. Manufacturers are also looking to export their products to other markets that require stringent food safety certifications, such as Japan, Australia, and Hong Kong. Thus, with an increasing domestic market and plethora of opportunities in developing countries, the future for chocolate manufacturers in Indonesia seems to be bright and positive.

Conclusion

As Indonesia's chocolate industry evolves through better farming practices and increased use of best practices across the supply chain, local manufacturers will have further incentives to scale up their businesses. Moreover, changing taste preferences and increasing disposable incomes among the local youth are likely to create greater demand for premium chocolates in Indonesia's markets. The local manufacturers discussed in this study are well placed to tap into this huge potential. Moreover, with most of these manufacturers looking to incorporate export compliance into their businesses, they can also cater to markets in developing countries that are relatively uncrowded as of now. However, this will require greater impetus to boost production of high-quality cacao beans from all actors involved, i.e., the farmers, cooperatives, government, and the local manufacturers.

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
APO	Asian Productivity Organization
APR	Annual percentage rate
ASEAN	Association of Southeast Asian Nations
CGIAR	Consultative Group on International Agricultural Research
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign direct investment
GDP	Gross domestic product
HACCP	Hazard Analysis and Critical Control Points
IFPRI	International Food Policy Research Institute
MTEC	National Metal and Materials Technology Center of Thailand
NSTDA	National Science and Technology Development Agency of Thailand
NGO	Non-governmental organization
SMEs	Small and medium-sized enterprises
TSP	Thailand Science Park
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
WTO	World Trade Organization

GLOSSARY OF TERMS

Agribusiness and agroindustry: "Agribusiness is a broad concept that covers input suppliers, agroprocessors, traders, exporters and retailers. 'Agroindustry' also is a broad concept that refers to the establishment of enterprises and supply chains for developing, transforming, and distributing specific inputs and products in the agricultural sector. For purposes of [this paper], both terms refer to commercialization and value addition in the agricultural sector with a focus on pre- and post-production enterprises and building linkages among enterprises" (FAO 2007).

Agricultural value chain: The farm-to-consumer range of value adding activities for an agricultural good that includes different phases of production as well as distribution and retail.

Agroenterprise: A unit of economic organization or activity, especially a private business that operates along the agroindustry value chain.

Agtech: Agricultural technology

Business cluster: A geographic concentration of interconnected and related companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate.

Contract farming: An agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices.

Customer perceived value: The difference between customers' perception of the benefits they believe they will derive from a purchase (a bundle of economic, functional and psychological benefits such as product, services, personnel, image value) and the costs they will have to pay (monetary, time, energy, psychic costs).

Enabling environment: A set of interrelated conditions, external to firms, including the policy, legal and regulatory framework; external trade policy; governance and institutions; physical security; macroeconomic policies; access to financial and business services; and the availability of physical and social infrastructure that impact on the capacity of firms to engage in business in an effective manner.

Food security: When all people, at all times, have access to sufficient, safe, and nutritious food to meet their dietary needs and lead an active, healthy life.

Incubator: A type of business development service that leases space to new business ventures and provides them with shared services, technical assistance, and access to local financial, educational, and business networks.

SMEs: Small and medium enterprises are companies whose headcount or turnover falls below certain limits. Size thresholds and the legal definition of an SME can vary according to the sector of economic activity and country.

Value added: The difference between the value of goods and services produced and the material costs of those goods and services.

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