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KREI

Joint Research for 2021 KAPEX with Vietnam

Project of Sesame production associated with new rural development in Vietnam

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National Agriculture Extension Center(NAEC)
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List of Abbreviations

DARD	Department of Agriculture and Rural Development
GRDP	Provincial's Gross Dometic Product
MARD	Ministry of Agriculture and Rural Development
NAEC	National Agriculture Extension Center
OCOP	One Commune One Product
ODA	Official Development Assistance
TFP	Total Factor Productivity
USD	United State Dollar
VAAS	Vietnam Academy of Agricultural Sciences
VietGAP	Vietnamese Good Agricultural Practices
VND	Vietnamese Dong

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1 Introduction of the KAPEX

1.1. Purposes of the Joint Research

The overall purpose of this research is to provide a comprehensive picture of the sesame value chain in the intended targeted provinces integrated with local development policies, which are a foundation for proposing an ODA project. This will be achieved through detailed purposes, as follows:

- The current situation of the main stages from input supply, sesame producing, collecting, storing, processing, and trading are analysed;
- Related policies including the national and local levels are evaluated with a focus of a National Target Program called the New Rural Program of Vietnam;
- Recommendations on proposing an ODA project on sesame production associated with the New Rural Program in the research area.

1.2. Outcomes of the Joint Research

- Inception report.
- Mid-term report.
- Research report on specialized rural development associated with sesame production project in Vietnam
- Project proposal on specialized rural development associated with sesame production project in Vietnam

2 Research Methodology

2.1. Research question

1) What is the current situation of implementation of the New Rural Development program including the development of OCOP products in the research area?

2) What are the characteristics, nature, roles and relationships of stakeholders of the sesame value chain in Dong Thap and Nghe An provinces?

3) What are the factors affecting the formation and operation of the sesame value chain in Dong Thap and Nghe An province?

4) What are the scientific basis and conditions for developing an ODA sesame production project?

5) Recommendations to develop an ODA sesame production project in Dong Thap and Nghe An?

2.2. Research Methodology

2.2.1. Steps of the research process

1) Assessing the current situation of sesame production, existing sesame value chain by using secondary data from statistical yearbooks, annual reports from the Department of Crop Production-MARD, DARD and provincial socio-economic development reports, and review of current policy on OCOP (one village one product) and new rural development program and other policy related to sesame productions. Review research reports and workshop result report of Korea – Vietnam sesame production workshop which was conducted in Nghe An province – Vietnam 2020.
2) Field surveys to collect primary data from the stakeholders in selected communes, cooperatives, local institutions to assess factors affecting the sesame value chain. Organize in-depth interviews with related and experts in Dong Thap and Nghe An provinces such as Department of Agriculture and Rural Development, Agricultural Extension Center, Provincial Sub-Department of Rural Development
3) Combining both primary and secondary data, legal documents related to the sesame value chain, OCOP and rural development program, and referring Korean experiences to enhance the existing sesame value chain associated with OCOP and new rural development program in the research area.
4) Recommending how to develop an ODA sustainable sesame pro-

duction project associated with the rural development program in Vietnam

2.2.2. Research framework

〈Table 1〉 Research framework

	Surveyors/interviewees	Information/data need to be collected
Primary data collection		
1	Sesame farmers	Cultivation practices, production plan, material input use, postharvest, marketing
2	Cooperative managers/ members	Organization of the cooperatives, whether sesame becoming OCOP certified? Does the cooperative organize farmers to produce sesame in the commune area?
3	Commune extension workers	What kind of technical service for sesame production?
4	Sesame purchasers	How do purchasers collect sesame seeds?
5	Sesame processing units	Current processing practices in the commune and in the plant
6	Commune People committees	Current sesame value chain in the commune? Role of actors in the chain? It is possible to develop a sesame value chain in the commune?
7	Rural development program units	Any activities of the program operating in the commune, how to include sesame production in the new rural program in the research area
Secondary information/data collection		
8	Agriculture research institutes	Research results on sesame (cultivation, processing, business…)
9	Provincial Department of Agriculture and Rural Development	Legal/institutional issue (providers) social/cultural issue, etc
10	Farmer union/cooperative union/OCOP units at all levels	Cooperative management/business planning for cooperative Is it possible for establishing sesame cooperatives, whether sesame products can be OCOP certified?
11	Extension services	Current technical supports for sesame production

12	Sesame enterprises	Sesame market, sesame need for processing
13	MARD (Department of Cooperative, Department of Crop, International Cooperation Department, Department of Planning …)	Policy for sesame development, plan for OCOP development

Data analysis/consultation meeting

Using models (SPSS) to analyze data collected (creating dependent and independent variables) to obtain figures of current sesame production in the research area.

Qualitative research is a scientific method of observation to gather non-numerical data. This type of research refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things. Interviewing stakeholders in current Sesame value chain in Nghe Anh and in Dong Thap as well as referring local authorities to identify cooperatives/enterprises and communes are able to organize sesame production based on value chain approach, estimate sesame production area in communes of the research area. Analyzing stakeholders in the value chain including the core of the value chain, extended value chains and enabling environment. Create a questionnaire and perform a survey to get primary data.

Conducting a consultation meeting to consult management units, private sector (company, enterprises, cooperative) and farmers about the development of sesame value chains linked with production units (Cooperative, enterprises, communes…)

Based on data/information gained to recommend a project proposal for the ODA project.

2.3. Research team

Korean experts:

- Seoul National University (SNU): Dr. Seongtae Ji (Professor)
- Hoam Corp. (Agricultural corporation): Dr. Churlwhan Kang (CEO)
- Korea Rural Economic Institute (KREI)

- Dept: Agroindustry Innovation Research: Dr. Yonglyoul Kim (Research Director)
- Center for International Agricultural Partnership: Dr. Jongsun Kim (Director) Mr. Heeseong Lee (Researcher)

Vietnamese Experts:

〈Table 2〉 Research team

No	Full name	Position	Research task
1	Dr. Le Quoc Thanh	Director General of NAEC	Team leader
2	Dr. Nguyen Viet Khoa	Head of Training and Education Division/NAEC	Coordinators/value chain/reporter
3	Dr.Nguyen Xuan Thu	Vice Director of Legumes Research and Development Center/VAAS	Crop cultivation expert in the south, Vietnam
4	Bui Quang Dinh	Institute of Agricultural Science for Southern Viet Nam/VAAS	Crop cultivation expert in the north, Vietnam
5	MSc. Le Thanh Tung	Vice Director of Department of Crop/MARD	Policy expert
6	Dr. Hoang Xuan Truong	Vice Director of Research Institution for Agriculture System	Cooperative/expert
7	Nguyen Thi Thanh Huyen	Research – NAEC	Research assistant
8	Dao Thanh Huong	Extension staff – NAEC	Research assistant
9	Dinh Hai Dang	Extension staff – NAEC	Research assistant
10	Do Da Giang	Extension staff – NAEC	Research assistant

3 Analysis of Agriculture Development Policies And Strategies of Vietnam

3.1. Vietnam social economic strategy and policy

■ Development perspective

1) Fast and sustainable development based mainly on science and technology, innovation and digital transformation. It is necessary to renew thinking and action, proactively grasping promptly and effectively taking advantage of opportunities of the Fourth Industrial Revolution in association with the process of international integration to restructure the economy, develop digital economy, digital society, considers this a decisive factor to improve productivity, quality, efficiency and competitiveness. To bring into full play the advantages of regions and regions; harmonious development between economy, culture, society, environmental protection and

adaptation to climate change; pay attention to and create favorable conditions for policy beneficiaries, people with meritorious services, the poor, disadvantaged people and ethnic minorities.

2) Reform and improve the quality of socialist-oriented market economy institutions fully, synchronously, modernly, integration and effective and effective law enforcement are prerequisites to promote the development of the country. The market plays a key role in mobilizing, allocating and effectively using production resources, especially land. The legal system must promote innovation, digital transformation and the development of new products, services and economic models. Must attach more importance to social development management; The expansion of democracy must be associated with maintaining discipline and discipline. To rapidly and harmoniously develop economic sectors and types of enterprises; Private economic development is indeed an important driving force of the economy.

3) Arousing the aspiration to develop a prosperous and happy country, the will to self-reliance and promoting the strength of the great national unity bloc to build and defend the Fatherland. Making the most of the human factor, considering people as the center, the most important subject, resource and goal of development; Considering cultural values, Vietnamese people are the foundation and important endogenous strength to ensure sustainable development. There must be mechanisms and policies to promote the spirit of dedication to the country; All policies of the Party and State must aim at improving the people's material, spiritual and happy life.

4) Building an autonomous economy must be based on mastering technology and proactively and actively integrating and diversifying markets, improving the adaptability of the economy. New national production capacity must be formed with self-reliance, effective participation, improved position in global value chains and effective resilience to large and unusual external impacts. Promoting internal resources is a decisive factor associated with external forces and the strength of the times. Constantly strengthening the economic potential, developing the business force of the Vietnamese to become stronger and stronger, and mobilizing the synergy of the country, improving the efficiency and benefits brought by international integration.

5) Actively, resolutely and persistently struggle to firmly protect national independence, sovereignty, unity and territorial integrity; closely and harmoniously combine economic, cultural and social development with consolidating national defense and security, environmental protection, and improving the efficiency of foreign affairs; maintain political security, ensure social order and safety. Building an orderly, disciplined and safe society, ensuring the peaceful and happy life of the people.

■ Overall goal

Striving to 2030, to be a developing country with modern industry, high middle income; modern, competitive, effective and efficient management institutions; a dynamic, fast and sustainable economic development,

independence and self-reliance on the basis of science, technology, and innovation in association with improving efficiency in foreign affairs and international integration; arousing the aspiration for national development, bringing into play the creativity, will and strength of the whole nation, building a prosperous, democratic, fair, civilized, orderly, disciplined, safe and secure society. ensure the peaceful and happy life of the people; constantly improve the people's life in all aspects; firmly protect the Fatherland, a peaceful and stable environment for national development; improve Vietnam's position and reputation in the international arena. To strive to become a developed and high-income country by 2045.

■ Main indicators

a) Economics

- The average growth rate of gross domestic product (GDP) is about 7%/year; GDP per capita at current prices by 2030 will reach about 7,500 USD3.
- The proportion of the processing and manufacturing industry is about 30% of GDP, and the digital economy is about 30% of GDP.
- The rate of urbanization reaches over 50%.
- Average total social investment reaches 33-35% of GDP; public debt does not exceed 60% of GDP.
- Contribution of total factor productivity (TFP) to growth reached 50%.
- The average growth rate of social labor productivity is over 6.5%/year.

- Reduce energy consumption per GDP unit at 1-1.5%/year.

b) Society

- The Human Development Index (HDI) remained above 0.74.
- Average life expectancy is 75 years, of which the minimum healthy life time is 68 years.
- The rate of trained workers with degrees and certificates is 35-40%.
- The proportion of agricultural laborers in the total social labor drops to less than 20%.

c) Environment

- Forest coverage rate is stable at 42%.
- Rate of treatment and reuse of wastewater into the river basin environment reaches over 70%.
- 9% reduction in greenhouse gas emissions.
- 100% of production and business establishments meet environmental standards.
- To increase the area of marine and coastal conservation zones to reach 3-5% of the natural area of the national sea area.

As proposed, an ODA project on sesame associated with new rural development in Vietnam can be significantly contributed to the socio-economic of the targeted provinces. Because in the framework of this project, sustainable production and marketing of this value chain will

be a focus where proper varieties of sesame will be selected with appropriate production protocol to enhance production efficiency, more profitable but ensuring environment protection and especially, contributing to the development of the civil organizations through co-operatives strengthening. Besides, not only production stage will be improved, this project will aim at bettering other stages of the value chain such as logistics and processing; therefore, it will dramatically contribute to the goal of improving the indicators related to processing efficiency and proportion.

3.2. Agriculture Strategy and main policies

The overall goal of the strategy is to continue restructuring the agricultural sector towards sustainable agricultural development, improving the quality, added value and competitiveness of agricultural products; environmental protection, ecology; increase income for people in rural areas; ensure food security and national defence security. Promote the development of modern agriculture, clean agriculture, and organic agriculture, associated with the development of agro-processing industry, adaptation to climate change and sustainable connection with the global agricultural product value chain.

Specifically, by 2025, the value-added growth rate of the agricultural sector will reach an average of 2.5 to 3.0%/year. The growth rate of labor productivity in agriculture, forestry and fishery (hereinafter referred to as agriculture) averages from 7.0 to 8.0%/year.

The proportion of agricultural laborers in the total social labor decreased to about 25%; the rate of trained agricultural laborers reaches over 55%; over 80% of agricultural cooperatives operate effectively; the income of rural residents increased at least 1.5 times compared to 2020.

Structural policy according to 03 groups of agricultural products

One of the tasks up to 2025 of the Plan is to structure it into three product groups: National product group; key product groups at provincial level; group of local specialties.

For the group of national key products: To focus on investment and development in the direction of concentrated, large-scale commodity production, associated with the agricultural product processing industry in the form of sustainable value chain linkage. Prioritize investment resources to promote synchronous mechanization, application of science and technology, building value chains associated with quality management systems, food safety, traceability and commercial development. national brand.

Orientation to develop key national product groups: rice, coffee, rubber, cashew, pepper, tea, fruit trees, vegetables, cassava, pork, poultry meat and eggs, pangasius, shrimp , timber, wood products, non-timber forest products

For key product groups at the provincial level: Localities, based on their advantages, specific conditions and market needs, have mechanisms and policies and prioritize resources for investment in developing key agricultural products at the provincial level. conscious. Promote production according to good and equivalent production processes, meeting standards and technical regulations on food safety and

environmental protection; enhance processing to diversify products, develop products with geographical indications and clear origin

For groups of local specialty products: Focus on implementing mechanisms, policies and solutions to improve product quality, production organization capacity, step by step approach to sustainable markets along the value chain. products associated with the One Commune One Product (OCOP) Program; prioritizing the development of advantageous products in order to promote the identity, arouse the potential, creativity and pride of the people, promote the organization and ensure the value of the community in the development of OCOP products. associated with new rural construction, especially developing the model of community-based tourism in rural areas.

Policy to restructure production by sector

Accordingly, the restructuring of production in the field of crop production in the direction of reducing the proportion of production value of food crops to about 35%, short-term industrial crops to about 2.1% and perennial industrial crops to about 14 .5%, increasing the proportion of fruit trees to 21% and vegetables to 17% to meet the market's consumption demand, contributing to ensuring national food security in the new situation.

Effectively manage and use land specialized in rice cultivation, flexibly converting between food crops and food crops. Develop organic agriculture and ecological agriculture to meet the needs of the market and serve tourism.

The average production value growth rate is from 2.0 to 2.2%/year, the average added value is from 1.8 to 2.0%/year; By 2025, the value of

products harvested per hectare of arable land will reach about 120 million VND.

Policy on restructuring agricultural production by region

Promote regional linkages in sustainable agricultural production development among localities in order to exploit the advantages and potentials of each region and each locality, namely the Northern Midlands and Mountains, the River Delta. Hong, North Central region, South Central Coast region, Central Highlands region, Southeast region, Mekong River Delta region

3.3. Overview of Vietnam's agriculture development plans from 2021-2025

3.3.1. Overview of Vietnam's agriculture development plans

The crop production industry plays a very important role in developing the agricultural economy, ensuring national food security, creating jobs, stabilizing people's lives and protecting the environment; in addition to improving productivity, attention must be paid to improving food quality and safety, increasing added value and increasing income for farmers; The development of the crop production industry must follow the market mechanism, on the basis of promoting regional advantages, effectively using resources, reorganizing production according to value chains, applying science and technology, and enhancing the preservation of crops,

processing; mobilize social resources, economic sectors, effectively promote the support of the state and international integration.

To develop crop production in the direction of sustainability, safety, increase added value, competitiveness on the basis of efficient use of resources, labor, capital, and faster improvement of crop production farmers' lives, contributing to poverty alleviation, socio-political stability, environmental protection and adaptation to climate change.

Some specific targets for the period 2021-2030

- The average growth rate of crop production value is 2.3-2.5%/year;
- Export turnover of main agricultural products by 2030 will reach 25 billion USD;
- Average output value per hectare of arable land is 150 million VND.

Restructuring crop production towards developing large-scale production, focusing on preservation, processing and consumption along the value chain on the basis of promoting product advantages and regional advantages. Promote the application of science and technology, especially high technology to increase productivity, quality, reduce costs and adapt to climate change. To focus on investing in developing the processing industry, especially deep processing and post-harvest preservation in a modern direction, in order to reduce post-harvest losses and increase the added value of products.

Restructure crop production according to 3 product levels:

1) Group of the National key products (rice, cassava, vegetables, fruit, coffee, rubber, cashew, pepper, tea), in order to synchronously invest, develop the concentrated commodity production areas, large scale, cooperative organization, linkage along the value chain and application of advanced science and technology.

2) Group of the Provincial key products, based on local advantages and market demand, selects this product group to orient development and invest in the same direction as for National products, but the scale at the local level; have policies and solutions to expand the scale and competitiveness to add to the National key products group.

3) Group of the Local specialty, has a small scale, associated with specific geographical indications, will be built and developed together with the construction of New Rural areas in districts and communes according to the model of "one commune, one product."

Restructure production

- Promote the development of cooperatives, cooperative groups, representative organizations of farmers in the field of crop production to associate with enterprises and scientific organizations in production, processing, preservation, consumption along the value chain;
- To step up the attraction of enterprises to invest in the agricultural sector, giving priority to the development of groups of enterprises doing primary processing, deep processing, and by-product processing, applying high technology to advantageous commodities, focus on gradually forming complexes of agriculture, industry and high-tech

services, closely associated with farmers according to the model of multi-functional agricultural production and sustainable development.

- Develop and organize the implementation of linked production along the value chain for the National key products.
- Planning the large-scale concentrated commodity production areas associated with agricultural product processing and preservation establishments.
- Strengthening the application of mechanization in production to reduce costs and reduce post-harvest losses.

3.3.2. National target program –New Rural Development Program

Continue to implement the Program in association with the effective implementation of agricultural restructuring, rural economic development, the urbanization process, going into depth, efficiency and sustainability; implement the construction of advanced new rural areas, model new rural areas and new rural areas at village level. Improve the material and spiritual life of rural people, promote gender equality. Developing the rural socio-economic infrastructure synchronously and modernising in step by step, ensuring a bright, green, clean, beautiful, safe environment and rural landscape, rich in traditional cultural identity, adapting to climate change and sustainable development.

Striving for the whole country to have at least 80% of communes meet new rural standards, in which, at least 10% of communes will meet model new rural standards, no more communes meet less than 15 criteria;

continue to build advanced new rural areas and model new rural areas for communes, districts and provinces that have been recognized as meeting new rural standards; the average income of rural people will increase at least 1.5 times compared to 2020;

Striving for the whole country to have at least 50% of districts, towns and provincial cities meet new rural standards, complete the task of building new rural areas, of which at least 20% of districts meeting the standards will be recognized as advanced new rural areas, newly enhanced rural district, model new rural district. Each province and city directly under the Central Government has at least 02 district-level units meeting new rural standards;

- Striving for the whole country to have at least 15 provinces cities directly under the Central Government are recognized for completing the task of building new rural areas;
- Striving for 60% of villages, hamlets, (hereinafter referred to as hamlets) in extremely difficult communes in the border, mountainous, coastal areas and islands will be recognized for meeting new rural standards according to the new rural criteria prescribed by the provincial People's Committees.

3.3.3. Approach to developing Vietnam’s food system

The rice industry plays an important role in the development of agriculture and rural areas, contributing to ensuring national food security, affecting the lives of the majority of farmers, social security and

stability. It is an industry with advantages in ecological conditions associated with cultural values and heritage of the long-standing wet rice civilization. However, the development of the rice industry is facing challenges due to low efficiency, resource consumption, environmental pollution and the impact of climate change, especially in the key rice production deltas. In order to overcome challenges, promote advantages, and maintain an important position in the field of cultivation, the rice industry needs to be further restructured until 2025 and 2030 to meet new requirements for high development. more and more sustainable.

+ General objective: Continue to restructure the rice industry in the direction of improving efficiency and sustainable development with the objectives (i) to fully meet domestic consumption demand, as the core for ensuring national food security (ii) improving quality, nutritional value, ensuring food hygiene and safety (iii) forming and improving the efficiency of the rice value chain (iv) adapting and mitigating climate change (v) efficient use of resources and protection of the ecological environment (vi) increase farmers' incomes and benefits for consumers (vii) export of high quality and high value rice.

Some specific targets by 2025

- Keeping the rice land area from 3.6-3.7 million ha, the cultivated area 7.0-7.2 million ha, the rice output from 40-41 million tons.
- Export about 5 million tons of rice; in which fragrant, specialty and Japonica rice accounts for 40%, glutinous rice 20%, high quality white rice 20%, medium and low grade rice 15%, processed rice products 5%; the percentage of exported rice with brand names is over 20%.

- The percentage of planted area using certified seeds is over 80%; using high quality varieties over 70%; reduce the amount of seed sown (average 80 kg/ha) by over 70%; application of advanced farming processes (ICM, IPM, SRP, SRI, 1P5G,...), good production practices (VietGAP and equivalent, smart rice farming with climate change, organic agriculture,…) over 60%; application of high technology, digital technology about 10%.
- Reduce the amount of chemical fertilizers and chemical pesticides used in rice production by 30% or more.
- Post-harvest loss rate is less than 8%.
- The rate of mechanization in rice production reaches an average of 70%, particularly in the Mekong River Delta over 90%.
- The percentage of cultivated area linked to production - consumption is over 30%.
- Profit for rice growers over 30%.
- Reduce greenhouse gas emissions in rice production by 5%.

3.3.4. Development of Oil and Sesame plants

The development of oil and sesame plants should be based on the perspective of crop production development and perform the following main tasks:

- Strategies for research and improvement of science and technology:

Closely linking scientific and technological research, technology transfer, training, with vegetable oil production and business; ensure the sustainable development of vegetable oil industry, protect the environment at the safest level;

- Market expansion strategy: boosting exports, contributing to economic growth.
- Strategy for production development, building material areas according to the chain, improving the competitiveness of the commodity industry.
- Developing sesame production:
- Based on the comparative advantages of the region, a sustainable production platform should develop a closed, specialized raw material area, intensive processing, exploit potential markets, arrange crop rotation of changing sustainable crop structure.
- Formulate and implement a research and development program on sesame varieties with high yield, pest-resistant varieties, good quality, suitable for ecological regions, import new varieties, meeting the requirements of raw materials for the vegetable oil industry and other specialized products; Combined with the study of farming methods towards organic agriculture and appropriate, environmentally friendly plant protection, building models intensive farming with high productivity and economic efficiency.
- Linking domestic and foreign cooperation to expand production and processing in accordance with each development stage of the industry and the locality.

- Training and improving human resources, finance and technology for sector development.

3.4. Agriculture and Rural Development plans for the period 2021-2025 of Nghe An province

3.4.1. Overall objectives

Actively innovating, bringing Nghe An to a fast and sustainable development; to 2025 Nghe An to become a decent province in the Northern region.

3.4.2. Specific objectives

- The average growth rate of the province's gross domestic product (GRDP) in the period 2021 - 2025 will reach 9.5-10.5%.
- GRDP per capita in 2025 will reach about 83 million VND (equivalent to about 3,500 USD).
- GRDP structure: agriculture, forestry and fishery 19% - 20%; industry and construction 38% - 39%; services 42% - 43%.
- Export turnover by 2025 will reach 1.765 billion USD.
- Budget revenue by 2025 will reach VND 26,000 - 30,000 billion.

- Total investment capital of the whole society in the period of 2021 - 2025 will reach about VND 500 trillion.
- The rate of multidimensionally poor households decreases each year by 1-1.5%, of which 2-3% in mountainous areas.
- By 2025, there will be 82% of communes meeting new rural standards (of which, 20% of communes will reach improved new rural standards, 5% of communes will meet model new rural standards) and 11 district-level units recognized for completing the construction task and meeting new rural standards (in which, 1 district achieved the model new rural district).

3.4.3. Development orientation and Major tasks

Promote economic restructuring in the direction of development from breadth to depth and long-term vision. Improve capacity and competitiveness to catch up with new opportunities, advantages and opportunities. Accelerate the construction of E-Government, towards a digital economy. Develop policies to actively participate in the Fourth Industrial Revolution.

- Regarding Agricultural and Rural development

Promote restructuring of the agricultural sector on the basis of applying scientific and technical advances, transforming the structure of crops and livestock towards the development of a multi-functional agricultural sector, international integration, and adaptation to climate changes.

Forming a food production industry, linking along the value chain from farming, harvesting, preserving and processing to organizing consumption according to an association model depending on the scale and characteristics of each individual region. Encourage accumulation of land to build large-scale fields, concentrated specialized production areas, high-tech applied agriculture, clean agriculture, and modern organic agriculture with high efficiency and sustainability. Synchronously implement solutions to promote attraction of enterprises to invest in agriculture and rural areas; creating conditions for the establishment and improvement of operation efficiency of cooperatives and new-type cooperatives, raising the average growth rate of agriculture, forestry and fishery in the 2021-2025 period to 4.5-5%.

Converting inefficient rice-growing land to producing crops and livestock with high economic efficiency; stabilize rice production on the land area of 2 seasons, actively irrigated with a cultivated area of about 170,000 ha. Invest in intensive farming, apply scientific advances in production and expand area and consumption markets to develop a number of potential crops, such as tea, oranges, medicinal plants, peanuts, sesame, etc. Promote the development of hi-tech agricultural area.

Continuing to implement the new rural construction program in the direction associated with urbanization, in fact, going into depth, efficiency and sustainability on the basis of focusing on improving the quality of new rural criteria, building advanced new rural communes, model new rural communes and building new rural areas at village level.

Improve the efficiency of using public investment capital; strengthen advocacy work, improve the efficiency of management and use of ODA

programs and projects and concessional loans from foreign donors in accordance with the local borrowing and debt repayment capacity. Effectively develop and implement the public investment plan for the period of 2021 - 2025, in which priority is given to investment in key projects that are pervasive to the socio-economic development of localities, regions and sectors. Implement solutions to increase budget revenue such as building mechanisms and policies to encourage investment, production, business and export, to both promote economic growth and create a sustainable source of revenue for the budget. Strengthen the management of collection of land use levy and income from import and export activities.

Focus on mobilizing all investment resources to build economic and social infrastructure. Strongly encourage all economic sectors to invest, contribute capital to build synchronous infrastructure, strengthen public-private cooperation. Strengthen socialization of investment, especially rural transport, education, training and health care.

- *Science and technology development*

Innovate, facilitate the development of science, technology and innovation. To build Nghe An into a science and technology center in the North Central region, focusing on application and transfer of scientific and technological achievements and high technology, training human resources for production and life. Associate research and application with intellectual property and product branding. Focus on attracting and developing industries using high technology and clean technology. Promote International integration and cooperation in science-technology, attracting the participation and contribution of the community of

scientists. Striving to 2025, the technological level of enterprises producing major products will reach a good level compared to the whole country, the technology of producing key products of the province has a technological innovation rate of 35-38%; contribution of total factor productivity (TFP) to the economic growth of the province is from 45 - 50%.

3.5. Agriculture and Rural Development plans for the period 2021-2025 of Dong Thap province

3.5.1. Overall objectives

To develop the agro-industry-trade economy on the basis of taking advantage of opportunities from the integration process to improve competitiveness, gradually increasing the value of product chains in the direction of globalization; synchronously develop a system of socio-economic infrastructures capable of adapting to climate change, focusing on key infrastructures with spillover effects; improve the quality of human resources to meet the requirements of bringing the province's economy to participate in the industrial revolution 4.0, in association with job creation, raising people's incomes, ensuring social security, protect the environment, improve the cultural and spiritual life of the people.

3.5.2. Specific objectives

Striving for economic growth in the 2021 - 2025 period to be 7.5%/year, of which: The agriculture - forestry - fishery sector will increase by 3.5%/year; the industry - construction sector increased by 10.23%/year (industry increased by 9.96%/year; construction increased by 12%/year); the trade - service sector increased by 8.8%/year.

3.5.3. Development orientation and Major tasks

To develop the agricultural economy in the direction of producing high-quality goods; encouraging the accumulation and concentration of land according to the requirements of developing high-tech, organic and sustainable agriculture, creating concentrated production areas, specialization, mechanization, automation, advanced management up; accelerate the process of industrialization and modernization of agriculture and rural areas in the direction of intensive farming, specialized farming, application of biotechnology, scientific and technical advances in production and conversion of plant varieties and livestock high quality to meet market demand and increase value per unit of cultivated area.

Focus on developing more key products (*rice, pangasius, ornamental flowers, short-term industrial plants and potential commodities*) to form and sustainably develop concentrated agricultural and aquatic production areas, producing according to the value chain of each product, gradually

standardizing the farming system associated with traceability (Blockchain technology), bringing agricultural products to participate in the global supply chain.

Gradually convert the inefficient rice cultivation area to crops and livestock of high economic value; identification of leading varieties and disease-free propagation for key crops of the province. To develop the garden economy *(fruit trees, ornamental flowers, short-term drought-resistant industrial plants,...)*, focusing on products with strengths in branding and production efficiency, step by step approaching and achieving the standards certify certain types of products.

Focusing on developing large-scale cooperatives, strengthening activities of "joint production", "joint purchase", and "joint sale" in order to increase the quality of agricultural products, reduce costs, and increase adaptability to the market and negotiating power. Build cooperatives with sufficient capacity to link production, link consumption, develop value-added products and consume agricultural products for members. Maintain and develop the model of the Farmers' Union, develop new cooperatives on the basis of the Union to meet the aspirations and actual needs of the people, gradually developing steadily from low to high.

Effectively implement the start-up program and the one-commune-one-product (OCOP) program on the basis of reorganizing craft village production in combination with high-tech farming, application of new technologies, combining with experiential tourism and e-commerce development,..., in order to improve the living standards of rural people, reduce poverty sustainably and developing a new rural. Support to improve the quality of OCOP products of the province.

Maintain and improve the quality of communes up to standards, launch new rural construction according to improved criteria, model new rural areas. Promoting the spirit of self-reliance and self-management of people participating in local governance, in order to enhance the central role of community cohesion in sharing new production models, applying science and technology,... to serve as the basis for the formation of cooperative groups and cooperatives in the direction of multi-services; combine the construction of new rural communes with the "Smart Village", constantly improving the quality of life of rural people, focusing on building the appearance of the countryside to become a place worth living.

Increasing the use of cyberspace to increase the frequency of effective connections between market information, traceable production areas of raw materials and processing and consuming enterprises. At the same time, supporting enterprises and production facilities to apply e-commerce to their business activities. Establishment of a Farmer Support Center on chain-oriented agricultural product production and business solutions; serving a number of people's needs for soil sample analysis and production process guidance.

Striving to 2025: The added value of the agricultural - forestry - fishery sector will reach 22,672 billion VND; 90% of communes meet new rural standards, of which 30% of communes meet advanced standards; 05 district-level units meet the new rural district standards and 01 district meets the enhanced new rural standards; the rate of rural population using clean water reaches 98%.

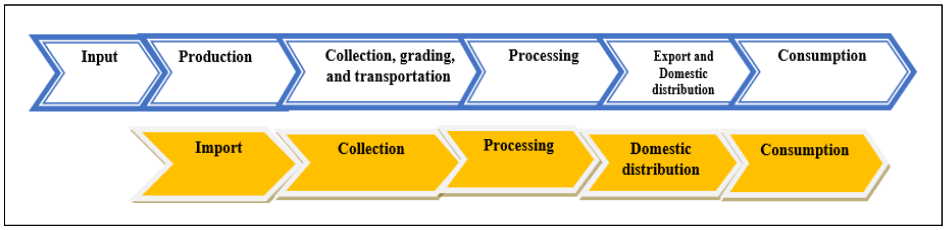
4 Situation Analysis on Vietnam's Sesame Value Chain

4.1. General situation of the sesame value chain

Researchers revealed that the world sesame consumption has been increasing due to the change of consumer's habit of food consumption with more aware of health benefits from this product. It is estimated that about 70% of the total volume of sesame produced globally is for food and oil processing (Myint, Gilani, Kawase, & Watanabe, 2020). Nowadays, sesame is considered one of the potential candidates for biofuel production, pharmaceuticals, and niche foods (Rahman et al., 2020). For an increased demand for sesame in both international and domestic markets, this product is the potential to bring benefits to involved stakeholders, especially the rural ones in Vietnam.

From the information of literature review and fieldwork in Nghe An and Dong Thap provinces, key stages of the sesame value chain in Vietnam can be described, as follows:

〈Figure 1〉 Domestic and import sesame channels in Vietnam



As above mentioned, since 2014, Vietnam Sesame Seed Production fell dramatically. In 2019, the country was ranked 26th among other countries in Sesame Seed. compared to 15th in 2017. This led to the quantity import of sesame of Vietnam increasing by 3.6% year on year from 2014 to 2019. (NationalMaster, 2021). It is estimated that 90% of oil production in Viet Nam is based on the importation of materials (crude oil and oil seeds) because the domestic production of oil seed crops does not meet the demand (Tran, Dinh, Vo, Carter, & Hill, 2017).

There are different stages in the sesame value chain being input supply, production, collection, processing, domestic distribution, export, and consumption (both in domestic and overseas markets). In the framework of this research, the stages from production to consumption are focused.

4.1.1. Input supply

There are key inputs for sesame production in which seeds play an important role in ensuring product quality and productivity. Currently, seeds used by most household producers are self-supply. The producer selects the best seeds from the last season, stores them for the next season

production although there are seed companies providing certified seeds as the quantity from this source is still limited.

4.1.2. Production

In Vietnam, sesame is grown in almost all ecological regions, due to its wide adaptability, easy to grow, low investment, short growth period, and suitable economic capacity of poor farmers. However, from 2015 onwards, the area of sesame nationwide has tended to decrease sharply from 54.84 thousand hectares (2015) to 31.18 thousand hectares (2019). The average yield is as low as 0.8 tons/ha;

〈Table 3〉 Sesame production nationwide from 2014 to 2019

Content	Year					
	2014	2015	2016	2017	2018	2019
Area (1.000ha)	42,58	54,84	50,04	36,64	28,54	31,18
Yield (ton/ha)	0,81	0,84	0,86	0,80	0,73	0,92
Productivity (1.000 ton)	34,43	46,27	43,02	29,41	20,89	28,87

Source: General Statistic Office

The reason for the decrease in sesame area is that farmers still consider sesame as a secondary crop, so they have not paid attention to development, in addition, research on breeding and sesame cultivation techniques is still limited and not yet given due attention. In addition, the effects of climate change, the weather changes abnormally and harshly: prolonged drought, erratic rains and floods cause difficulties from planting to harvesting, making farmers less interested in growing sesame.

〈Table 4〉 Sesame area nationwide by region from 2014 to 2019

Content	Year					
	2014	2015	2016	2017	2018	2019
North (1,000ha)	**8,63**	**8,63**	**7,69**	**7,87**	**6,98**	**12,08**
Red River Delta	0,44	0,49	0,45	0,48	0,42	0,19
Northern midlands and Mountains	0,55	0,61	0,54	0,48	0,33	0,84
North Central	7,64	7,53	6,71	6,91	6,22	11,05
South (1,000ha)	**33,95**	**46,21**	**42,35**	**28,77**	**21,56**	**15,09**
South Central Coast	14,02	15,12	14,60	13,48	11,52	5.80
Highlands	3,34	5,22	4,32	4,22	4,37	2,60
South East	1,63	1,42	1,60	1,66	1,53	1,13
Mekong Delta	14,96	24,45	21,83	9,41	4,14	5,56

Source: General Statistic Office

The comparison of the sesame growing area shows that: In the southern provinces, the annual sesame area is always larger than in the northern provinces, on average from 7.0 to 〉 30 thousand ha.

- *In terms of productivity*: The Southeast provinces have the highest sesame yield (ranging from 0.92 to 1.08 tons/ha), followed by the Mekong Delta with an average of 〉 0.8 tons/ha. The lowest is in the Red River Delta and the Northern Midlands, with an average of 〈0.5 tons/ha;

〈Table 5〉 Sesame production in each region across the country from 2014 to 2019

Content	Year					
	2014	2015	2016	2017	2018	2019
Red River Delta (1.000 ha)	**0,44**	**0,49**	**0,45**	**0,48**	**0,42**	**0,19**
Yield (ton/ha)	0,90	0,98	1,02	0,98	1,05	0,84
Northern midlands and Mountains (1.000 ha)	**0,55**	**0,61**	**0,54**	**0,48**	**0,33**	**0,84**
Yield (ton/ha)	0,51	0,51	0,52	0,54	0,52	0,55
North Central (1.000 ha)	**7,64**	**7,53**	**6,71**	**6,91**	**6,22**	**11,05**
Yield (ton/ha)	0,62	0,62	0,61	0,56	0,42	0,69
South Central Coast (1.000 ha)	**14,02**	**15,12**	**14,60**	**13,48**	**11,52**	**5.80**
Yield (ton/ha)	0,58	0,61	0,67	0,64	0,67	0,77
Highlands (1.000 ha)	**3,34**	**5,22**	**4,32**	**4,22**	**4,37**	**2,60**
Yield (ton/ha)	0,58	0,57	0,59	0,57	0,52	0,47

Content	Year					
	2014	2015	2016	2017	2018	2019
South East (1.000 ha)	1,63	1,42	1,60	1,66	1,53	1,13
Yield (ton/ha)	0,87	0,83	0,80	1,00	0,92	0,85
Mekong Delta (1.000 ha)	14,96	24,45	21,83	9,41	4,14	5,56
Yield (ton/ha)	0,92	0,95	1,08	1,00	0,93	0,90

Source: General Statistic Office

- *In terms of production*: The Mekong Delta accounts for 45% - 55% of the whole country's sesame production. Particularly in 2018, sesame production in the Mekong Delta was low, accounting for only 25.8% of sesame production in the country.

〈Figure 2〉 Sesame production in Vietnam

4.1.3. Collection and Transportation

After harvesting, most raw sesame seeds are extracted and dried by individual farmers, sold to the local collectors and transported to the companies for processing or exporting the raw sesame to overseas markets. The stage of collection and transportation are mainly based on private stakeholders in the spot market without contracts or agreements. A proportion of the sesame produced throughout Vietnam is purchased by enterprises based in Ho Chi Minh City at an agreed price. A study in Binh Dinh (Nguyen & Nguyen, 2013) stated that most collectors deal directly with farmers to set the purchase price of sesame. A similar situation was also observed in Nghe An and Dong Thap in this study. Cooperatives can be collectors in this value chain, who purchase raw sesame seeds from the farmers and sell them to processing or trading companies.

4.1.4. Processing and distribution

Since 2014, Vietnam Sesame Seed Processing showed no change despite a decrease in domestic production. That means the imported sesame to the country is for processing. At 21 thousand metric tons in 2017, the country was ranked number 16 comparing other countries in sesame seed processing (NationalMaster, 2021). In some production areas like Nghe An province, only 20% sesame of the products produced in the province is sold to processing companies (mainly for oil production).

At the processing stage, private establishments, cooperatives or

enterprises will undertake this task. The distribution stage is usually the stalls of cooperatives, supermarkets, convenience stores and wholesalers/ retailers in big cities, in addition, many large enterprises perform export contracts. Regarding preliminary processing, preservation and processing in the sesame chain, there are still limitations, so the added value of sesame products is not high.

The value chain processing facility in general is not active in the raw material area, for example, in Nghe An and Dong Thap provinces. In addition, the processing facilities have not applied advanced techniques in processing, the processing capacity is small, leading to low productivity, quality, efficiency and competitiveness of products. The processing technology is mainly based on traditional methods, manual processing, the main product is sesame oil but the quality is not stable.

Processing output tends to decrease due to reasons such as most processing facilities are not proactive in the material area. When farmers lose their crops, due to extreme weather events and epidemics, people tend to self-distribute; market prices fluctuate, farmers tend to switch to other crops.

4.1.5. Export

Exported sesame is mainly to China and through unofficial channels. Most of the sesame produced in Vietnam are exported to China (70% in Nghe An). Thus, the sesame value chain is still a traditional agricultural product value chain, the number of actors involved in the linkage chain

and agricultural product consumption is still large, with many intermediaries. However, the China market is not stable, in 2021, only 50% of sesame produced in the province were sold to this market compared to 80% as usual.

According to FAO, in 2019 Vietnam exported 5,583 tonnes of sesame seeds. By 2019 alone, the market for Vietnam sesame seeds (oil seeds category) has surged, changing by 12.925 pc compared to the year 2018. Between 2017 and 2019, sesame seeds' exports decreased by -18.97% earning the exporter US$12.90m for the year 2019 (NationalMaster, 2021). Among the importers, the Republic of Korea is emerging as a potential one where produced 14,000 tonnes in 2017 and in the same year it imported 75,000 tonnes of sesame. Unlike China and Japan, Korea imports sesame predominantly from the two Asian countries, India and China (Rahman et al., 2020).

4.1.6. Consumption

In the consumption stage, there are different products such as sesame seeds and sesame-based ones. In the domestic market, there are traditional open markets where sesame seeds are sold in raw form, most of which have no label and traceability. At the moment. For oil consumption, there are existing two product types, which are industrial and manual ones. The manual produced one is mainly available in the production regions (such as in Nghe An and Dong Thap), the dominant is the industrial one.

4.1.7. Stakeholder linkages

Farmers have not yet linked together to establish farmer organizations such as cooperatives or groups, or participate as farmers in satellite production for businesses. In addition, there has not been active participation of farmers in the stages of creating added value for products such as preliminary processing, product processing, and general consumption of products. The linkage of input supply for producers is still limited due to the small production area of the model.

Cooperatives/Cooperative Groups/Enterprises have not yet boldly invested in the production, preservation and processing of sesame products. Food safety management along the value chain of sesame still has many problems to improve. Along with that, the awareness of Producers/Cooperatives/Groups/Enterprises and even consumers about safe sesame products is still limited. The fact that the processing facility is not active in the raw material area shows that the link between the processor and the farmer is still weak.

From Central-level policies, the provinces have not yet had policies suitable to local conditions in managing and supporting the development of the sesame chain. In the two surveyed provinces, Nghe An and Dong Thap, there are not many cooperatives and enterprises investing in processing, mainly purchasing raw sesame and exporting raw to China. In which, there are a number of enterprises and cooperatives that are most prominent such as Sy Thang Agro-forestry Company Limited; Dong Thinh Service Business-Cooperative in Nghe An. Tan Tien Agricultural Products One Member Company Limited in Dong Thap.

4.2. SWOT analysis of the sesame value chain

4.2.1. Strengths

- Farmers work hard and have a lot of experience in sesame production
- Sesame is an intercrop crop, so the area can be expanded when there are sufficient production conditions
- In our country, sesame can be produced in 3 seasons/year
- Vietnam has a diversity of sesame varieties, which can be a source of raw materials for breeding good sesame varieties adapted to climate change
- Sesame is valuable and sesame oil is more expensive than peanut oil…
- There have been a number of cooperatives and companies that have processed sesame into sesame oil and have products participating in national programs such as OCOP.

4.2.2. Weaknesses

The link between the stages of the value chain:

- Vertical linkages between producers (farmers) and other stages such as input service providers, storage, processing and consumption services are still loose; There is no horizontal link between farmers (Cooperative Groups, CIG group, Cooperative...)

- Producers often do not pay attention to the market and its requirements
- Outdated training, research and development support structure;
- Food quality and safety have not been paid enough attention;

Weaknesses in the production stage:

- There is no new set of varieties, old sesame varieties are planted by the farmers themselves, so the quality is not high, there is a phenomenon of degeneration, easy to be infected with pests and diseases -> yield and quality are not high.
- Production is mainly based on experience, not invested in intensive farming, which arise in low yield and quality of raw sesame.

Weaknesses in preliminary processing and processing:

- The processing facilities have not yet invested in infrastructure and facilities such as cold storage systems, dryers...; limited transportation, purchasing products that have been dried by farmers; the raw material area and product quality are not guaranteed.
- Lack of capital to expand production and business, purchase equipment (cargo trucks).
- The brand and traceability system for products has not been built yet to enhance trust with consumers. The product packaging system is still monotonous, most of which have not been labelled with the origin of the product.

Weaknesses in the consumption stage:

- Promote mass media for consumption in the domestic market.

4.2.3. Opportunities

- Currently, Vietnam's policies are available such as Decree 98 on linking value chain stakeholders from production to consumption, Decree 57 attracting businesses to invest in agriculture.
- To have access to science and technology, new technologies on varieties, production processes, to improve yield and quality of raw sesame seeds.
- Participating in the sesame production value chain to create close links with producers, establishments, businesses, and consumers.
- Currently, the demand for sesame oil and other products from sesame is quite large. Main customers are people with good income in urban areas, big cities and export to foreign markets.
- The cooperation relationship between Vietnam and countries in the world is increasingly consolidated and strengthened, which is a favourable condition for approaching domestic and international partners as well as commodity circulation.
- Building and promoting the brand of sesame oil and some other products from sesame.

4.2.4. Threats

- Most provinces do not have policies to support the development of production, processing and consumption of sesame products to encourage and support establishments, enterprises, factories,... to invest in machinery and equipment, warehouse system for processing and producing products: sesame oil, confectionery... from sesame.
- The impacts and obstacles to the environment have not been considered;
- Policies to support the development of models of some provinces focus mainly on the development and expansion of production scale, but have not focused on supporting promotion, building traceability system, and capacity control, improve product quality, good manufacturing practices for new members in order to expand the chain in a oriented manner.
- Risks of extreme weather, natural disasters, climate change greatly affect sesame production.
- Prices of materials, fertilizers... tend to increase, affecting the investment ability of producers -> productivity, quality of raw materials is not high.
- The quality requirements of products exported to other countries are very strict.
- The Covid 19 epidemic is very complicated, affecting production, purchasing, transporting and circulating products.

5 Survey Results

5.1. Survey results in Nghe An

5.1.1. Current situation of sesame cultivation in Nghe An

Nghe An has the largest sesame production area in the North, accounting for 30% of the area and nearly 40% of the national output, concentrated in districts such as Dien Chau, Nghi Loc, Nam Dan, Vinh City, and Tan Ky, Quynh Luu... in which Dien Chau district has the largest area, accounting for 50-60% of the Province's area; Sesame is grown in 2 seasons of Winter-Spring and Summer-Autumn. In recent years, the area of sesame in the whole province has remained at > 3,000 ha/year, specifically: 3,653 ha in 2019 with an average yield of 0.74 tons/ha, an output of 2,700 tons; In 2020 the area was 3,270 ha; average yield 0.4 tons/ha, an output of 1,300 tons; In 2021, the province's planting area is 2,974 ha, the average yield of

0.70 tons/ha, and the output will be 2,200 tons.

In the 3 years from 2019 to 2021, the sesame growing area has decreased compared to previous years, the yield fluctuated and reached the lowest level in 2020 at only 0.4 tons/ha; Output in 2019 reached the highest at 2,700 tons.

Regarding the use of varieties, Nghe An province mainly uses local sesame varieties (black sesame, yellow sesame...) and new sesame varieties such a V6; VD11; VD16... Local sesame seeds are planted by farmers themselves, degraded, susceptible to pests and diseases, and low yield. New sesame varieties V6; VD11; VD16 has been selected by research agencies with a high and stable yield that can reach from 0.8 - 1.0 tons/ha, depending on the variety and the level of cultivation; has a growing period of 80-90 days, in which the variety VD11 excels in disease resistance, fruit separation, spill resistance, and good drought tolerance.

Thus, sesame varieties produced in Nghe An are still poor, mainly are local sesame varieties, which farmers have planted themselves, have many disadvantages, and low productivity. New sesame varieties V6; VD11; VD16 had a high yield and are more resistant to diseases than local varieties, but the planting area is not much because farmers have not had access to it.

It is necessary to have a further analyzing of the appropriation of choosing proper varieties for the value chain development in this project based on specific production areas as well as targeting the identified market demand. For instance, In Nghe An, a group of sesame varieties that are drought tolerance can be highly considered. The issue is to ensure the availability of those varieties providers. Besides, the purpose of sesame use (for household cooking, oil extracting or processing other products) will be

considered for suggesting suitable varieties at scale. For example, if the Korean market is one of the targeted ones, the potential varieties might be suggested and provided for trials and replication by this market stakeholders/importers.

- Cultivation techniques:

* ***Sesame planting season***: Sesame in Nghe An is grown mainly in 02 crops per year (Spring and Summer-autumn crop).

1- Spring season:

The sowing season is from February 20 to March 10 (solar calendar), harvested at the end of May and the beginning of June. The average area of the spring crop is 600-700 ha/year (accounting for about 20% of the total sesame area of the year). Spring sesame yield is (0.6 - 0.7 tons/ha); Spring sesame is less interested in production because the economic efficiency is not as high as peanuts and some other beans. If sesame is planted in the spring season, the popular cropping system can be Peanut/Maize-Sesame.

In the spring season, peanuts give the highest net profit of 68.2 million VND/ha, followed by maize 41.7 million VND/ha and the lowest was sesame at 15.2 million VND/ha (Thus, the sesame area in the spring season is very limited due to lack of competitive advantage with other crops. In this season, sesame is only grown in areas with very difficult farming conditions where peanuts and maize cannot be well growing.

〈Table 6〉 Economic benefits of spring season crops

Crops	Yield (ton/ha)	Price (VND 1.000)	Total cost (million VND)	Total Revenue (million VND)	Net profit (million VND)
Spring peanut	3,5	22	28,8	77.000	68,2
Spring sesame	0,8	40	16,8	32.000	15,2
Spring maize	60	1	18,3	60.000	41,7

Source: Surveyed data, 2021

2- Summer-autumn season:

The sowing season is from June 5 to June 25 (solar calendar), harvested from early to mid-September. The sesame area of the Summer-autumn crop is about 2,400 - 2,800 ha/year (accounting for 80% of the whole year's sesame area). The summer-autumn sesame crop is located in a time frame with relatively harsh weather conditions. In the early part of the season, there are often hot sun and heavy rain, leading to seedling death and reduced density, so the yield is low. Sesame is planted right on the field after harvesting Spring peanuts.

In the summer season, sesame gave the highest net profit of 34.2 million VND/ha, followed by maize 27.7 million VND/ha and the lowest was peanuts at 16.2 million VND/ha. The most planted area of sesame is in the summer season, where it gives the highest benefit.

〈Table 7〉 Economic benefits of summer season crops

Crops	Yield (ton/ha)	Price (VND 1.000)	Total cost (million VND)	Total Revenue (million VND)	Net profit (million VND)
Summer peanut	1,5	30	28,8	45.000	16,2
Summer sesame	1,0	45	10,8	45.000	34,2
Summer maize	50	0,8	12,3	40.000	27,7

Source: Surveyed data, 2021

Note: Planting Summer maize and sesame does not have to till the land (no cost of tillage)

3- Using sesame seeds:

70% of farmers use local varieties of black and yellow sesame with a short growing time (70 - 75 days); 30% of farmers use new sesame varieties VD11, V6 which have high yield potential for production.

〈Figure 3〉 Vietnamese Sesame seeds growing in Nghe An province

Cultivation techniques:

80% of farmers grow sesame in bands (flaps) with a width of 1.5 - 2.0m, applying the sowing method (seeds are spread evenly on the bed surface; seed quantity is 4-5 kg/ha); 20% of farmers sow sesame by canals (row spacing 30 cm; plant spacing 10 cm; density 30-35 plants/ ㎡).

- Fertilizer: Amount of fertilizer and lime for 1 ha:

• Lime powder: 60% of the farmers use lime for priming with the amount of 200/kg/ha; 40% of farmers do not apply lime.

- Organic fertilizers: 20% of farmers apply manure with the amount of 5 tons/ha; 10% of farmers apply micro-organic fertilizer with the amount of 1000 kg/ha; 70% of farmers do not use both types of organic fertilizers mentioned above.
- Chemical fertilizers: 90% of farmers apply NPK (3:9:6) with the amount of 200-300 kg/ha for sesame; 10% of farmers do not or apply in very little.

- *How to fertilize*: 40% of farmers apply all organic fertilizer + 100% NPK + 100% lime powder before sowing; 60% of farmers apply organic fertilizer + 100 lime powder + 1/2 chemical fertilizer (the remaining 1/2 chemical fertilizer is applied when the plant has 7-8 leaves).

- *Irrigation*: 80% of farmers do not irrigate for sesame (because there is no water supply system in the field); 20% of farmers irrigate for sesame at the stage of firming fruit (in drought conditions).

- *Pest control*: Sesame is mainly grown on the field, which is not regularly rotated with wet rice, so it is damaged by many pests and diseases such as crickets, ants, greenworms, and borers. Root-neck disease, leaf spot disease, rust, bacterial wilt... But farmers pay little attention to pest control for sesame.

Regarding the situation of harvesting, preserving, processing and consuming products, there are still many difficulties. In Nghe An, sesame is harvested and preserved mainly by manual methods. Sesame is cut with a sickle, then brought to dry, smashed to get seeds, fanned clean and sold to traders with prices ranging from 30 - 40,000 VND/kg because it is difficult to preserve sesame, farmers often sell it right after 15 - 20 days harvested.

Nghe An province has 35 purchasing and processing establishments scattered in districts: Dien Chau, Do Luong, Yen Thanh, Hung Nguyen, Vinh City... Most in Do Luong, there are 26 purchasing establishments, 15 processing facilities.

Nghe An's sesame purchasing and processing establishments are small-scale, mostly private. Currently, there are no large-scale establishments or enterprises to associate with farmers to produce and consume products.

Advantages and Disadvantages in sesame production in Nghe An

Advantage:

- Sesame is a traditional crop, most farmers have land to grow sesame. The economic efficiency of sesame is relatively high due to its wide adaptability, tolerance to extreme weather (drought, heat, ..) and short growth period.
- Sesame land is mainly located in riverside, coastal and semi-mountainous areas, although it is poor in nutrients, it has a light mechanical composition, so it is very suitable for the requirements of sesame plants.
- Climatic conditions (temperature, light...) are relatively suitable for sesame plants to grow, develop and give high yields.
- Favorable traffic conditions create conditions for exchange and trade to develop commodity production.

Disadvantages:

- Sesame production land is mainly located in areas with good con-

ditions, poor humus and water retention while the use of organic fertilizers has not been paid attention.

- Climate change is becoming more and more serious, the degree of drought occurs with high frequency, the occurrence of rainstorms is erratic, which is the cause of reducing the yield and quality of sesame.
- Irrigation system to provide water for crops in general and sesame in particular has not been invested, so it does not actively add water for sesame in necessary periods (if drought conditions are encountered).

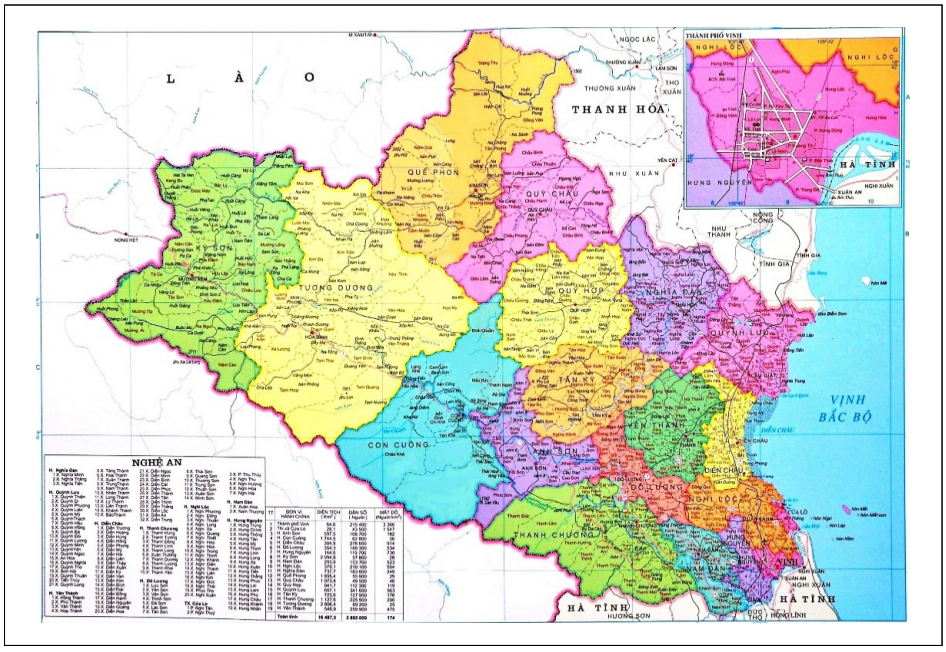
General assessment:

- In terms of geographical location, topography, land resources and climate of Nghe An are relatively suitable for sesame production. In recent years, the area and yield of sesame in Nghe An has been unstable (low yield, averagely 0.4 - 0.7 tons/ha). The main reason is the lack of good varieties, besides that, farmers' application of new technical advances to sesame production is still very limited.

5.1.2 Map of the sesame value chain in Nghe An

Sesame is grown mainly in coastal districts such as Quynh Luu, Dien Chau, Nghi Loc

〈Figure 4〉 Administrative map of Nghe An province



〈Table 8〉 Statistics on sesame area, productivity and output in 2018 in key districts in Nghe An province

No	Name	Area (ha)	Yield (quintal/ha)	Productivity (ton)
1	Diễn Châu District	1.882,62	2,3	432,68
2	Nghi Lộc District	413,40	3,52	145,36
3	Quỳnh Lưu District	156,26	10,54	164,70
4	Nam Đàn District	132,90	7,3	97,00
5	Vinh City	125,00	6,00	74,98
6	Tân Kỳ District	120,40	8,31	100,00
7	Cửa Lò Town	102,00	2,63	26,85
8	Yên Thành District	97,40	8,00	77,94

Source: Statistics, 2018

Table 8 shows that the total area of sand land along Nghe An's coast is 21,428 ha. This land is characterized by soil with coarse mechanical composition, discrete structure, low absorptive capacity, poor water

holding capacity, so it is often subject to severe drought. Nutrients such as humus, nitrogen, phosphorus are poor, total potassium is high, but it is easily digestible. Therefore, in order to improve the production efficiency of crops grown on sandy soil, it is necessary to improving the physico-chemical properties of the soil, in which attention should be paid to the selection of crop system with drought-tolerant, high temperature such as sesame, mung-bean.

In Nghe An, the potential for development of sesame is still very large because sesame is a crop to be grown on groundnut production in the coastal districts of Nghe An province. In the summer-autumn season, only mung-bean can compete with sesame on sandy soil. Therefore, it is necessary to study and select sesame varieties with high yield and oil content, as well as suitable impact techniques for ecological zones to exploit the full production potential of the region. This will contribute to boosting production capacity, improving incomes and living standards for farmers.

Specifically analyzing the causes that make sesame growing area in Nghe An decreasing day by day can be seen:

- Regarding the use of varieties, currently, sesame varieties in Nghe An mainly use local varieties (black sesame, yellow sesame...) and V6 sesame varieties; VD11; VD16... The local sesame varieties are planted by farmers themselves, store from the previous season, so the variety is degraded, susceptible to pests and diseases, and the yield is not high. Sesame varieties such as V6; VD11; VD16 are sesame varieties selected from the sesame group, with high and stable yield in different seasons and locations, which can reach from 50 -100kg/500 ㎡, depending on the variety and intensity

level; has a growth period of 80-95 days; unbranched (VD11, VD16) or less branched (V6); has disease resistance, in which the variety VD11 excels in resistance to bacterial wilt, fruit splitting, shedding and drought tolerance, but the planting area is limited.

- Regarding the situation of harvesting, preserving, processing and consuming products, there are still many difficulties. In Nghe An, sesame is harvested and preserved mainly by manual methods. Sesame is cut with a sickle, then brought to dry, smashed to get seeds, fanned clean and sold to traders with prices ranging from 30 - 40,000 VND/kg, because it is difficult to preserve sesame, farmers often sell it right after 15 - 20 days harvested.

With small areas planted by people, the products created are mainly for family consumption, small trade in rural markets or processed into sesame oil for the family. For growing areas with a larger area, they are purchased by traders or purchased and processed by some private establishments to create different products from sesame. In addition, sesame is also purchased to export to other provinces for different purposes.

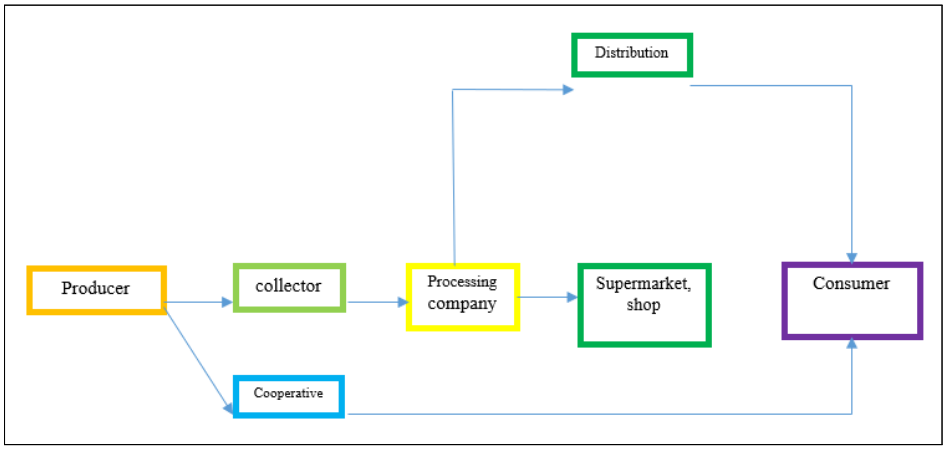
- Regarding preliminary processing and processing: Currently, in the province, there are a number of purchasing and processing establishments scattered in districts but concentrated in a few districts such as Do Luong, Yen Thanh, Hung Nguyen, Vinh City. The number of purchasing establishments in the province is 35, the number of processing establishments is 35. Typically, in Do Luong, there are 26 purchasing establishments and 15 processing establishments. Thus, the number of purchasing and processing establishments in the whole province is relatively large, but the scale of establishments is still small, mostly private, opened to produce sesame products such as rice paper, candy, oil. sesame,

and dried sesame. In addition, there are a number of purchasing establishments for export to other provinces. Currently, there are no large-scale establishments or enterprises in the province to associate with farmers to produce and purchase products in the form of association contracts. Processing facilities are often located in districts with small sesame growing areas, districts with large sesame growing areas have very few processing facilities, so it is difficult for production and consumption, so the sesame production area in recent years tended to decrease.

5.1.3. Stakeholders analysis of Nghe An's sesame production

Results of value chain assessment in sesame production were carried out by the Agricultural Extension Center of Nghe An province in 2 communes: Dien Thinh, Nghi Loc district and Nghi Long commune, Nghi Loc district, each commune randomly surveyed 30 households:

〈Figure 5〉 Sesame value chain in Nghe An Province, October 2021



a) Facilities for production and trading of input materials

The source of agricultural materials for production households is very important to increase agricultural production and improve productivity in both quantity and quality. Agricultural materials for production households include seeds, fertilizers, pesticides, tools, and machines. Supply management involves decisions such as: what's kind of inputs; where and when to buy; price; methods of warehouse management and supply of agricultural materials.

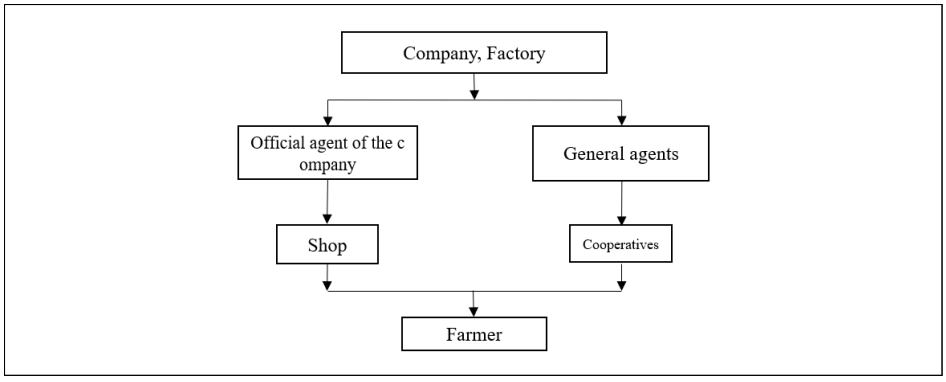
〈Table 9〉 Supply of agricultural materials of surveyed production households

(% of total surveyed households, n=30)

Type of input	Coopetative		Private Shop		Other households		Self-supply	
	Dien Thinh Commune	Nghi Long Commune	Dien Thinh Commune	Nghi Long Commune	Dien Thinh Commune	Nghi Long Commune	Dien Thinh Commune	Nghi Long Commune
Varieties	0	0	0	0	0	0	100	100
Fertilizer	100	0	0	100	0	0	0	0
Pesticide	100	0	0	100	0	0	0	0
Land preparation service	0	0	0	0	0	0	100	100

Source: Surveyed data, 2021

〈Figure 6〉 Channel of supplying agricultural materials of surveyed households



Sesame varieties

In the sector of agricultural production, the seed is an important factor determining the yield and quality of harvested products. Therefore, the selection of good seed sources, ensuring productivity, yield, resistance to pests and diseases and adapting to climate change (drought, waterlogging) is a dilemma for breeders and managers at present. now on.

Through the survey interview, 100% of the production households in the two surveyed communes used the family's available seed source harvested from the previous season to sow for the next. Because the variety is stored from the previous, the households do not apply selective measures to maintain the population, so the variety is easily mixed, reducing the genetic purity, the yield potential and being infected with many dangerous diseases such as disease. Bacterial wilt, black mold root rot... Besides, the sesame seed used by farmers is black and white sesame, of which 32 surveyed households in 2 communes use local sesame black seeds, (accounting for 53.3%); 28 surveyed households used both black and white sesame varieties (46.7%). The survey results also show that the supply of sesame seeds in Nghe An province is still limited, almost no units are providing qualified seed sources, affecting the ability to develop a sustainable sesame chain. This is also one of the reasons why the sesame production area in Nghe An is decreasing day by day. Therefore, it is necessary to find and supply good quality sesame seeds to ensure a high and stable yield.

Fertilizer and Pesticides

In Dien Thinh commune, Dien Chau district, 100% of surveyed households used fertilizers and pesticides distributed from cooperatives. However, in

Nghi Long commune, Nghi Loc district, 100% of surveyed households used fertilizers and pesticides from private suppliers. On the other hand, the long-standing habit of farmers growing sesame in Nghe An often do not apply to fertilize or fertilize in very limited amounts when the plant begins to flower. The fact that producers buy products in small quantities will put them at a disadvantage when negotiating prices. In addition, the production households buy fertilizers and pesticides at the last stage of the supply channel (Figure 2), so their payment also includes the cost of all the intermediaries, which leads to higher payments per unit of output.

In-depth research was carried out with 4 cooperatives providing input services in Dien Thinh commune (in Dien Chau district including Dong Thinh Cooperative, Dien Hung Agricultural Cooperative, Bac Thinh Cooperative, Nam Thinh Cooperative)

〈Table 10〉 The actual situation of input service supply in Dien Thinh commune, Dien Chau district, Nghe An province

Content	Unit	Dong Thinh Cooperative	Dien Hung Cooperative	Bac Thinh Cooperative	Nam Thinh Cooperative
Founded year	Year	2016	2011	–	2003
Number of members in 2020, 2021	Member	7	6	6	62
Number of households associated with the production	Affiliate household	0	0	0	0
Area of warehouse, store, production space	㎡	1500	852	1800	360
Investment	Million Dong	203	700	500	1.000

Content	Unit	Dong Thinh Cooperative	Dien Hung Cooperative	Bac Thinh Cooperative	Nam Thinh Cooperative
Services offered		Fertilizer, Pesticide	Seed, Fertilizer, Pesticide	Fertilizer, Pesticide	Fertilizer, Pesticide
Transport		Motobike	Car	2 motobikes	2 tractors, 6 motorbikes

Source: Surveyed data, 2021

The main activity of the surveyed cooperatives is the supply of input materials, of which 2 cooperatives, Dong Thinh Cooperative and Dien Hung Agricultural Cooperative, have activities of preliminary processing, processing and consumption of products. Supply of input materials: fertilizers, pesticides, plant varieties. With this type of input material supply service such as fertilizer, it helps members feeling insecure about fertilizer quality as well as product price.

However, according to the surveyed cooperatives, the current difficulties they face in trading inputs for local sesame production such as the highly competitive market, the private suppliers trading in different products. There are many floating commodities, in addition, the prices of fertilizers and pesticides have increased due to transportation difficulties affected by the COVID-19 pandemic as well as the erratic weather situation. Moreover, only Dong Thinh Cooperative has links in production with farmers. Most cooperatives have limited means of transportation.

Due to the competition in consumption, the survey cooperatives are willing to let their customers pay in the form of deferred payment. This partly reflects the difficulties of farmers in the production process, especially poor households, in additional, not having enough production capital, they also have to bear the price difference, leading to high costs,

affecting households' profits, at the same time causing difficulties in capital for the supplier inputs for production.

Production status of sesame farmers

** Farming information*

- Gender: The table shows that, in 60 sesame farming households in the two surveyed districts in Nghe An province, there are 44 households headed by men, accounting for 73.3%. It shows that men still play an important role in household production. Besides, 60 surveyed households are Kinh people so the production customs are similar.

〈Table 11〉 Information on gender of sesame farmers

Content of rating	Frequency	Percentage (%)
Gender	**60**	**100**
Male	44	73,3
Female	16	26,7

Source: Surveyed data, 2021

- Cultivated area and labor force involved in the production: Production land and human resources are important factors in the agricultural production process.

〈Table 12〉 Cultivated area and human resources involved in sesame production in 2 communes

Content of rating	Unit	Min	Max	Average	Standard deviation
1. Number of people	People/household	2	8	5,15	1,147
2. Number of people of working age	People/household	2	6	3,87	1,081

Content of rating	Unit	Min	Max	Average	Standard deviation
3. Number of people participating in agricultural production activities	People/household	1	4	1,98	0,854
4. Sesame planting area	ha	0,05	0,25	0,136	0,455

Source: Surveyed data, 2021

The area of land for sesame cultivation in the 2 surveyed communes is generally very low, averaging only 0.136 ha/household. The household with the largest sesame growing area is 0.25 ha/household, the smallest household area is only 0.05 ha/household. Most of the land for growing sesame of households in the 2 surveyed communes is the owner's land. Small production area increases input costs in the production process. Large production land area will create many products, favorable conditions to attract businesses to consume products.

In addition, labor involved in the sesame production process is also an important factor. The households producing sesame in the two surveyed communes are mainly family forces, the number of people involved in agricultural production activities is at least 1 person, at most 4 people, on average each household has about 1,98 family workers. Family labor helps to reduce labor costs and contributes to income improvement.

- Age of producer household: In the production of sesame, age and production experience are directly proportional to each other. The older of the age, the more production experience contributes to making the production process more efficient.

〈Table 13〉 Age of household producer

Content of rating	Number	Percentage (%)
1. From 26-40 year old	5	8,3
2. From 41-59 year old	39	65,0
3. From 60 year old	16	26,7
Total	**60**	**100**

Source: Surveyed data, 2021

The survey shows that 65.0% of household heads are between the ages of 41 and 60 years old. 8.3% are in the age group of 26-40 years old, 26.7% are over 60 years old. The higher the age, the more experience in sesame production of the surveyed communes. However, with increasing age, there are many limitations to training, participating in agricultural extension work, and applying scientific and technical advances to production.

〈Table 14〉 Number of years of experience in sesame production in the direction of commodity production

Content of rating	Unit	Min	Max	Average	Standard deviation
Number of years of experience production in the direction of commodity production	năm	10	30	19,05	7,146

Source: Surveyed data, 2021

Through the process of the direct survey from farmers in the two surveyed communes in Nghe An province, sesame cultivation has been attached to farmers for many years, the experience of growing sesame comes from family tradition.

- Academic level: Besides production experience, education level is al-

so an important factor determining the success of the production process. The higher the level of education, the higher the need to explore and learn new production techniques. A high level of education will bring advantages to people not only in the production stage but also in the process of product preservation and processing as well as product consumption.

However, the difficulty for farmers in Nghe An is that the education level of household heads is still low, mainly farmers have just finished primary and secondary school. Therefore, learning and applying new science and technology into the production process is also limited and difficult.

* *The reason why farmers choose to produce sesame*

Through direct interviews from sesame farmers in two survey communes in Nghe An province, the results show that 100% of the reasons why farmers choose to produce sesame because this crop is resistant to drought and heat from May to August and can avoid storms in August and September. On the other hand, sesame is a plant that requires low investment, is easy to care for and to sell (or easy to use).

* *Capital market*

Besides human resources and natural resources, financial resources play an important role in the production process of households. Assessing the functioning of the capital market and the ability and level of participation of farmers helps us understand the difficulties of farmers in the market as well as offer solutions to increase farmer participation credit capital markets.

The survey results show that the all surveyed households facing to the lack of capital for production, because the loan is mainly through local mass organizations with a small amount. Official credit sources often have low incentives, long loan procedures, and unsecured loans are not yet popular.

* *Economic efficiency of households from sesame production*

Financial cost analysis from the sesame farming model of the household is to calculate whether the production of sesame is financially viable or not. From the results calculated in the financial analysis appendix, it shows that the average total production cost of the household, including the cost of family labor, is 18,195,000 VND/ha. The average revenue that farmers get after selling products is 35,516,667 VND/ha. The average profit of farmers is 17,321,667 VND/ha.

The profit of sesame farmers is affected by many factors such as fertilizer cost, seed, pesticide, care, harvesting, and transportation. The analysis of labor cost show that Family Labor cost is the factor that has the most impact on profits.

〈Table 15〉 Analysis of financial indicators from sesame production activities

Content	Unit	VND/ha
1. Average total cost/ha	Dong	18.195.000
2. Average revenue/ha	Dong	35.516.667
3. Average profit/ha	Dong	17.321.667
4. Revenue/Cost		1,95
5. Profit/Cost		0,95
6. Profit/Revenue		0,48

* Revenue/Cost = 1.95 times, this shows that for every 1,000 VND spent, the farmer earns an average of 1.95 thousand VND in revenue.

* Profit/Cost = 0.95 times this means that for every 1,000 VND spent, the average profit of the farmer will increase by 0.95 times.

* Profit/Revenue = 0.48 times, this means that for every 1,000 VND of revenue, of which farmers will increase their profit by 0.48 thousand VND.

* *Economic effect of a hectare of sesame*

〈Table 16〉 Economic efficiency of one hectare of sesame

Content	Unit	VND/ha
1. Average total cost	Dong/ha	18.195.000
2. Average Revenue	Dong/ha	35.516.667
3. Average profit	Dong/ha	17.321.667
4. ROI (Return on Investment)		0,95
5. % profit/revenue	%	48,77

Source, Surveyed data, 2021

From the results of the 2 tables, sesame production brings additional income for households, specifically, the ROI is 0.95%, equivalent to the return on investment or the opportunity cost up to 95% is high and worth investing to increase the area.

In summary: Limits in production of sesame

- Small scale, fragmented. The sesame growing area of households varies from 0.05 ha to 0.25 ha. The average area of each household is about 0.136 ha.
- The source of input materials, especially the quality seed source, is almost nonexistent, leading to the disruption of the production chain.
- Natural conditions: degraded land; extreme weather due to heat and drought from May to August every year and storms and floods from August to September.
- Currently, sesame in Nghe An is only produced on a small and sponta-

neous scale, has not yet formed a farmer's organization (Cooperative/ Group), has not received the proper attention of the local government. On the other hand, in some localities, farmers think that sesame is an easy plant, so they just sow it in the field, let the plant grow on its own, do not care about weeding or fertilizing, spraying, so the yield of sesame is not high.

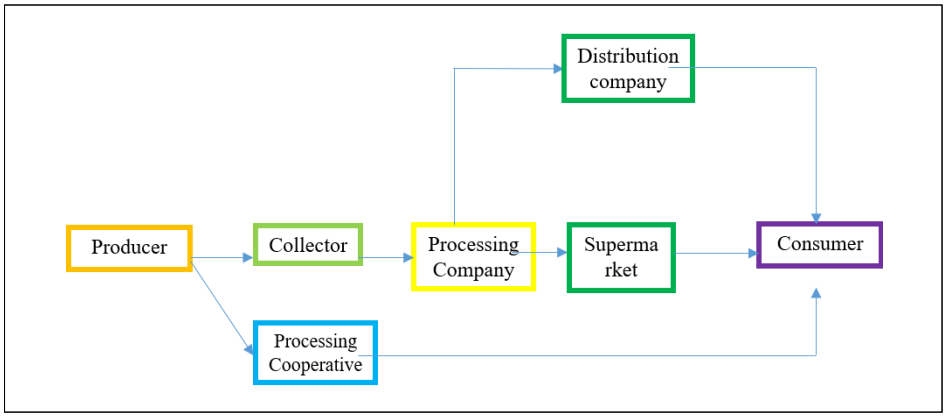
- Low level of education, outdated farming practices.
- The average age is high, so the ability to access farming techniques in intensive sesame production is still limited.
- Lack of capital for production
- Vertical links in the value chain between producers and cooperatives/enterprises at the production stage are still loose. There is no horizontal link between producers and producers such as Groups, co-interest groups (CIG), or cooperatives...

b) Sesame processing and consumption establishments

Collection

Due to limited financial capacity, the collection scale is still small, the output products are mainly raw products, which are consumed according to the channels shown in Figure 7.

〈Figure 7〉 Sales channel of sesame producing households



〈Table 17〉 Rate of selection of product buyers of surveyed households

Indicator	Total number of households surveyed	Processing cooperatives		Collectore	
		Number (household)	Percentage	Number (household)	Percentage
Dien Thinh Commune	30	9	30	21	70
Nghi Long Commune	30	0	0	30	100

Source: Surveyed data, 2021

There are many marketing channels for sesame products in the two surveyed districts, but collectors occupy an important position. Most of the households will sell sesame products after drying to the collectors. The collectors will supply directly to the processing company or processing cooperative. The survey results also show that the surveyed households do not have a consumption link with processing cooperatives through contracts.

Preliminary processing, processing

According to the survey results of 3 processing facilities in Dien Chau

district, which has the largest sesame growing area in Nghe An province (accounting for 50-60% of the province's total area), shows that the main activities of the processing facilities include purchasing sesame, processing sesame, wholesale and retail.

〈Table 18〉 Scale of purchasing and processing in the last 1 year

Processing	Type			
	Dried sesame		Sesame oil	
	Input	Output	Input	Output
Dong Thinh Cooperative	15-20 tons			1800 lits of sesame oil
Dien Hung Agricultural Cooperative	150 tons	120 tons		
Sy Thang Agro-Forestry-Fishery Import and Export Company Limited	70-100 tons	50-80 tons		4000-4500 lits

Source: Surveyed data, 2021

Processing output tends to decrease due to reasons such as most processing facilities are not proactive in material areas. When farmers lose their crops, due to extreme weather events and epidemics, people tend to self-distribute; market prices fluctuate, farmers tend to switch to other crops.

- Regarding links in the production and purchase of input materials

The processing facility is not active in the raw material area, showing that the link between the processor and the farmer is still weak. The survey results show that only the processing facility of Dong Thinh Cooperative supports farmers at the input stage.

〈Table 19〉 The actual situation of purchasing input materials of processing facilities

Processing facility	Type of input materials and products (specify)	Who do you buy? Where?	Purchase (1. Freelance; 2. Pre-agreement orally; 3. Contract signing)	Accounted for a proportion of total input (%)	Requirements on the production process, certification, product quality, delivery conditions, payment conditions, etc.
Dong Thinh Cooperative	V6	Cooperative's member	Freelance	40%	Large, good and clean seeds Payment in cash
	Black sesame	Cooperative's member	Freelance	35%	Large, good and dried seeds Payment in cash
	Yellow sesame	Cooperative's member	Freelance	25%	Large, good and clean seeds Payment in cash
Dien Hung Agricultural Cooperative	Dried sesame	People inside and outside the commune	Freelance		Not yet Payment in cash
Sy Thang Agro-Forestry-Fishery Import and Export Company Limited	Dried sesame	Farmers in Dien Chau District	Freelance, direct deal, phone.	100%	Sesame seeds are firm, dry, clean, do not contain impurity soil...

Source: Surveyed data, 2021

The selling prices of raw sesame seeds and sesame products by processing facilities are shown in the following table:

〈Table 20〉 Purchase price of raw materials and products in 2020

Type of input materials and products	Processing facility	Unit	Cheapest price	Time	Most expensive price	Time	Average price
Black, dried sesame	Dong Thinh Cooperative	Dong/kg	40.000	October	45.000	July	42.500
	Dien Hung Agricultural Cooperative	Dong/kg	40.000	October	45.000	July	42.500
	Sy Thang Agro-Forestry-Fishery Import and Export Company Limited	Dong/kg	40.000	October	45.000	July	42.000
Yellow, dried sesame	Dong Thinh Cooperative	Dong/kg	31.000	October	36.000	July	33.500
	Dien Hung Agricultural Cooperative	Dong/kg	31.000	October	36.000	July	33.500
	Sy Thang Agro-Forestry-Fishery Import and Export Company Limited	Dong/kg	30.000	October	35.000	July	31.000
White, dried sesame	Dong Thinh Cooperative	Dong/kg	20.000	October	26.000	July	23.000
	Dien Hung Agricultural Cooperative	Dong/kg	20.000	October	26.000	July	23.000
	Sy Thang Agro-Forestry-Fishery Import and Export Company Limited	Dong/kg	20.000	Octobeer	25.000	July	22.000

Source: Surveyed data, 2021

The table above shows that sesame prices, in general, tend to be higher in July and lowest in October of the year. In which, the average price of dried black sesame is 42,000-42,500 VND/kg and the highest is 45,000 VND/kg, the cheapest is 40,000 VND/kg.

- About the process and technology used in processing

Processing facilities have not yet applied advanced techniques in processing, with small processing capacity, leading to low productivity, quality, efficiency and competitiveness of products. The processing technology is mainly based on traditional methods. Due to manual processing, the formed product is often monotonous and unstable in quality.

- Evaluate the effectiveness of using processes and technologies in purchasing, sorting, preliminary processing, processing and preservation of processing facilities.

〈Table 21〉 Evaluating the efficiency of using processes and technologies in purchasing, sorting, preliminarily processing, processing and preserving of processing facilities

Name	Processes and technologies in use	Effective in use	Limits in use	Processes and technologies to be applied in the near future
Dong Thinh Cooperative	New technology oil press machine	Good quality	Small capacity	New machine and larger capacity
Dien Hung Agricultural Cooperative	-	-	-	-
Sy Thang Agro-Forestry-Fishery Import and Export Company Limited	Crafts, Semi-Crafts	Creating jobs for workers	Productivity and quality are not high	Installing a system of modern machinery and equipment into the production process

Source: Surveyed data, 2021

Product marketing channels

Through survey data of 3 samples of the sesame marketing channels in Nghe An, it shows that cooperatives are collecting products and selling products directly to consumers at the cooperative's shop.

〈Table 22〉 Consumption situation of Dong Thinh Cooperative, Dien Thinh commune, Dien Chau district, Nghe An province

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Verbal agreement email; 3. Signing contract)	Requirements on the production process, certification, product quality, delivery conditions, payment conditions, etc.
Processing company/factory					
Wholesale (distributor/agent)					
Retail (supermarkets, shops)					
Hotel, restaurant,					
Consumers	How to sell – At home – Local store/booth – Deliver to home	Sesame seeds and sesame oil of all kinds	100%		Cash The product quality meets customers' standards
Other (if any)					

Source: Surveyed data, 2021

〈Table 23〉 Product consumption situation of Dien Hung Agricultural Cooperative, Dien Thinh commune, Dien Chau district, Nghe An province

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orall agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
Processing company/factory					
Wholesale (distributor/agent)					
Retail (supermarkets, shops)					
Hotel, restaurant, cafeteria					
Consumers	– Shops at the cooperative	Dried sesame	100%		Cash Product quality is guaranteed
Other (if any)					

Source: Survey data, 2021

〈Table 24〉 Product consumption situation of Sy Thang Agriculture, Forestry and Fisheries Import–Export Co., Ltd, Dien Thinh commune, Dien Chau district, Nghe An province

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orall agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
Processing company/factory					
Wholesale (distributor/agent)	1. Ntea Vietnam Group, 2. International	Sesame oil, dried Sesame	50%	Signing contract	

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orall agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
	Application Development and Investment Co., Ltd				
Retail (supermarkets, shops)	Muong Thanh supermarket	Sesame oil	30%	Signing contract, agreement via phone	
Hotel, restaurant, cafeteria					
Consumers	How to sell? – At home (Store/booth at……) – Shipping – Home delivery	Sesame oil, dried Sesame	20%		Cash Product quality is guaranteed
Other (if any)					

Source: Survey data, 2021

Linkage between the processing company and the distribution company: The link is made under the annual contract signed between the supplier company and the product consuming partner. The scale of association is done through orders and delivery invoices including: quantity, type and purchase price in each time, delivery time, form of payment. Orders are sent by Fax or by email.

The link between the processing company and the supermarket: The link is made according to the annual contract signed between the supplier company and the product consuming partner. The scale of association is done through orders and delivery invoices including: quantity, type and

purchase price in each time, delivery time, form of payment. Agreement by phone.

In general, the consumption market of Nghe An sesame is mainly the domestic market, not exported to other countries. Through research, Sy Thang Agro-Forestry-Fisheries Co., Ltd. has initially approached the wholesale and retail markets.

〈Table 25〉 Selling price of sesame and sesame oil in 2020

Type of product	Consumption facility	Unit	The cheapest price in October		The most expensive price in July		Average price		Profit rate/ selling price (%)
			Retail price	Wholesale price	Retail price	Wholesale price	Retail price	Wholesale price	
Dried, black sesame	Dong Thinh Cooperative	Dong/ kg	42,000	40,000	45,000	43,000	43,000	41,000	5%
	Dien Hung Agricultural Cooperative	Dong/ kg	42,000	40,000	45,000	43,000	43,000	41,000	5%
	Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd	Dong/ kg	45,000	43,000	50,000	48,000	47,000	45,000	5%
Dried, yellow sesame	Dong Thinh Cooperative		33,000	31,000	36,000	34,000	34,000	32,000	5%
	Dien Hung Agricultural Cooperative		33,000	31,000	36,000	34,000	34,000	32,000	5%
	Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd	Dong/ kg	35,000	32,000	40,000	37,000	37,000	35,000	
Dried, white sesame	Dong Thinh Cooperative	Dong/ k g	22,000	20,000	26,000	24,000	24,000	22,000	5%
	Dien Hung Agricultural Cooperative	Dong/ kg	22,000	20,000	26,000	24,000	24,000	22,000	5%

Type of product	Consumption facility	Unit	The cheapest price in October		The most expensive price in July		Average price		Profit rate/ selling price (%)
			Retail price	Wholesale price	Retail price	Wholesale price	Retail price	Wholesale price	
	Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd	Dong/ kg	25,000	23,000	30,000	28,000	27,000	25,000	5%
Sesame oil	Dong Thinh Cooperative	Lit	80,000	75,000	100,000	85,000	90,000	80,000	7%
	Dien Hung Agricultural Cooperative	-	-	-	-	-	-	-	-
	Sy Thang Agriculture, Forestry and Fisheries Import-Export Co.Ltd	Lit	80,000	75,000	150,000	140,000	120,000	110,000	7%

Source: Surveyed data, 2021

The above figures show that the oil processing stakeholders can gain a higher proportion of profit compared to other stakeholders (sesame drying ones). As mentioned in the above section, farmers producing sesame also gain a high profit proportion with the proportion of profit/cost being 0.95; thus this value chain can be considered a promissing high-profit value to stakeholders from production to processing stages.

c) Specialized sesame cooperatives, farmers' organizations

The above information shows that the stages from producing to marketing the raw sesame of individual farmers are through spot market stakeholders and the agricultural co-operatives or private companies.

There are no specialized cooperatives and common interest groups of small farmers working together to coordinate the production stage and negotiate with other stakeholders of the value chain. The reason might be at the moment, sesame in Nghe An is only produced on a small and spontaneous scale, has not yet formed a farmer's organization (Cooperative/Groups), has not received proper attention from the locality.

Once there are not yet specialized sesame cooperatives, there are challenges in giving supports to the producers such as ToT training, seeds production, facilities and equipment investment because sesame production and trading currently might not be the main focus of the cooperative in their business.

This lack can also lead to difficulty in applying the common production protocol to ensure that the proper quantity and quality of the sesame seeds are consistently supplied to buyers.

5.1.4. Sesame and sesame's products Supply and Demand (advantages /competitiveness/ weakness)

Sesame products in Nghe An are mainly dried sesame and sesame oil. Due to the processing technology mainly based on traditional methods, manual processing, the main product is sesame oil but the quality is not stable.

Sesame oil is being used more in the food-service industry due to its high nutritional value and can be used in various cuisines. The trend towards organic consumption is also expected to boost demand for sesame oil.

To clearly see the factors affecting the success, sustainability as well as failure of sesame chain development in Nghe An province, we conduct a SWOT analysis of sesame chains in Nghe An and are shown in the following table:

〈Table 26〉 SWOT analysis of sesame chain in Nghe An province

Stages / SWOT	Input (quality of raw materials, means of purchasing, the way to the place of sesame cultivation, the relationship with sesame growers, ...)
Strengths	Local sesame varieties with oil content and high quality meet the needs of consumers. This type is often used to process sesame oil of good quality, which is very popular with consumers Convenient transportation system to sesame production areas and to each household for purchasing and transportation. locating in the area, company can buy dried sesame from production households with more competitive prices – The means of purchasing are very diverse such as motorbikes, agricultural vehicles, trucks... can go to the point of purchase conveniently.
Weaknesses	– There is no policy to support the development of production, processing and consumption of sesame products to encourage and support enterprises, factories... to invest in machinery, equipment, system of warehouses, factories... to process and produce products: sesame oil, confectionery... from sesame – The oil content and quality of material sesame of some varieties are not high, so the production of sesame oil products is not good. This type is usually only used to produce and process into products such as sesame cakes, confectionery... + There are no new varieties. The old sesame varieties are planted by people themselves, so the quality is not high, there is a phenomenon of degeneration, easy to be infected with pests and diseases –〉 yield and quality are not high. + Production is mainly based on experience, without intensive investment –〉 low yield and quality of raw sesame – There is no clear link with sesame farmers.
Opportunities	– The interest of all levels and sectors in the development of production and products from sesame seeds: Programs, investment projects; Support policies for businesses purchasing, processing... – Infrastructure and rural transport system are being concerned by authorities at all levels, increasingly perfected – The belt area has the ability to convert and expand to produce large seeds, which will be produced to meet the demand for raw materials for processed products in the near future.

	– To be accessed to science and technology, new technologies on varieties, production processes, ... to improve productivity and quality of raw materials. – Participating in the production value chain in order to make a close link with producers, facilities, businesses, and consumers...
Threats	– Climate change has a great impact on sesame production – Prices of materials, fertilizers... tend to increase higher and higher, affecting the investment ability of producers –〉 productivity, raw material quality is not high – The Covid 19 epidemic is very complicated, affecting production, purchasing, transporting and circulating products – Increasing demand for product quality by domestic and foreign consumers
	Preliminary processing, processing, packaging (factory – existing equipment, etc.)
Strengths	Having a sufficient system of roasting, drying, bagging, vacuum, oil press and oil refining machinery systems... to ensure production with a low loss rate, create products of good quality, and bring high quality products. Higher profit (Only at Sy Thang – Dien Chau facility)
Weaknesses	Most other facilities: – Preliminary processing is mainly done manually, takes a lot of time, takes a lot of effort, requires a lot of labor, so the cost is high –〉 the production value is not high. – The factory is temporary, mainly making use of warehouses, offices, houses... so the area is narrow, not ensuring the regulations on fire prevention, labor safety, safety food hygiene... – Machines and equipment for preliminary processing and processing are still very rudimentary and poor... with a high loss rate –〉 low profit value.
Opportunities	– The interest of all levels and sectors in the development of production of sesame and sesame products: Investment programs and projects; Policies to support businesses in purchasing and processing. – Supported to transfer of science and technology, equipment, machinery... in the stages of preliminary processing, processing, packaging and product branding – Get loans to expand production scale, invest in the system of modern equipment and machinery lines for processing sesame products of good quality, bringing high value of income. – To be participated in study visits at large-scale facilities, enterprises and factories with modern technology.
Threats	– The Covid 19 epidemic is very complicated, affecting production and processing. – Financial ability to invest in purchasing equipment, machinery, factories, warehouses... is still limited. – Human capacity to receive transfer, applying science and technology, technology and using modern equipment and machines in the stages of preliminary processing, processing, packaging, product branding in accordance with regulation.

	Consumption (Geographic location – shipping on sale, certification, brand – existing reputation, partners – existing markets, partners – potential markets, competitors, Government's requirements, policy from import countries)
Strengths	The geographical location right on National Highway 1A is very convenient for the transportation and circulation from the stage of raw material purchasing to the consumption of sesame products. – Products of good quality, well meet consumer tastes – Currently, the company has a reputation in the market inside and outside the province, there are many businesses that want to cooperate in the near future. (Only at Mr. Sy Thang's company– Dien Chau)
Weaknesses	– Sesame oil products have not been registered for OCOP products, so there is no product label, no product brand has been built. – Sesame oil products have good quality, so the selling price is quite high, customers are mainly people with good income or more. Local people and middle–income people often use peanut oil and some industrial cooking oils with cheaper price than sesame oil. – Having not been able to expand the market in big cities and especially the export market.
Opportunities	– The interest of all levels and sectors in the development of production of sesame and sesame products: Investment programs and projects; Policies to support businesses in the consumption stage. – Currently, the demand for sesame oil and other products from sesame is quite large. Main customers are people with good income or more in urban areas, big cities and export to foreign markets. – The cooperation relationship between Vietnam and countries in the world is increasingly consolidated and strengthened, which is a favorable condition for approaching domestic and international partners as well as goods circulation. – The system of infrastructure and means of transport is becoming more and more complete, which is very convenient for transporting and consuming products. – Building and promoting the brand of sesame oil and some other products from sesame.
Threats	– Many big competitors have financial potential, scientific and technical capacity, technology... – Meeting the regulations on goods, product quality requirements of the export market. – Building and affirming product brands, especially for export markets.

Source: Summary of research results

The above SWOT analysis plays an important role to the project preparation team that enables to include further analysis for interventions. For example, the core stakeholders for intervention can be cooperatives as

they are considered effective ones of the value chain, and supporting cooperatives is a strategic plan of the province and the whole country. Different main stages of the value chain can be further improved for the whole value chain development such as through an enhancement in production at scale, facilities and technology transfer in processing potential processed products such as in oil production. The processed one is very promising to participate in the OCOP program if further supports are provided such as packaging and branding.

5.1.5. Postharvest management and Technology (R&D/Extension/Training, etc.)

Sesame products from Nghe An, like other agricultural products, are still exported in raw form or with limited processed content, with lower quality and export value than similar products from many other countries. Post-harvest technology and management is one of the main reasons for low income of farmers, low competitiveness of agricultural products….

According to the survey results of 3 processing facilities in Dien Chau district, which has the largest sesame growing area in Nghe An province (accounting for 50-60% of the province's total area), the processing output tends to decrease. due to reasons such as: most of the processing facilities are not proactive in the material area. When farmers lose their crops, due to extreme weather events and epidemics, people tend to self-distribute; Market prices fluctuate, farmers tend to switch to other crops.

The fact that the processing facility is not active in the raw material area

shows that the link between the processor and the farmer is still weak. The survey results show that only Dong Thinh Cooperative's processing facility supports farmers in the input stage (fertilizer). In addition, the processing facilities have not yet applied advanced technology. Progress in processing, processing capacity is small, leading to low productivity, quality, efficiency and competitiveness of products. Processing technology is mainly based on traditional methods, manual processing, the main product is sesame oil but the quality is not stable.

5.1.6. Distributor, Wholesaler and Trader of sesame in Nghe An

Through survey data of 3 samples of the sesame consumption chain in Nghe An, it shows that: cooperatives are consuming products by selling products directly to consumers at the cooperative's booth. Particularly, Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd has more diversified consumption channels, as shown in the following table:

〈Table 27〉 Sesame chain consumption market in Nghe An

Consumption market	Dong Thinh Cooperative			Dien Hung Agricultural Cooperative			Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd		
	Name	product	Occupying rate	Name	product	Occupying rate	Name	product	Occupying rate
Company, factory			0%			0%			0%
Wholesale (distributing company, agent)			0%			0%	International Application Development and Investment Co., Ltd	Sesame oil, dried sesame	50%

Consumption market	Dong Thinh Cooperative			Dien Hung Agricultural Cooperative			Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd		
Retail (supermarkets, shops)							Muong Thanh Supermarket	Sesame oil	30%
Hotel, restaurant,			0%			0%			0%
Consumers		All kinds of Sesame seeds and sesame oil	100%		All kinds of Sesame seeds and sesame oil	100%		Sesame oil, dried sesame	20%
Other			0%			0%			0%

Source: Surveyed data, 2021

5.1.7. Agricultural markets (retail/wholesale/supermarket) in Nghe An

The surveyed data shows that the agricultural market in Nghe An is still mainly a form of retail. Through the survey data of 3 samples of the sesame marketing channels in Nghe An, it shows that: cooperatives are buying the product from farmers and selling them directly to consumers at the cooperative's shops. Particularly, Sy Thang Agriculture, Forestry and Fisheries Import-Export Co., Ltd. has more diversified marketing channels, meeting the criteria to supply distribution companies such as Ntea Vietnam Group, Investment and Development Co., Ltd. international application; Muong Thanh supermarket.

5.1.8. Consumer analysis (demand/preference/changes of food consumption)

Sesame oil consumption is steadily increasing around the world due to changing consumption habits and increasing health consciousness. Consumers today prefer products with high nutritional value. Therefore, the demand for sesame oil is increasing because sesame oil contains many vitamins, minerals, fiber, good fats and proteins. Sesame oil is also widely used in Southeast Asian cuisines. In addition, sesame oil is also used in cosmetics and other health care products. It is becoming increasingly popular throughout Europe as a high-quality cooking oil.

Increasing awareness about the benefits of sesame oil in skin and hair care products, as well as the increasing acceptance of sesame oil in various cosmetic items, is likely to drive the global market to grow. in the coming years. In addition, consumers are gradually adopting new trends such as nutritious and sustainable diets. Consumer understanding of the need for a healthy lifestyle is leading people to choose more sustainable food products. Furthermore, due to the growing negative attitudes towards food items of animal origin, plant-based products, and sustainable diets are being emphasized.

Sesame is not considered the main food in Vietnam so it lacks a comprehensive system of data and statistical analysis of this product consumption period, regionally and locally.

It is quite an emerging trend in the consumption of the oil extracted from raw seeds such as peanuts and sesame in Nghe An. Local people are willing to pay a higher price for the in-local-processed oil (2-3 times compared to

the conventional product) from local raw materials (Tien Dong, 2021). This trend is considered an opportunity for cooperatives or groups of sesame producers to diversify and add value to their products besides producing and selling raw sesame seeds.

5.2. Survey results in Dong Thap

Dong Thap is a province located upstream of the Tien River, with an alluvial land area of 164,541 ha, accounting for 48.63% of the natural area, abundant fresh water, so it is very convenient for the development of dry crops. especially cash crops (corn, sweet potato, sesame, legumes, etc.), agro-forestry plants (sugar cane, jute, sedge, tobacco...) and ornamental flowers.

In addition to the areas with dykes for thorough flood control, it is very convenient for three-crop rotation farming on rice land such as 02 rice crops, 01 vegetable crop, or 02 rice crops, 01 crop crop for high economic efficiency, the province Dong Thap also has advantages for cultivating specialized vegetables or cash crops (sesame, soybeans, corn...) on the islets, high dunes, fertile soil and convenient to apply advanced technology to create quality products.

The Spring-Summer/Summer-Autumn crop in Dong Thap (from February to May every year) is a crop with many advantages for sesame due to its high temperature, abundant sunshine, and high humidity due to its influence. This is a unique advantage that other places do not have, this

climate feature is very favorable for the growth and development of sesame.

With favorable soil and climate conditions, short growing period, the average yield of 1.0 - 1.4 tons/ha, low investment cost, the stable selling price of raw materials on average 40,000 - 40,000 VND/kg, etc., the profit brought by sesame is 2-3 times higher than that of rice.

In the period 2015-2016, sesame is the main crop of Dong Thap province with an area of 8,513 ha/year (in 2016) with the main varieties: black sesame, yellow sesame and white sesame. Most of the sesame varieties planted by farmers themselves are similar to those of floating origin, leading to confusion and degradation. However, the area of sesame in Dong Thap province has decreased gradually in recent years, to only 1,091 hectares in 2021. The main reason is the lack of labor (there is no mechanized machinery in sesame production); degraded, poor quality varieties; price of raw sesame decreased (the highest was 65,000 VND/kg in the years 2015-2016 and the lowest was 30,000 VND/kg in the last 2 years). Currently, farmers are switching to other crops with higher economic efficiency (vegetable soybeans, chilli peppers, melons, gourds, squash,...). To see more clearly the sesame area of Dong Thap province, we refer to the data in the tables below:

〈Table 28〉 Sesame area in Dong Thap province in the period 2015-2021

Year	Tracking area (ha)	Statistical area (ha)
2015	8.507,0	8.473,9
2016	**8.513,4**	8.482,8
2017	3.441,9	5.451,7
2018	1.533,5	3.243,8

Year	Tracking area (ha)	Statistical area (ha)
2019	1.663,2	3.760,8
2020	2.741,7	2.837,5
2021	**1.090,6**	-

Source: Dong Thap Province Crop and Plant Protection Department

In 2017, the area, productivity, production of sesame, the area under sesame cultivation decreased sharply compared to 2016. Specifically in the following table:

〈Table 29〉 Sesame area, productivity and output in 2017 in Dong Thap province

No.	Administrative unit	Cultivated are		Productivity (hundredweight /ha)	Output (Ton)
		(ha)	(%)		
	The whole province	**5.162**	**100**	**15**	**7.723**
1	Cao Lanh city	1.289	24,96	15	1.886
2	Sa Dec city	8	0,16	15	12
3	Hong Ngu city	0	0,00	0	0
4	Tan Hong district	123	2,38	15	179
5	Hong Ngu district	146	2,83	15	223
6	Tam Nong district	6	0,11	17	9
7	Thap Muoi district	2	0,03	16	3
8	Cao Lanh district	1.454	28,16	15	2.232
9	Thanh Binh district	5	0,10	19	10
10	Lap Vo district	1.451	28,11	15	2.127
11	Lai Vung district	650	12,59	15	999
12	Chau Thanh district	30	0,57	15	44

Source: Dong Thap Statistical Yearbook in 2017.

Table 29 shows that the sesame area is distributed among 12 districts, of which the most is Cao Lanh district 1,454 ha; Lap Vo district 1,451 ha and Cao Lanh City is 1,289 ha, according to 2017 statistics. The area of sesame has decreased very quickly as shown in Table 12. From 8,507 ha in 2015 to 1,090.6 ha in 2021.

In the years 2020 and 2021, due to the COVID-19 epidemic situation, it is not possible to sell to China, so the area of the whole province decreases sharply. Details in the following table:

〈Table 30〉 Sesame area in Dong Thap province in 2020

No	District	Winter-spring 2019-2020 (ha)	Summer-Autumn 2020 (ha)	Total area (ha)
1	Cao Lanh city		168,8	168,8
2	Sa Dec city		40	40
3	Hong Ngu city			0
4	Tan Hong district	32,2	66	98,2
5	Hong Ngu district	10	150	160
6	Tam Nong district	9	10	19
7	Thap Muoi district		0,6	0,6
8	Cao Lanh district	5	1536	1541
9	Thanh Binh district	11		11
10	Lap Vo district		600,9	600,9
11	Lai Vung district		107	107
12	Chau Thanh district			0
Total		67,2	2679,3	2746,5

Source: Dong Thap Crop and Plant Protection Department

〈Table 31〉 Sesame area in Dong Thap province in 2021

No	District	Winter-spring 2019-2020 (ha)	Summer-Autumn 2020 (ha)	Total area (ha)
1	Cao Lanh city	0,5	98,5	99
2	Sa Dec city		5	5
3	Hong Ngu city			0
4	Tan Hong district	0,5		0,5
5	Hong Ngu district		80	80
6	Tam Nong district	4		4
7	Thap Muoi district			0
8	Cao Lanh district		607	607
9	Thanh Binh district	2,4		2,4
10	Lap Vo district	6	264,5	270,5

No	District	Winter-spring 2019-2020 (ha)	Summer-Autumn 2020 (ha)	Total area (ha)
11	Lai Vung district		18	18
12	Chau Thanh district		4,5	4,5
Total		13,4	1.077,5	1.090,9

Source: Dong Thap Crop and Plant Protection Department

Many districts no longer have an area for growing sesame in the winter-spring crop, and in the summer-autumn crop, only a few districts maintain a very limited area. And the average yield of sesame in Dong Thap province in 2022 and 2021 also dropped sharply to only 14 quintals/ha (1.4 tons/ha).

〈Table 32〉 Price of black sesame in Dong Thap province in the last 3 years

Year	Minimum price (VND)	Maximum price (VND)	Note
2019	35.000	43.000	The price of yellow sesame is usually lower than the price of black sesame from 2,000 to 4,000 VND/kg
2020	30.000	47.000	
2021	38.000	45.000	

Source: Survey date in 2021

When the sesame area was the largest in 2015, 2016 the price of sesame fell below 30,000 VND/kg (the lowest was 22,000 VND/kg).

Dong Thap has the potential to develop sesame because in the shallow flooded area between Tien River - Hau River and the south of Nguyen Van Tiep canal, there is a system of dikes for thorough flood control and good drainage. This is also a sesame (sesame) farming area with a large area so far of the province. Potential to expand the high acreage to replace the low efficient Summer-Autumn rice area. Sesame is a short-term crop (about 85 days) so it is easy to arrange to intercrop with rice.

Therefore, sesame is a crop that needs to be developed for structural transformation in the current period in the models of crop rotation, intercropping and overlapping, most commonly following the structure of **Early Winter-Spring Rice - Spring-Summer Sesame - Summer-Autumn rice** aims to break the monoculture of rice, contribute to soil improvement, increase income for farmers and ensure the source of raw materials for vegetable oil production.

Winter-Spring season:

Sesame can be sowed from December to January (solar calendar), harvested from February to March (solar calendar). Sesame in the winter-spring season is less be falling and be attacked by pests and diseases, which is convenient for harvesting (easily drying seeds, seeds are bright and beautiful, less susceptible to mould attack). The average area of the winter-spring crop is 500-800 ha/year (accounting for about 15-20% of the whole year's sesame area); the highest yield in the year was (0.9 - 1.0 tons/ha); It is difficult for the winter-spring sesame crop to compete with rice (because rice cultivation to ensure food security and rice production is applied synchronously mechanization, so it solves the problem of labour during the season). The previous crop of Winter-Spring sesame is winter vegetables (Sesame is planted right on the field after harvesting winter vegetables)

In the Spring season, sesame plants made a net profit of 29.2 million VND/ha, while rice only got 18.1 million VND/ha.

〈Table 33〉 The economic efficiency of spring crops

Crops	Yield (ton/ha)	Price (VND 1.000)	Total cost (million VND)	Total revenue (million VND)	Net profit (million VND)
Spring rice	6,0	6	17,9	36	18,1
Spring sesame	1,0	45	16,8	45	29,2

Source: Surveyed data, 2021

Spring-Summer season:

Sesame is sowed in February-March (solar calendar) and harvested 5-6 (solar calendar). This is the main sesame season of the year. The average area is from 2,200 - 2,600 (accounting for 60 - 70% of the whole year sesame area); Sesame yield is from 0.7 to 0.8 tons/ha. The previous crop of Spring-Summer sesame is spring vegetables (Sesame is planted on barefoot to produce spring vegetables)

In the Spring season, sesame gives a net profit of 23.7 million VND/ha, while rice only got 12.1 million VND/ha.

〈Table 34〉 The economic efficiency of spring-summer crops

Crops	Yield (ton/ha)	Price (VND 1.000)	Total cost (million VND)	Total revenue (million VND)	Net profit (million VND)
Spring-Summer rice	5,0	6	17,9	30	12,1
Spring-Summer sesame	0,9	45	16,8	40,5	23,7

Source: Surveyed data, 2021

Currently, sesame in Dong Thap is only produced on a small and spontaneous scale, has not yet formed a farmer's organization (Cooperative/THT/Club), has not received the proper attention of the locality. On the other hand, in some localities, farmers have the idea that

sesame is an easy plant, so they keep sowing (sowing) in the field to let the tree grow, not caring about weeding or fertilizing or spraying, so the yield is improved. sesame is not high.

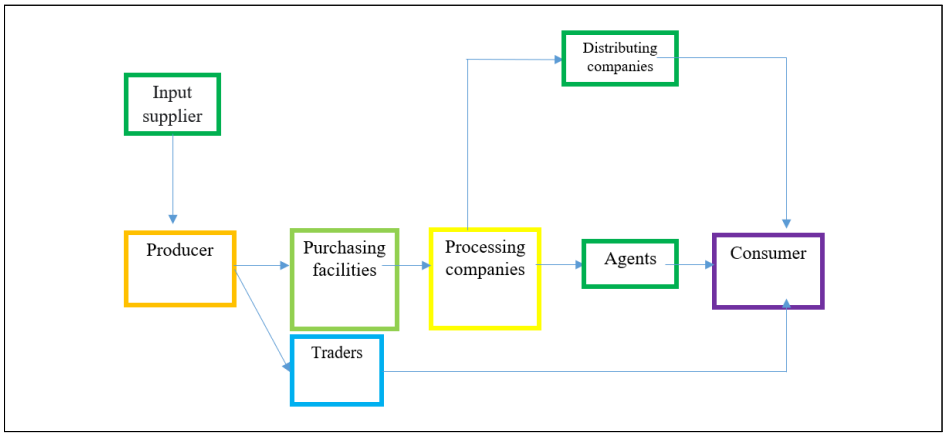
The facilities that collect, process and purchase sesame (sesame granaries) in Dong Thap province are quite few and small in scale (buying from 200-1000 tons of sesame per year); The number of establishments is also decreasing year by year: From over 10 establishments in 2016, to now there are only 03 establishments (Cao Lanh City 01, Sa Dec City 01 and Cao Lanh District 01) basis). The collection facilities that export to China by way of the prongs are mainly due to the lack of food safety certification. Dong Thap currently has no facilities to process sesame products.

From 2018 until now, Dong Thap has not had the policy to develop the sesame industry. Before that, there was model building, testing, seed restoration, technical training, and printing of technical documents. Because sesame was not selected as a tree in the Restructuring Project of the province and districts, it has not been interested in production development recently.

The biggest difficulty in the sesame industry in Dong Thap province at present is the quality of the seeds (most of which are left by the farmers themselves from the previous crop or bought commercially for seed production) and the equipment and machinery for mechanization. The source of manual labor is increasingly scarce and the price is high.

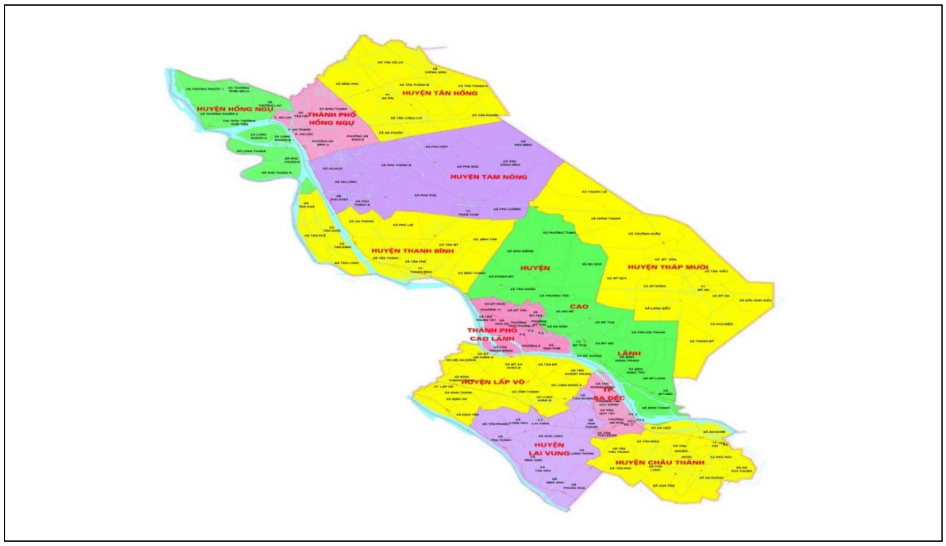
5.2.1. Stakeholders analysis of Dong Thap's sesame production

⟨Figure 8⟩ Sesame value chain in Dong Thap



- **Sesame production area map**: Sesame is distributed in 12 districts of which 03 districts are concentrated: Cao Lanh, Lap Vo and Cao Lanh City.

⟨Figure 9⟩ Administrative map of Dong Thap province



〈Table 35〉 Area, yield and productivity of sesame of Dong Thap province in 2017

No.	Administrative unit	Cultivated area		Productivity hundredweight /ha	Yield (Ton)
		(ha)	(%)		
	The whole province	**5.162**	**100**	**15**	**7.723**
1	Cao Lanh city	1.289	24,96	15	1.886
2	Sa Dec city	8	0,16	15	12
3	Hong Ngu city	0	0,00	0	0
4	Tan Hong district	123	2,38	15	179
5	Hong Ngu district	146	2,83	15	223
6	Tam Nong district	6	0,11	17	9
7	Thap Muoi district	2	0,03	16	3
8	Cao Lanh district	1.454	28,16	15	2.232
9	Thanh Binh district	5	0,10	19	10
10	Lap Vo district	1.451	28,11	15	2.127
11	Lai Vung district	650	12,59	15	999
12	Chau Thanh district	30	0,57	15	44

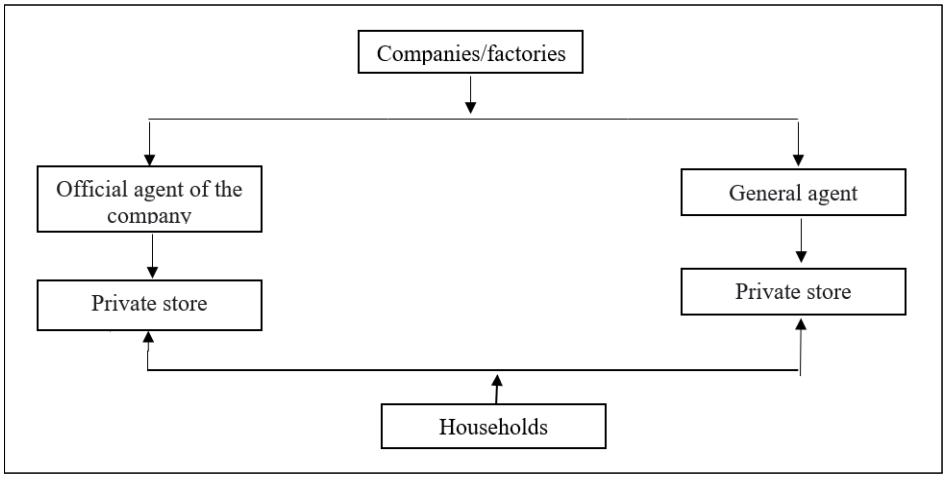
Source: Statistical Yearbook of Dong Thap Province in 2017

- Analysis of stages in the value chain: Input services, production, collection, preliminary processing, processing, trading

a. Facilities for production and trading of input materials

Although not all farmers actively participate in the market, it is undeniable that the market for agricultural inputs plays an increasingly important role in the development of the agricultural economy. agriculture and the livelihoods of farmers. The study of the market for agricultural inputs aims to further strengthen the activities of farmers associated with the market and make the market better serve the production and consumption needs of the households.

〈Figure 10〉 Agricultural material supply channel of surveyed households



In-depth research was carried out with input service businesses in Binh Hang Trung and Phong My communes (Cao Lanh district) and My An Hung commune (Lap Vo district). The results are illustrated in the table below:

〈Table 36〉 Actual situation of input service provision in Dong Thap

Target	Unit	Input service providers								
		Nguyen Ngoc An	Nguyen Dang Khoa	Nguyen Nhat Linh	Nguyen Thi Kim Oanh	Trieu Minh Thuan	Nguyen Thi Tuyen	Huynh Thi Nga	Le Van Ha	Bui Thi Sang
Founded year	Year	2000	2013	2010	2003	1995	2011	2000	2010	1998
Number of member in 2020, 2021	Member	1	2	4	1	2	2	3	3	3
Number of households associated with production	Associated household	0	0	0	0	0	0	0	0	0
Area of warehouse, store, production space (㎡)	㎡	110	100	200	100	160	100	Store: 80㎡, kho 200㎡	Store 30㎡, kho: 110㎡	Store: 35㎡, kho 160㎡
Investment capital	Million VND	50	500	3000	100	100	900	20	35	100

Target	Unit	Input service providers								
		Nguyen Ngoc An	Nguyen Dang Khoa	Nguyen Nhat Linh	Nguyen Thi Kim Oanh	Trieu Minh Thuan	Nguyen Thi Tuyen	Huynh Thi Nga	Le Van Ha	Bui Thi Sang
Services offered	Ton/year	Fertilizer, pesticides	Fertilizer, pesticides	Seed, Fertilizer, pesticides	Fertilizer, pesticides	Fertilizer, pesticides	Fertilizer, pesticides	Fertilizer, pesticides	Fertilizer, pesticides	Fertilizer, pesticides
Transport		Motorbike	Motorbike	Car	Motorbike	Motorbike	Motorbike	Motorbike	Motorbike	Motorbike
Which commune										
Number of people who usually buy	Person/ day	180	50	100	55	260	100	30-40	20-30	50-60

Source: Survey data, 2021

The main fields of activity of input service providers in the two investigated districts of Dong Thap province are fertilizers and pesticides.

According to the input material businesses, the difficulties they are currently facing in trading in input materials for local sesame production are mainly due to the highly competitive market. Therefore, the stores are willing to let their customers pay in the form of deferred payment. This not only affects the profits of farmers but also causes difficulties in capital for establishments providing input services for production. In addition, the high prices of fertilizers and pesticides due to the impact of the COVID-19 pandemic have also caused limitations for the current input business establishments.

b. Farmers

i) Production status of sesame farmers

* *Farming information*

- Gender : in the production of agricultural products in general, men are usually the head of the household and decide on the production

process of the household. Survey results show that, out of 60 sesame growing households, 100% of households are headed by men and decide to produce. From that, it can be seen that men have a very large and important role in the production process of households. Besides, the majority of people in Cao Lanh and Lap Vo districts are Kinh people. Through a direct survey from 60 sesame farming households, the people here are Kinh people, with a custom of practicing this practice. The factory is almost the same.

〈Table 37〉 Information on gender of sesame farmers

Content of rating	Frequency	Percentage (%)
Gender	**60**	**100**
Male	60	100
Female	0	0

Source: Surveyed data, 2021

- Cultivated area and labor force involved in production: Production land and human resources are one of the important factors in the agricultural production process.

〈Table 38〉 Cultivated area and human resources involved in sesame production in 3 communes

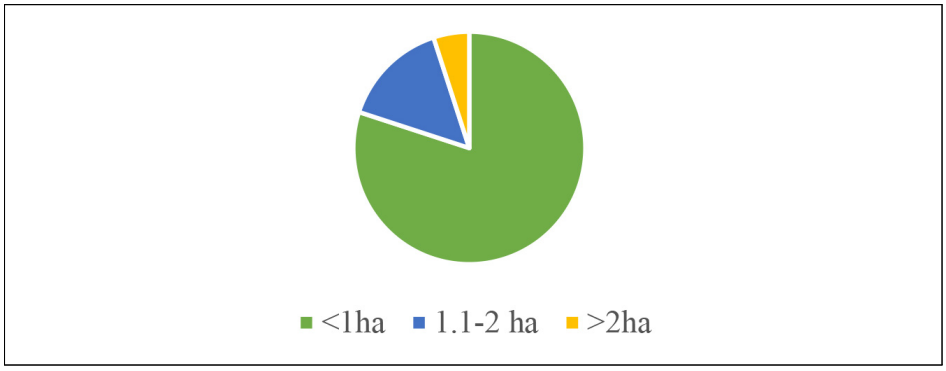
Content of rating	Unit	Min	Max	Average	Standard deviation
1. Number of people	People/ household	3	8	4.53	1.200
2. Number of people of working age	People/ household	1	6	2.97	1.089
3. Number of people participating in agricultural production activities	People/ household	1	6	2.13	0.911
4. Sesame planting area	ha	0.2	2.5	0.773	0.5142

Source: Surveyed data, 2021

The area of land for sesame cultivation in the 3 surveyed communes is generally still low, averaging only 0.773 ha/household. The household with the largest sesame growing area is 2.5 ha/household, the smallest acreage is only 0.2 ha/household. Most of the land for sesame cultivation of the households in the three surveyed communes is the owner's land. Small production area increases input costs in the production process. Large area of production land can create many products, creating favorable conditions for product consumption.

Besides, the area under sesame cultivation is divided into the following groups:

〈Figure 11〉 Structure of households growing sesame by area



In addition, labor involved in the sesame production process is also an important factor. The households producing sesame in the three surveyed communes are mainly family forces, the number of people involved in agricultural production activities is at least 1 person, at most 6 people, on average each household has about 2, 13 family workers. This helps to reduce labor costs, contributing to income improvement.

- Age of producer household head: In the production of sesame, age and production experience are directly proportional to each other. The older the age, the more time involved in production, the longer the production experience contributes to making the production process more efficient.

〈Table 39〉 Age of household producer

Content of rating	Number	Percentage (%)
1. From 26-40 year old	9	15,0
2. From 41-59 year old	43	71,7
3. From 60 year old	8	13,3
Total	**60**	**100**

Source: Surveyed data, 2021

The survey shows that 71.7% of household heads are between the ages of 41 and 60 years old. 15% are between the ages of 26-40. 13.3% over 60 years old. The higher the age, the more experience in sesame production of the surveyed communes. However, with increasing age, there are many limitations to training, participating in agricultural extension work, and applying scientific and technical advances to production.

〈Table 40〉 Number of years of experience in sesame production in the direction of commodity production

Content of rating	Unit	Min	Max	Average	Standard deviation
Number of years of experience production in the direction of commodity production	Year	1	7	4.53	1.599

Source: Surveyed data, 2021

* *The reason why farmers choose to produce sesame*

The results of the survey in three communes in Dong Thap show that the reason that farmers choose to produce sesame is that: sesame is a traditional crop (perennial practice), ecological conditions are suitable for sesame plant development and investment. low, easy to care for, easy to sell.

* *Market for inputs*

- Breed: Through direct interviews, 100% of surveyed households in the 3 communes all use local black sesame (black sesame) varieties.

〈Table 41〉 Sources of sesame seeds

Assessment content	Frequency	Rate (%)
1. Agricultural Extension Center	0	0
2. Cooperatives	0	0
3. Local farm supplies store	47	78.3
4. Other households	0	0
5. Self- supply	13	21.7
Total	**60**	**100**

Source: Surveyed data, 2021

Through face-to-face interviews, households choose to buy seeds at a private agent because of the availability of the product, but all households consider the quality to be normal.

- Fertilizers and pesticides: Through the survey, in 3 surveyed communes, 100% of surveyed households used fertilizers and pesticides from private shops.The fact that producers buy products in small quantities will put them at a great disadvantage when negotiating the

prices of input materials because they cannot negotiate discounts. In addition, the production households buy at the last stage of the input channel (retail), so their payment also includes the costs of all intermediaries in the input material supply channel, leading to a higher real payment per unit of output.

- Apply science and technology to production: During the sesame production process, the participation in training courses is only 35% because the training courses are not held regularly. Farming households that are attached to farming all year round should limit their participation in training courses. Through direct surveys from farmers, most farmers access information from simple sources such as relatives, friends, from other farmers or watching on television and listening to the radio. From there, it shows that the access to science and technology of sesame farmers is still limited.

〈Table 42〉 Number of households participating in training on sesame production

Assessment content	Frequency	Rate (%)
1. Participating in training	21	35%
2. Not participating in training	39	65%
Total	**60**	**100**

Source: Surveyed data, 2021

During the sesame production process, the participation in training courses is only 35% because the training courses are not held regularly. Farming households that are attached to farming all year round should limit their participation in training courses.

Through direct surveys from farmers, most farmers access information from simple sources such as relatives, friends, from other farmers or

watching on television and listening to the radio. From there, it shows that the access to science and technology of sesame farmers is still limited.

* *Capital market*

Besides human resources and natural resources, financial resources play an important role in the production process of households. Assessing the functioning of the capital market and the ability and level of participation of farmers helps us understand the difficulties of farmers in the market as well as offer solutions to increase farmer participation. credit capital markets.

The survey shows that the surveyed households all reflect the lack of capital for production, because the loan form is mainly through local mass organizations with a small loan amount. Official credit sources often have low incentives, long loan procedures, and unsecured loans are not yet popular.

* *Economic efficiency of households from sesame production*

The average total production cost of the household, including the cost of family labor, is 21,241,407 VND/ha. The average revenue that farmers get after selling products is 50,980,833 VND/ha. The average profit after deducting the total costs of farmers spent in the production process is 29,739,426 VND/ha.

〈Table 43〉 Analysis of financial indicators from sesame production

Target	Unit	Value
1. Average total cost	VND/ha	21,241,407
2. Average Revenue	VND/ha	50,980,833

Target	Unit	Value
3. Average profit	VND/ha	29,739,426
4. Revenue/Cost	Time	2,04
5. Profit/Cost	Time	1,40
6. Profit/Revenue	Time	0,58
7. ROI (Return on Investment)	%	140%

Source: Surveyed data of 60 households

* Revenue/Cost = 2.04 times, this shows that for every thousand VND spent, the farmer earns an average of 2.04 thousand VND in revenue.
* Profit/Cost = 1.40 times this means that for every one thousand VND spent, the average profit of a farmer will increase by 1.40 thousand in revenue, higher than Nghe An province.
* Profit/Revenue = 0.58 times (58%), this means that for every thousand VND of revenue spent, farmers will increase their profit by 0.58 thousand VND.

- ROI (Return on Investment): We know that the higher the ROI, the more effective the investment, with an ROI of 140%, businesses, co-operatives and farmers can invest and bring efficiency. high.

From the above results, it can be seen that sesame farmers bring high efficiency, so it is advisable to invest in developing the sesame value chain in Dong Thap to bring higher benefits and values, contributing to the construction of a new rural area. sustainable, exploit the potential of the province.

Limitations in the production of sesame farmers:

- Small scale, fragmented. The sesame growing area of households varies from 0.2 ha to 2.5 ha. The average area of each household is about 0.773 ha.
- Natural conditions: much degraded land; extreme weather.
- Output: the lowest is 0.4 tons, the highest is 2.5 tons, the average is 1,137 tons.
- Average selling price: 35000 - 40000 VND/kg.

Currently, sesame in Dong Thap is only produced on a small and spontaneous scale, has not yet formed a farmer's organization (Cooperative/THT/Club), has not received adequate attention from the locality. On the other hand, in some localities, farmers have the idea that sesame is an easy plant, so they keep sowing (sowing) in the field to let the tree grow, not caring about weeding or fertilizing or spraying, so the yield is improved. sesame is not high.

- Low level of education, outdated farming practices.
- High average age indicates a shortage of young workers
- Lack of capital for production.

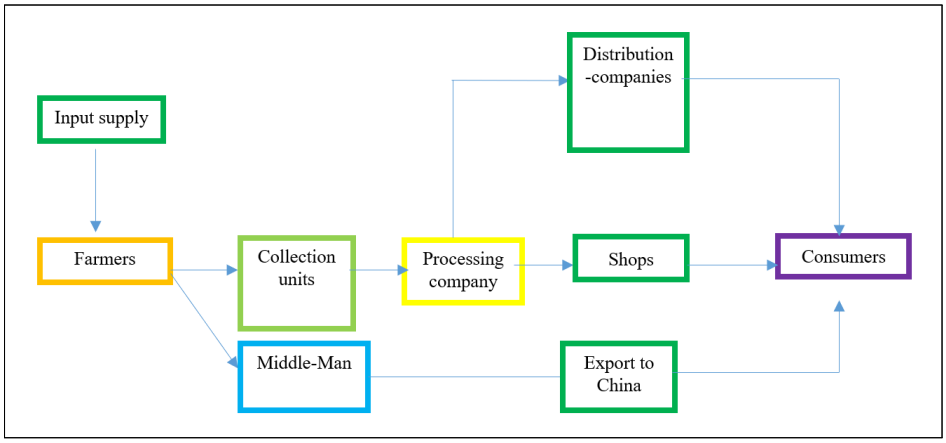
There is no vertical link in the value chain between producers and cooperatives/enterprises at the production stage. The horizontal link between producer and producer.

Sesame processing and consumption establishments

- Collection

Due to the small and fragmented production scale, the output products are raw products, so sesame in Dong Thap is mainly consumed through the following channels:

〈Figure 12〉 Sales channel of sesame products in the area of 3 Dong Thap communes



The facilities that collect, process and purchase sesame (sesame granaries) in Dong Thap province are quite few and small in scale (buying from 200-1000 tons of sesame per year); The number of establishments is also decreasing year by year: From over 10 establishments in 2016, to now there are only 03 establishments (Cao Lanh City 01, Sa Dec City 01 and Cao Lanh District 01).

The main form of purchasing sesame products in the investigation area is through traders. At the time of sesame harvest, after the households dry the products, traders or collectors come to the households to purchase. Traders are the main subjects that decide the price of products. The price is offered by the trader, and the farmer agrees and will sell it to the trader at a reasonable price. The survey shows that, without close cooperation in production to consumption, farmers selling to traders often face price pressure, selling to collectors is only temporary, not a long consist.

〈Table 44〉 Scale of purchasing, processing, wholesale and retail in the last 1 year of large purchasing facilities in Dong Thap

Type of product	Name	Input	Output
Fresh sesame	Vo Thi Kieu purchasing facility (Group 6, Hamlet 3, Binh Hang Trung commune, Cao Lanh district, Dong Thap province)	Scale: 300–500 tons of sesame/year	Scale: 300–500 tons of sesame/year
	Tan Tien Dong Agricultural Products One Member Co., Ltd	700 tons	700 tons
Dried sesame	Vo Thi Kieu purchasing facility (Group 6, Hamlet 3, Binh Hang Trung commune, Cao Lanh district, Dong Thap province)	–	–
	Tan Tien Dong Agricultural Products One Member Co., Ltd	–	–
Sesame oil	Vo Thi Kieu purchasing facility (Group 6, Hamlet 3, Binh Hang Trung commune, Cao Lanh district, Dong Thap province)	–	–
	Tan Tien Dong Agricultural Products One Member Co., Lt	–	–

Source: Surveyed data, 2021

c. Purchase price

〈Table 45〉 Purchasing prices of large facilities in Dong Thap

Products	Purchasing facilities	Unit	Minimum price	Time	Maximum price	Time	Average price
Dried black sesame	Vo Thi Kieu purchasing facility	VND/kg	30.000	August	52.000	April	45.000
	Tan Tien Dong Agricultural Products One Member Co., Ltd	VND/kg	40.000	August	46.000	April	43.000

Source: Surveyed data, 2021

Through the table on the general to bezel, it tends to be higher in April and lowest in August of the year. In that weight, the price of dried black

sesame is 43,000-45,000 VND / kg and the highest is 52,000 VND / kg, the cheapest is 30,000 VND / kg.

i) Preliminary processing, processing and trading of products

In Dong Thap, currently there is no processing. For the local preservation regime in Dong Thap: The preservation and processing stages are not paid attention, the product's value increase is not high. Because there is no policy to develop the sesame (sesame) industry as well as for farmers to sell products to traders exporting to China by way of quota because they do not need food safety certification, the current address in Dong Thap is not has a product variable unit, the only large production facility is Tan Tien Dong Thap Agricultural Products Company Limited (No. 639, Nguyen Thai Hoc, Ham Thuan Phu, Hoa Thuan ward, Cao Lanh city, Dong Thap province). and Ms. Vo Thi Kieu (Group 6, Hamlet 3, Binh Hang Trung Commune, Cao Lanh District, Dong Thap Province). However, the company also faced many difficulties such as limited infrastructure and quality facilities. Purchasing establishments also have to compete with traders who collect and export through unofficial channels.

Have not yet built vertical and horizontal links in the seed value chain. That average is the formula but also the basis for businesses and cooperatives in the coming time when there are projects and policies to develop value chains in the province.

d. Specialized cooperatives, farmers' organizations

Currently, sesame trees in Dong Thap are only produced on a small scale, spontaneously, and a farmer's organization has not yet been established (Cooperative/Groups). Similar to Nghe An province, there are no specialized same cooperatives or groups in Dong Thap. That may due to the culture of the region, where establishing a cooperative may take time to convince the individual farmers about its responsibilities and benefits. For this fact, it should be aware of challenges when transferring technologies in production and processing to related stakeholders, especially farmers.

5.2.2. Sesame and sesame's products Supply and Demand (advantages /competitiveness/ weakness)

Sesame plants are suitable for local soils, are drought-tolerant, have a short growth period, and give high yields. However, because there is no processing facility, sesame farmers mainly find traders to sell, the price is not stable, so the production efficiency is not high. In order for sesame to develop sustainably, in the coming time, functional sectors need to have solutions to stabilize the output of sesame trees, help people boldly invest in expanding the sesame area, and actively contribute to the development of sesame seeds. change the structure of crops in the locality.

Regarding the demand for sesame products, the change in awareness about the benefits of sesame oil has caused market demand to increase,

however, Dong Thap only has dried sesame products, not yet processed other products such as sesame oil. has greatly limited the ability to expand production as well as improve the value of products.

To clearly see the factors affecting the success, sustainability as well as failure in the development of the sesame chain in Dong Thap, we conduct a SWOT analysis of the sesame chain which are shown in the following table:

〈Table 46〉 SWOT analysis of sesame chain in Dong Thap

Strengths (S)	Weakness (W)
S1- Has a large land area, suitable for sesame production. S2- The local government agrees, creating all favorable conditions to help people produce S3- Convenience in transportation in the production area S4- Infrastructure for agricultural production is interested in investment S5- People's intellectual level is quite high, eager to learn and quickly apply new scientific and technical advances, boldly invest and intensively in sesame production S6- People are diligent, industrious, hard-working and have a lot of experience in sesame production S7- There are many enterprises, cooperatives, THT... supplying seeds and input materials for agricultural production in general and sesame production in particular.	W1- There is no policy to support the development of sesame production W2- Shortage of young workforce. Because the majority of young workers go to work for industrial parks, economic zones, factories, factories, etc., the remaining labor force is mainly the elderly and children. W3- Sesame is not the main crop in the crop structure W5- No new seed set. The old sesame varieties are seeded by the people themselves, so the quality is not high, there is a phenomenon of degeneration, easy to be infected with pests and diseases, the yield and quality are not high. W6- Production is mainly based on experience, not invested in intensive farming. Manual production, not yet applied mechanization W7- Sesame production is currently heavily influenced by the weather. (Growing sesame in the dry summer-autumn crop but not applying the watering method but waiting for water when it rains) W8- No forms of association in production yet W9- The situation of pests and diseases is increasing, causing more damage to producers
Opportunities (O)	**Threats (T)**
O1- Suitable climate and soil conditions O2- The land area capable of converting and expanding to grow sesame is quite large.	T1- Risks of extreme weather, natural disasters, climate change greatly affect sesame production

Expanding production scale according to VietGAP and GlobalGAP standards O3- Get the attention and support of the Departments and Branches in the province. O5- Large consumer market: domestic and export O6- To have access to science and technology, new technologies on varieties, production, preservation, processing... to improve production efficiency. O7- Join the value chain of sesame production O8- Branding of products. Participate in Forums, Fairs, apply technology to introduce and promote products	T2- Prices of materials, fertilizers... tend to increase, affecting the investment ability of producers. T3- Product quality requirements are increasing in terms of product quality by domestic and foreign consumers T4- The Covid 19 epidemic is very complicated, affecting the production, transportation, circulation and consumption of products.

Source: Summary of research results

Similar to Nghe An, from SWOT analysis, some interventions might be emerging to improve the value chain of Dong Thap province such as seed supply, improving/establishing collective production form for a strategy of enlarging production scale and ensuring the quality consistence of different producers.

5.2.3. Postharvest management and Technology (R&D/Extension/Training, etc.)

In Dong Thap, there are currently no processing facilities. The collection facilities that export to China through unofficial channels are mainly because there is no need for food safety certification. Dong Thap currently does not have a facility to process sesame products, this is the biggest difficulty in not developing the sesame growing area, completely dependent on the Chinese market, when the COVID-19 epidemic occurred,

the area decreased. very fast. However, this is also an opportunity for businesses and cooperatives to invest in building factories and workshops for sesame processing and official export, bringing benefits to both people, businesses and the country

5.2.4. Distributor, Wholesaler and Trader of sesame in Dong Thap

The survey shows that the purchasing establishments mainly distribute raw products.

〈Table 47〉 Product distribution status of purchasing establishments – Tan Tien Dong Thap Agricultural Products One Member Co., Ltd

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orally agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
Wholesale (distributor/ agent)	Ha Noi	Dried sesame (raw seed)	80%	Signing contract	Delivery to the Company Raw products packed in 50kg
Retail (supermarkets, shops)	Ho Chi Minh City	Dried sesame (raw seed)	20%	Agreement	Delivery to the Company Raw products packed in 50kg
Retail (supermarkets, shops)					
Hotel, restaurant, cafeteria	– How to sell? – At home (Store at…)				

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orally agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
	- Shipping - Home delivery				

Source: Surveyed data, 2021

* Tan Tien Dong Thap Agricultural Products Company Limited (No. 639, Nguyen Thai Hoc, Ham Thuan Phu, Hoa Thuan ward, Cao Lanh city, Dong Thap province).

〈Table 48〉 Product distribution status of purchasing establishments - Mrs. Vo Thi Kieu

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orally agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
Processing company/ factory					
Wholesale (distributor/ agent)	Purchased from traders and brought to the warehouse. Sell inside and outside the province, export to China	Black, dried sesame	100	Orally agreement/ phone; Signing contract	Product's quality
Retail (supermarkets, shops)					
Hotel, restaurant, cafeteria					
Consumers	- How to sell? - At home				

Selling to	Name; Address; Phone	Type of product sold	Occupying a percentage of total output (%)	Form of sale (1. Freely; 2. Orally agreement email; 3. Signing contract)	Requirements on production process, certification, product quality, delivery conditions, payment conditions, etc.
	(Store at…) – Shipping – Home delivery				

Source: Surveyed data, 2021

* Vo Thi Kieu (Group 6, Hamlet 3, Binh Hang Trung commune, Cao Lanh district, Dong Thap province)

5.2.5. Agricultural markets (retail/wholesale/supermarket) in Dong

The collection facilities that export to China through unofficial channels are mainly because there is no need for food safety certification.

5.2.6. Consumer analysis (demand/preference/changes of food consumption)

The general trend of the market today is to change food products from animals to products from plants, sustainable diets are increasingly focused. This is also an opportunity for sesame products.

6 Private Sector and Donor Perspectives in Sesame Value Chain

6.1. General status and prospect in private sector engagement in the sesame value chain in Vietnam

As the analysis of relevant stakeholder in the value chain, private sector can participate in the all stage of value chain including varieties and input suppliers, sesame collection, wholesale, processing and export.

In the input supply stage, the current sesame value chains face certain challenges, the biggest challenges for further development of this value chains related to lack of high yield varieties associated with appropriate protocol for farmers in sesame production practices. Farmers still cultivate sesame based on their experiences rather than based on scientific evidence. Moreover, lack of cooperation among the stakeholders is also a

challenge for further development of the sesame value chain. The sesame variety suppliers will provide important role in supplying high-yield varieties for farmers to improve the economic efficiency of sesame value chain. Currently, varieties are mainly kept by farmers in this season and used for next season, while there are some private agents also supply varieties but the volume is still limited due to these private agents still have available good quality sesame to serve their business. This limitation may come from the characteristics of the small sesame production scale, some private agents face difficult to expand their sesame business.

In the production stage, sesame is only cultivated in one season in the short period, farmers mainly play a role in this sesame production that produce over 90% of the total sesame output. There are some cooperatives also participate in the production stage, but it is still based on the core farmers, which have bigger production area, to organize sesame production including the purchase of input material, instruct and share experience with other farmers about sesame production. In some case, cooperatives also contact sesame buyers (e.g, collectors and wholesalers) to help farmers sell their sesame. Cooperatives in some provinces also play a role in collecting sesame form its members to sell it to other actors with bigger volume but this form is still limited.

In the sesame collection and trading stage, the problem is that there is a lack of the linkage between farmers and other stakeholders are not closed that cause difficulties in quality management to satisfy the markets, especially for the sesame export markets. Therefore, the operation of each stakeholder in the value chain is fairly independent. This stage is mainly engaged by local collectors at small scale of their business. Some private

companies also participate in collecting sesame to sell to other actors but only a few numbers of private companies participate in this process because sesame only play a small part in their overall business.

In processing and exporting stage, both cooperatives and private companies involve in processing sesame, in which private companies play more role in this process because it buys more sesame to serve their processing activities than other actors. These private companies buy sesame freely from farmers or local market, while they do not have contract with other stakeholders to ensure sesame supply for them. In the processing activities, processing sesame accounts for biggest parts of the processed products. Sesame oil can be sold in domestic markets or exported by export companies.

〈Table 49〉 Summary of the private sector engagement in the sesame value chains

Ref	Value chain stages	Stakeholders	Description	Implications for private sector engagement
1	Input supply	Local agents, private companies	- Sesame occupied a small part in their business - Lack of available sesame varieties to supply to farmers	- Access the high-yield varieties to supply to farmers. - Enhance cooperation with farmers and cooperatives to supply quality fertilizer and high yield quality varieties for producers.
1	Production	Farmers, Cooperatives, private companies	- Small scale production - Difficult to access high yield varieties - Mainly used local varieties with low yield and quality - Lack of effective production protocol in sesame production - Small production area	- Access high yield and quality varieties - Use efficient production protocol - Improve post-harvest practices - Linkage with other stakeholders in the sesame value chains

Ref	Value chain stages	Stakeholders	Description	Implications for private sector engagement
			leading to small output that cause difficulties in access big market – Lack of contract with buyers (wholesalers, processing or exporters) to sell sesame, while lake of linkage between farmers with other stakeholders in the sesame value chains. – Short sesame season (only a season in some region) so the volume is small that cause challenges for processing industries	especially with processing actors and exporters
2	Sesame Collection	Local collectors, cooperatives, private companies	– Small production area leading to high transaction cost in purchasing sesame from farmers – Sesame business creates a small income for collectors because it accounts for a small part of their business. – Lack of facilities for processing or grading sesame before selling to wholesalers or other actors in the sesame value chains. – Not have close relationships with other stakeholders in sesame value chains – Short harvesting season of sesame leading to challenges in maintaining their sesame business throughout the year.	– Cooperate with farmers to ensure available sesame to buy – Frequent contract farmers even in the off–season of sesame – Improved linkage with wholesaler to ensure the sale of sesame after buying from farmers
3	Sesame wholesale	Local wholesalers, private companies	– Face high transaction cost due to lack of big volume of sesame – Lack of linkage with other relevant stakeholders in	– Establish some collectors to buy sesame – Contract with farmers who have big sesame

Ref	Value chain stages	Stakeholders	Description	Implications for private sector engagement
			the value chains such as collectors, cooperatives or farmers – Difficulties in manage quality of sesame – Cannot coordinate the sesame value chains because lack of contract to stipulate the purchase such as volume, price and quality level	production area to reduce transaction cost in buying sesame – Shorting and grading sesame before selling it to other stakeholders in the value chains. – Close linkage with processing actors and exporter to expand the markets for sesame
4	Processing and export	Private companies and exporters	– Lack of materials for long-term processing resulting in limitation of investment in processing facilities – Use of conventional processing methods are still common that influence the quality of processed product – Lack of linkage with production area to maintain the materials for processing – Lack of control of production protocol to satisfy the export markets	– Grading sesame and product made from sesame into different quality level (e.g., premium, standards, first class) to access different markets – Improve the contract with other stakeholders including farmers to ensure the quality of sesame – Establish mechanism for co-management of sesame quality especially for export markets
5	Sesame retail	Local retailers, local grain agents	– Small volume of purchase during the year – Sesame has small part to play in their agricultural products business – Sesame is a short seasonal crop, to it is not available throughout the year. – It is hard to maintain loyal customers because there is a disruption in supplying sesame	– Focus on the high-quality sesame only – Ensure the availability of sesame longer to keep the customers instead of supplying in the season only
6	Sesame consumption	Local consumers	– Sesame is common for consumers but the consumption level is still low	– Access high quality products made from sesame – Understand the health

Ref	Value chain stages	Stakeholders	Description	Implications for private sector engagement
			– Consumers do not have much chance to access products made from sesame, especially sesame oil – Consumers have much products that can be replaced for sesame oil – Consumption habit of consumers: they have a habit to use available plant oil, so it is hard to change to sesame oil	benefit from consuming product made from sesame through available information source
7	Supportive Services	State agencies Research institutions (varieties supply), loan suppliers	– Sesame is not a main crop, so it is not a target in development support policies despite is has much potential for development in several provinces – Government at bot national and local level do not have separated programs for sesame production – The extension services have deployed several effect sesame production models but it still limits in scaling–up successful models.	– Keep support for producing more sesame varieties that can adapt to different province in Vietnam – Support for the linkage among stakeholders in the sesame value chains – More support for investment in researching and developing products made from sesame

6.2. Private sector, cooperatives are participating in the sesame value chain in Nghe An

Acctualy, a limited number of cooperatives participating in sesame business, some cooperatives have their members cultivated sesame with rice rotationally (one rice crop- one sesame).

For trading sesame company, Nghe An province has Sy Thang company is the biggest company now doing business in trading and processing sesame, their main activities are collection of sesame seeds from the farmer for processing sesame oil and selling sesame oil in province area.

6.2.1. Production overview of private sector

Agricultural enterprises in Nghe An province are mainly small and medium enterprises, often using local laborers to create many jobs for local people.

They have limited capital and often do not have access to large capital sources from investment banks. This causes limitations in equipment innovation and job development promotion for these enterprises.

Small businesses have stiff competition with large corporations that provide services together. As a result, small businesses often face losses in market domination, especially in foreign regions.

Small and medium enterprises mainly operate in the field of trade, not focus on production and processing.

6.2.2. Strengths, Weakness, Opportunity, Threats

〈Table 50〉 SWOT analysis of companies and cooperatives participating in the sesame chain in Nghe An

Processing and consumption establishments	Stages / SWOT	**Input** (quality of raw materials, means of purchasing, the way to the place of sesame cultivation, the relationship with sesame growers, etc.)
Dong Thinh Cooperative	**Strengths**	– A suitable land for sesame plants to grow well, with high yield and good quality, bringing good raw materials. – The area of sesame is large, the area of the members of the cooperative is 160 ha.
	Weaknesses	– It is highly dependent on weather, pests and diseases, unstable prices, low prices
	Opportunities	– Large area, high output. The market is large, with the attention of departments and agencies
	Threats	– In order to develop together in the renovation period, it is necessary to have more innovative technologies, techniques, warehouses, factories, and machinery
Dien Hung Agricultural Cooperative	**Strengths**	– The local sesame seeds are of good quality. – Convenient transportation
	Weaknesses	– It is highly on the weather, pests – Not linked well with the producer
	Opportunities	– Large area, high output. – Easy–to–consume product with the attention of departments and agencies.
	Threats	– Weather and Covid epidemic
Sy Thang Agro–Forestry–Fishery Import and Export Company Limited	**Strengths**	– Purchasing locations are communes in the district, easy to check the quality of input materials, convenient transportation
	Weaknesses	– There is no policy to encourage farmers to focus on growing sesame
	Opportunities	– Focal point for purchasing sesame from all farmers in the province
	Threats	– Sesame prices have decreased, leading to a reduction in the area of sesame cultivation
		Preliminary processing, processing, packaging (factory – existing equipment.)
Dong Thinh Cooperative	**Strengths**	– Located in the center of the residential area of the cooperative
	Weaknesses	– The factory is temporary, cramped, low, not guaranteed
	Opportunities	– Attention and support of projects and investments by departments and agencies

	Threats	– There is an organization and a more capable human resource
Dien Hung Agricultural Cooperative	**Strengths**	–
	Weaknesses	– Factory is temporary, cramped, low, not guaranteed
	Opportunities	– The interest and support of projects and investments by departments and agencies
	Threats	– No experience in processing
Sy Thang Agro–Forestry–Fishery Import and Export Company Limited	**Strengths**	– Has a complete system of machines for roasting, drying, bagging, vacuuming, oil presses and oil refining systems... for the processing stage
	Weaknesses	– Primary processing is done by hand, takes a long time
	Opportunities	– Bringing quality standard products to consumers
	Threats	– Labor costs, manual processing takes a long time
		Consumption (Geographic location – shipping on sale, certification, brand – existing reputation, partner – existing market, partner – potential market, competitors, agriculture requirements, policy import country's policy)
Dong Thinh Cooperative	**Strengths**	– Mainly a source of consumption by small traders looking for output. – Small household consumption, potential market is not available.
	Weaknesses	– There is no signing of OCOP products, so there is no product label.
	Opportunities	–
	Threats	– Need to find an outlet for a stable market
Dien Hung Agricultural Cooperative	**Strengths**	– Transport advantages
	Weaknesses	– Not having signed OCOP products, so there is no product label
	Opportunities	– Joining production and consumption association
	Threats	– Product quality and brand
Sy Thang Agro–Forestry–Fishery Import and Export Company Limited	**Strengths**	– Geographical location is right on National Highway 1A, convenient for transportation from raw material purchasing to consumption. – Currently the company has a brand in the market, many units and businesses want to cooperate in the near future
	Weaknesses	–
	Opportunities	– Will cooperate with domestic and foreign units and enterprises to expand the consumption market of sesame products
	Threats	–

Source: Summary of the research results

6.2.3 The units are planning to trade in sesame

In Nghe An, it is recommended to choose Dien Thinh commune, Dien Chau district to build the model, because this is the commune with the largest sesame production area, about 350ha in 2020 and has the potential to expand the area over 500ha.

* *Regarding the selection of leading companies and cooperatives, we should choose*

1. Sy Thang Agro-Forestry-Fishery Import and Export Company Limited

- As an enterprise in Dien Thinh commune, you can buy products directly from people.
- Currently, there is a large infrastructure and infrastructure for purchasing and processing sesame oil in Dien Chau district such as: warehouse, sesame oil processing equipment such as: Oil press machine (older model).
- Sesame oil products have labels, are sold directly to people and supplied to the market through some supermarkets, shops... (each year produces and consumes 4,000-4,500 liters of sesame oil).
- Hire production and processing workforce.
- Contact information: Mr. Pham Ngoc Thang – Director
- Address: hamlet 1, Dien Thinh commune, Dien Chau district, Nghe An province;
- Tel: 0913.076.385.

2. Dong Thinh Service Business Cooperative

- This is a cooperative in Dien Thinh commune that can buy products directly from people
- Having warehouse (narrow area), sesame oil processing equipment such as: Oil press machine (older model)
- Each year producing and consuming 1,800 liters of sesame oil
- Representative: Mr. Duong Nam
- Address: Dong Thinh Cooperative - Dien Thinh - Dien Chau - Nghe An
- Tel: 0374660703

The necessary investment support for companies and cooperatives includes.

- Dedicated product storage warehouse
- High-tech oil processing machine, bottling machine, sesame oil quality testing machine
- Product introduction booth
- Branding of sesame oil: A possibility of the product branding can be considered with the fact that improved sesame production will be achieved at scale. A collective branding (a collective trademark for cooperatives producing selected varieties with specific production protocol) might be an option as this type of product is owned by a group of producers so that the collective trademark will benefit to all members of the cooperatives. This collective trademark can be pro-

tected by the intellectual property law for both fresh and processed products (eg. seasame oil)

- Strengthening value chain management capacity

6.3. Private sector, cooperatives are participating in sesame value chain in Dong Thap

6.3.1 Production overview of private sector

Currently, small and medium-sized enterprises in the southern provinces, employing about half of the non-agricultural production workforce (accounting for 49%) in the whole country and in some regions have employed the vast majority of the labor force. non-agricultural production. However, the actual operation of small and medium-sized enterprises still faces difficulties due to the impact of objective and subjective factors, affecting the development, limitations in size and level of contribution to the economy.

Enterprises in Dong Thap and southern provinces are more active in processing and trading agricultural products, often linking with farmers through agricultural product chains. However, there are limited private companies have invested in sesame industry.

6.3.2 The units are planning to trade in sesame

Through the process of survey and actual analysis, it is shown that in order to develop the sesame value chain in Dong Thap, it is necessary to choose a location and object to attract investment, specifically as follows:

Regarding the selection of deployment sites: Phong My commune, Cao Lanh district should be selected.

This is a commune with a traditional sesame growing area, the land is slightly more hilly than other areas, sesame farmers are quite concentrated, the planting area for each household is also quite large. The commune's sesame farming area ranges from 400-1000 ha/year.

Phong My Commune, Cao Lanh District is a commune bordering Ward 11, City. Cao Lanh should be very convenient for model deployment, visit, study and market connection.

(The selection process has been discussed and agreed with the Center for Agriculture and Rural Development and the Department of Agriculture and Rural Development of Cao Lanh district).

Regarding the selection of enterprises implementing the consumption association:

Tan Tien Dong Thap Agricultural Products One Member Co., Ltd

- Address: No. 639, Nguyen Thai Hoc, Ham Thuan Phu, Hoa Thuan ward, Cao Lanh city, Dong Thap province.

- Tel: 0983 856689 (Nguyen Tan Tien)

Reasons for selection: Through the survey, the current evaluation shows that

- The company's factory and headquarters are relatively complete,

better than other facilities, convenient for traffic both by road and by waterway; located between the concentrated sesame growing areas of the province (15 km from the sesame growing area of Phong My commune, 20 km from the sesame growing area of Binh Hang Trung commune, about 12 km from the sesame growing area of Lap Vo district).

- Young and enthusiastic owner of the establishment has the desire to expand and invest in the development of sesame processing and export.

6.4. Private sector perspective in sesame production and trading

The private sector including enterprises and cooperatives has the following business views:

- Desire to have a sustainable source of raw materials, capable of providing sesame seeds in sufficient quantity and quality.
- Linking with the sesame oil consumption market to have a stable market for sesame products (sesame oil, products processed from sesame seeds).
- Can trade sesame seeds for partners if profitable (Enterprise can be the focal point to collect products to sell to parties).
- There should be government support policies on raw material areas, linkage policies.

6.5. Analysis of ODA projects from international communities

There are limited ODA projects from international communities supporting sesame production in Vietnam, as sesame is not their interest. However South Korea has an implemented project on some crops including Sesame, the following is major information:

KOPIA (Korea Project on International Agriculture) is a program that operates at the research institutions of the partner country and by the researchers and extension agents of both Korea and the partner country. It aims to develop and transfer new agricultural technologies or appropriate practices and adapt them to the diverse country conditions.

The major objective of KOPIA program is to develop and distribute the technologies appropriate at the country conditions and reflecting needs of beneficiaries. KOPIA Vietnam Center operates based on the original purpose of RDA that transfers technologies of Korea to Vietnam from development to extension.

Cooperation sectors: i) Joint technology development, identifying practices; ii) Dissemination of adopted technologies (the tools are demonstration field, demo farms, demo village, reflection of extension activities); iii) Capacity building of researchers and extension agents thru training in Korea; iv) Field workshops at the demo farms; v) Institutional establishment and vi) Expert consultations.

Achievements of KOPIA Vietnam Center: Collaborative research and demonstration: 14 collaboration technical projects have been funded and

implemented including sesame small project (technical support on establisment of demonstration model, capacity buiding for farmers)

6.6. Private sector perspective and strategies for sesame development

Develop specialized and closed raw material areas, intensively process, exploit potential markets, arrange crop rotation and change crop structure sustainably.

Formulate and implement a program of research and development of high-yield, pest-resistant, good-quality sesame varieties, suitable for ecological regions, import new varieties, and meet the requirements of raw materials. materials for the vegetable oil industry and other specialized products, Combined with the study of farming methods towards organic agriculture and appropriate, environmentally friendly plant protection, building models intensive farming with high productivity and economic efficiency.

Linking domestic and foreign cooperation to expand production and processing in accordance with each development stage of the industry and the locality.

Training and improving human resources, finance and technology for product development.

Develop agricultural extension program on sustainable sesame production.

7 Experience of Korea in Sesame Value Chain Development

7.1. Korean sesame production history

In Korea, sesame was called “Homa” or “Jima” and cultivated even before the Three Kingdoms period, but the modern study on sesame started in 1953 (Rural Development Administration [RDA], 2018). Since then, Korean sesame production history can be divided into three steps: development period, decline period, and stable period.

1) Development period

First of all, until 1960, the sesame cultivation area was only a few thousand ha; however, since 1970, some good cultivars had been promoted and distributed, so about 10,000 ha was maintained. In the 1980s, cultivation technology such as plastic mulching, etc. was developed, and high-quality cultivars such as “Ansan sesame” were produced, so the nation’s sesame cultivation area increased significantly. In particular, in

1987, it increased to the maximum area (i.e., 94,000 ha), and sesame became the second national crop only after rice.

2) Decline period

However, since 1987, the agricultural workforce was lacking because of rapid urbanization, and labor costs increased too much; therefore, the profits of sesame cultivation farms started to decrease. Moreover, because of Uruguay Round, a large amount of inexpensive overseas sesame was imported, thereby doubling the problem. Thus, the Korean sesame cultivation area and production amount shrank rapidly. In fact, after the Korean sesame cultivation area reached the maximum of 94,000 ha in 1987, the cultivation area and production amount continued to decrease, and even after 2000, the cultivation area kept decreasing, and it decreased to 23,184 ha in 2013 (RDA, 2018).

3) Stable period

After the cultivation area decreased to 23,184 ha in 2013, it somewhat increased. A major reason for it was that sesame was cultivated in paddy fields. In fact, the sesame area in paddy fields was only 1,338 ha in 2000, but in 2014, it increased to 2,245 ha in 2014. Cultivating sesame in paddy fields has advantages such as good draining and easy installation of drains because of being terraced fields. Moreover, in terms of quality, sesame cultivated in paddy fields does not have many issues. Thus, the reduction of the rice cultivation area caused by the reduction of Korean rice consumption can increase sesame cultivation in paddy fields for a while, and it is expected that the sesame cultivation area would increase to a certain level.

7.2. Korean sesame consumption pattern and supply chains

1) Consumption pattern

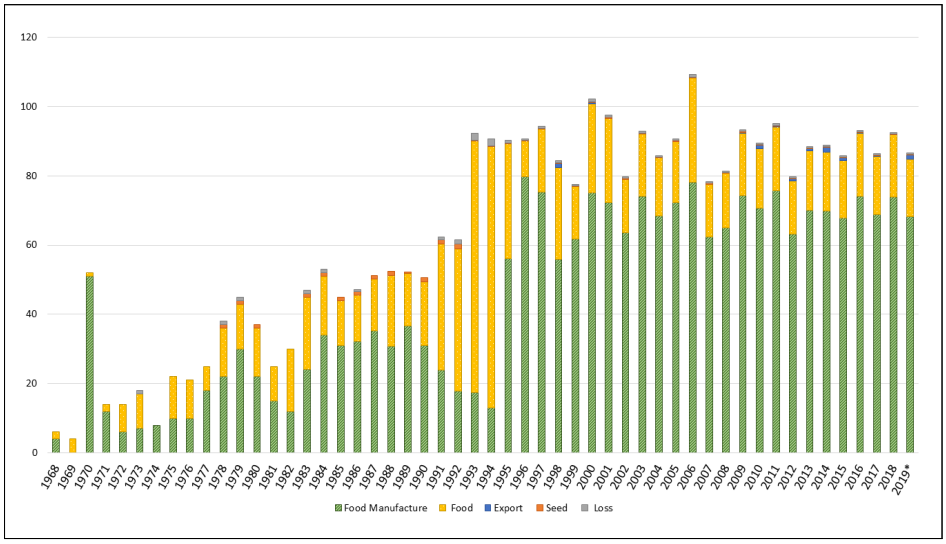
Korean sesame is generally used as sesame oil as well as food additives such as sesame salt, roasted salt, etc. Recently, not only food additives but also various processed products have been developed, so they are either consumed domestically or exported to other countries. Processed sesame products include soy milk, porridge, dressing, snacks, ice cream, etc. (RDA, 2012). In addition, sesame has received attention not only as food but also for industrial use. Sesame contains a good amount of antioxidants (sesamin, sesamolin, sesaminol, etc.) that are good for antiaging, and black sesame contains lecithin that helps brain activity. Besides, it contains various beneficial functional substances such as vitamin B1, vitamin B2, vitamin E, calcium, selenium, etc., so they are used for pharmaceutical or cosmetics materials through extraction. Moreover, because sesame contains abundant proteins, calcium, and phosphorus, sesame seeds are used to feed birds, and sesame by-products (sesame pulps, etc.) are utilized for organic fertilizer and livestock feed manufacturing. Furthermore, sesame has a high content of oleic acids, but processing costs are relatively low, so it is also utilized for producing biodiesel (RDA, 2012).

2) Supply change

The sesame consumption amount had increased steadily from the 1990s to 2000s, but after that, the annual consumption amount per person had

remained at about 2 kg. According to the figure below, sesame is demanded mostly for processed products and food, and since 1995, the total demand for processed products and food has not changed much.

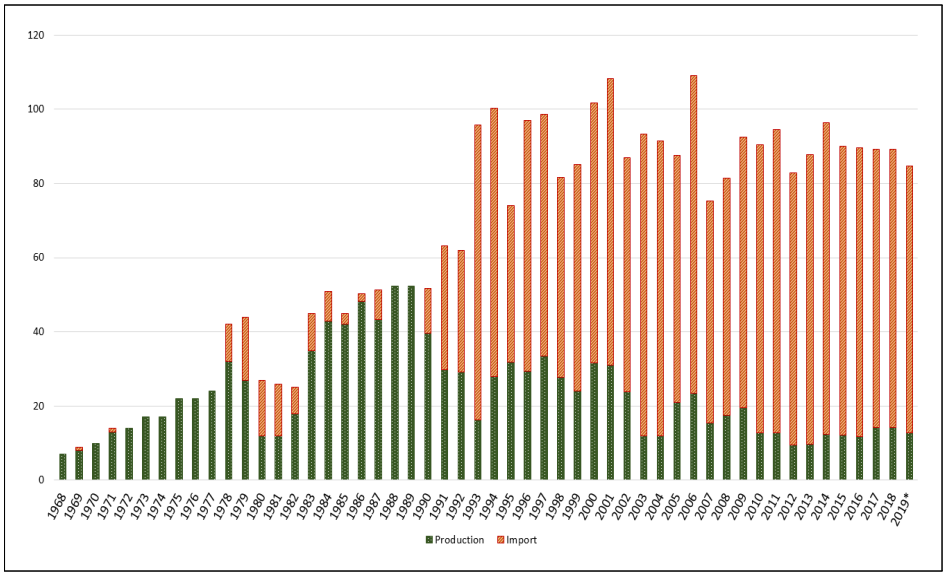
〈Figure 13〉 Sesame demand change



Source: Korean Rural Economic Institute (KREI) (2020)

Meanwhile, according to the figure below, since 1990, the domestic production amount has decreased continuously, but the importing amount increased. In fact, the self-supply has also decreased continuously, so it remains nowadays at 10%-15% compared to 67% in 1990 (RDA, 2018). However, as shown in the sesame production stable period, the supply change shows that the production amount has somewhat increased since 2013.

〈Figure 14〉 Sesame supply change



Source: KREI

7.3. Korean agricultural administration and lesson

The main reason that the sesame cultivation area decreased in Korea was the difficulty of mechanization and greater labor force requirement. Therefore, rather than having a large size of crop cultivation or specialized cultivation, small-sized sesame cultivation for self-consumption was mostly done, and because of the aging of farmers, the sesame cultivation area decreased as well. Moreover, because of the complicated logistics structure caused by small-sized cultivation, the big difference between the retail price and farmers' price occurred. Thus, in this part, Korean sesame cultivation technology has great saving effects as an essential factor to

promote the sesame industry. If such technology is introduced to Vietnam through local customization, Vietnam is expected to overcome various difficulties experienced by Korea more rapidly and effectively.

1) Korean sesame cultivation method

Type	Details
Monoculture	Among all cultivation methods, this is the most standard method and is commonly used nationwide. The greatest harvest amount can be obtained, and it is most profitable as vegetables can be grown after harvesting early in Gyeonggi-do and the central and northern parts of Gangwon-do.
Transparent plastic mulching cultivation	For sesame, if the temperature is low after seeding, it is inappropriate for germination, and the germination rate and early growth become low. Moreover, because of severe damages caused by take-all, sesame is known to be unstable among summer crops. To overcome this, soil temperature needs to be increased, and humidity needs to be optimized through plastic mulching cultivation, and transparent plastic mulching cultivation has various big advantages such as increasing soil temperature, suppressing soil water evaporation, even germination status, securing the seedling stand rate to prevent take-all, etc., but it has a disadvantage that herbicides need to be used before mulching.
Black plastic mulching cultivation	Black plastic mulching cultivation has a lower soil temperature increase effect than transparent plastic mulching cultivation, so early growth is low and take-all damages are concerned, but it suppresses weed growth so that no herbicide needs to be used. Moreover, after late May, sesame grows very well, so there is no difference between black plastic mulching cultivation and transparent plastic mulching cultivation.
Non-mulching cultivation	Because plastic mulching cultivation developed in the 1980s, non-mulching cultivation almost disappeared. However, because of recent concerns on soil contamination and being obstacles for mechanized cultivation, non-mulching cultivation has been returning. Still, there are tasks such as poor germination caused by early low temperature and drought, securing seedling stand method, pest control, intermediate management, agricultural machine development, application research, etc.
Double cultivation in paddy field	As the sesame cultivation area became stable, double cultivation of onion & sesame, spring potato & sesame, winter cabbage & sesame, garlic & sesame, etc. has increased, and the sesame cultivation area in paddy fields has been increasing steadily.

Type	Details
Transplanting cultivation	In the past, it was used to supplement empty areas, but the survival rate was low when transplanting. However, as the new seedling transplanting cultivation method was developed, the survival rate increased. Some farms transplanted plug seedlings directly to the field, but it is a difficult cultivation method except for special cases.
Fruits and vegetables aftercrop greenhouse cultivation	After harvesting crops such as watermelon, strawberry, Korean melon, corn, etc. in greenhouses, sesame cultivation as an aftercrop can reduce labor force and increase profits, so the cultivation area is becoming large gradually.

Source: RDA (2018)

2) Korean sesame cultivation mechanization technology

In sesame agriculture, from sowing to harvesting and threshing, a much labor force is required. Thus, Korea has continuously developed and distributed technology that can save the labor force through mechanization. In this part, as the main example, plastic mulching mechanization for plastic mulching cultivation will be introduced, and step-wise mechanization and effects are as follows.

First, in the sowing step, after scattering fertilizer and soil pesticides, plowing and preparing the soil, plastic mulching and sowing are done at the same time using a plastic mulching device and sower attached to a tractor (refer to the figure below). At that time, it traditionally takes 310 hr/ha for the human labor force, but it only takes 5 hr/ha if the work is done using the machine, saving about 98%. Furthermore, on soil with suitable humid conditions after raining, sowing is possible for more than 10,000 pyeong (*1 pyeong = about 3.3 ㎡) per day, and if soil moisture is appropriate when sowing, securing the seedling stand rate can be possible for much harvest (RDA, 2018).

〈Figure 15〉 Simultaneous work using a sower attached to a tractor

Source: RDA (2018)

Next, the weeding and thinning mechanization (i.e., middle step) does not differ much from traditional cultivation. Moreover, in the harvest step, sesame combine harvester or cutter can save 98% of the labor force (i.e., 8 hr/ha) compared to the traditional 330 hr/ha. Lastly, in the threshing step, sesame-threshing separators save 85% of the labor force (i.e., 30 hr/ha) compared to the traditional 205 hr/ha. Thus, overall, the mechanization technology had 64% of saving effects.

Such saving effects of mechanization were shown even in non-mulching cultivation, and non-mulching mechanization took 247 hr/hr and showed 80% of saving effects compared to traditional cultivation (1,255 hr/ha).

Meanwhile, for transplanting cultivation, sesame seedling transplanting mechanization technology is used. At that time, a sesame transplanter is used 20–30 days when the second true leaf develops completely after young sesame seedlings are available. The sesame transplanter is an automated device that transplants from the original package and does watering

automatically. However, cultivation using sesame seedling transplanting mechanization technology requires precise seedling technology, and the sesame transplanter is expensive, so it is currently judged that it would not be appropriate for Vietnam, where extensive sesame agricultural method is used.

3) Implications

Currently, because of continuous market demand caused by Korean sesame's unique scent and taste and high profits (i.e., 2–3 times greater than importing sesame), the middle-aged and elderly farmers are maintaining the cultivation area of about 20,000 ha in Korean farms. However, young farmers are rarely interested in sesame cultivation. The reason is that, as previously mentioned, the mechanization rate is less than half of that of rice agriculture, and profits are unstable compared to rice. In addition, because of being vulnerable to climatic damages, normal production amounts are often not met. Thus, such burden is directly transferred to cultivating farmers so that the motivation of cultivation becomes lost. Moreover, because of COVID-19, the overseas labor force is often prevented from entering Korea, so the labor force now lacks even more than before.

Thus, Korea is developing and distributing various types of mechanization technology, and especially, harvesting using combine harvesters is tried by utilizing sesame's shattering resistance cultivars. Later, if harvesting using combine harvesters becomes successful for commercial cultivation, it will improve the field crop mechanization rate, and other small and middle-sized crops such as perilla, rapeseed, glutinous

millet, adlay, etc. would be influenced as well, thereby expanding the production of domestic field crops. Through it, if coherent sesame mechanization technology is settled from sowing to harvesting using combine harvesters, domestic sesame self-supply will be increased significantly, and exporting sesame will happen as well.

Such a trend is expected to occur in developing countries such as Vietnam as a way to improve additional values of sesame. Vietnam needs to prioritize promoting mechanization technology development and distribution for sesame agriculture.

7.4. Good seed development and supply

1) Korea's early sesame seed development and supply process

So far, RDA has promoted and supplied a total of 60 sesame cultivars, and developing and supplying such cultivars is another technology that leads Korean sesame production in addition to sesame agricultural mechanization technology.

In 1960, for the first time in Korea, "Andong seeds" that were cultivated in Andong-si of Gyeongsangbuk-do were collected and named "Andong sesame" after processing with pure line breeding method, and they were supplied to farms in Gyeongsangbuk-do. After that, in 1961, a cultivar called "Palmo sesame" (which is also a local product of the Haenam region of Jeollanamdo) was promoted and supplied to the Honam region. Moreover, in 1962, "Early Russian," which was a sesame cultivar collected

in the southern part of Russia by the US Department of Agriculture (USDA) after processing with pure line breeding method, was promoted as "90-day sesame," and it was supplied nationwide.

In the 1970s, the first cross-breeding cultivar was created for the first time in 1972, and it was cross-bred between Haenam sesame (i.e., parent plant) of Korea and America's K10. It was named "Suwon No. 5," which was a white seed coat colored cultivar, and supplied nationwide. After that, in 1974, brown seed coat colored "Suwon No. 9" through cross-breeding in 1974, and "Suwon No. 21" through processing with pure line separation method after collecting it in Gangwon-do in 1978 were promoted.

In the 1980s, "Pungnyeon sesame" and "Gwangsan sesame" in 1981, and "Danbaek sesame" in 1982 were promoted through cross-breeding, and in 1984, "Ansan sesame" was promoted through the mutation breeding method, and about 30% of Korean farms cultivate it, so it is the cultivar with the greatest share.

2) Major excellent cultivars

As mentioned previously, in the 1970s, sesame cultivars such as "Suwon No. 5," "Suwon No. 9," etc. were supplied to harvest more, but the demand of farms could not be met. However, in the 1980s, cultivars with a great amount of harvest and high quality were promoted through cross breeding and mutation breeding, so they contributed to a large amount of sesame harvest.

The characteristics of major sesame cultivars promoted from the 1980s until now are as below (RDA, 2018).

Name of cultivar	Promoting year	Plant type	Pericarp color	Length (㎝)	Maturity (month/day)	Weight of 1000 seeds (g)	Oil percentage (%)	Quantity (㎏/10a)
Geumok	2017	Narrow Branched	White	143	8.21	2.9	49.1	123
Nuri	2016	Narrow Branched	White	138	8.23	2.7	49	118
Dodam	2015	Narrow Branched	Brown	137	8.23	2.8	45.4	107
Gangan	2014	Narrow Branched	White	147	8.22	2.6	46.4	117
Geonbaek	2013	Narrow Branched	White	149	8.24	2.6	50.2	119
Sangbaek	2011	Narrow Branched	White	150	8.29	2.7	48.4	106
Chamhwang	2010	Narrow Branched	Brown	134	8.25	2.6	44.5	105
Daheuk	2009	Narrow Branched	Black	117	8.23	2.8	43	97
Milseong	2007	Narrow Branched	White	129	8.2	2.8	48.7	98
Pyeongan	2006	Narrow Branched	White	134	8.21	2.8	47.4	99
Gopum	2005	Narrow Branched	White	124	8.22	2.5	50.6	92
Gangheuk	2003	Narrow Branched	Black	119	8.25	2.6	47.1	95
Ansan	1984	Branched	White	112	8.21	2.2	54	82

Source: RDA (2018)

3) Implications

In Korea, to promote the sesame industry, many efforts have been exerted to develop and supply good seeds. So far, seed development has been done while focusing on the demand of farms such as cultivation for a large amount of harvest, etc. However, the recent focus is developing shattering-resistant cultivars to improve mechanization speed. In addition, sesame cultivar development is expected to increase not only to meet the

demand of farms but also to meet the demand of consumers. Likewise, for Vietnam, as urbanization is in progress and incomes of people increase, mechanization, development of cultivars that are compatible with mechanization, and product development research for using sesame ingredients effectively will be necessary.

Furthermore, as the agricultural population ages and global trade order (e.g., FTA, etc.) changes, many sesame farms experience difficulties because of changes in agricultural conditions, increased costs, etc., so efforts are exerted to overcome such difficulties. In particular, the most notable policy is the sixth industrialization policy, in which the policies of first, second, and third industrialization are combined. It is a strategy that, in addition to producing sesame, the agricultural economy will be boosted by improving profits and making jobs by processing and selling sesame, as well as touring agricultural farms. If such a strategy can improve stability by making multiple sources of profits for sesame farmers, those farmers would continue sesame cultivation without giving it up, and Korean sesame's self-supply rate can be increased, and the sesame industry's technology development and supply will be boosted even more.

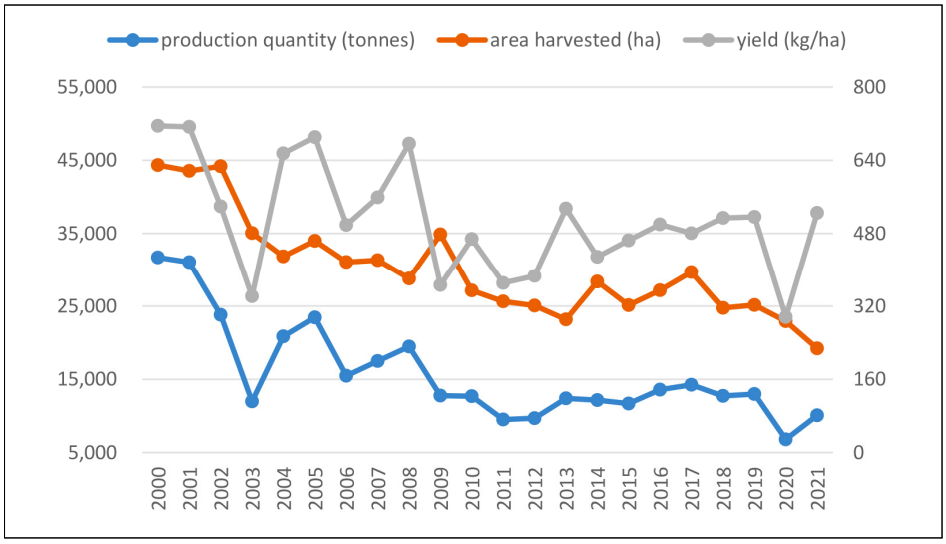
Therefore, by referring to the Korean sesame industry's results for each period, developing countries such as Vietnam need to reduce the required labor force of sesame farms, develop cultivars to increase sources of profits, and establish strategies for the sixth industrialization.

7.5. The Current State of the Supply and Demand of Sesame Seeds in Korea

1) The Current State of Production

The sesame seed cultivation is labor intensive and sensitive to climate change that its cultivation in Korea has dropped because of the labor shortage in the countryside and increased risk caused by frequent abnormal climate. As of 2021, the cultivation area and production quantity of sesame seeds in Korea were 19,218 ha and 10,090 t, respectively, and they each dropped 56.6% and 68.2%, respectively, from 2000. The production quantity recorded over 50,000 t in 1988, remained 20,000–30,000 t afterward, and then clearly dropped since the 2000s.

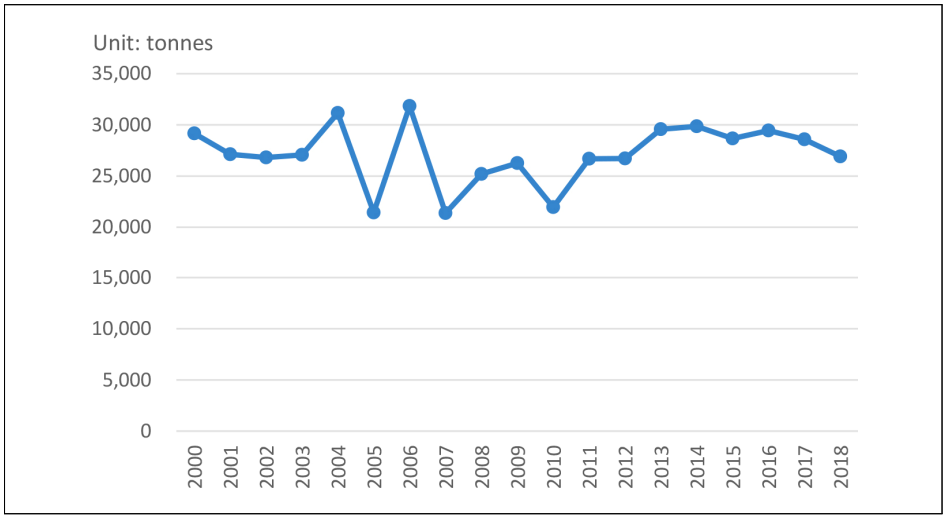
〈Figure 16〉 Cultivated area, Production quantity and yield trends of sesame seeds in Korea



Source: Korean Statistical Information Service (KOSIS)

The production quantity of sesame seeds in Korea mostly fluctuated between 20,000 t and 30,000 t and then recently stabilized. As of 2018, the quantity recorded 26,919 t.

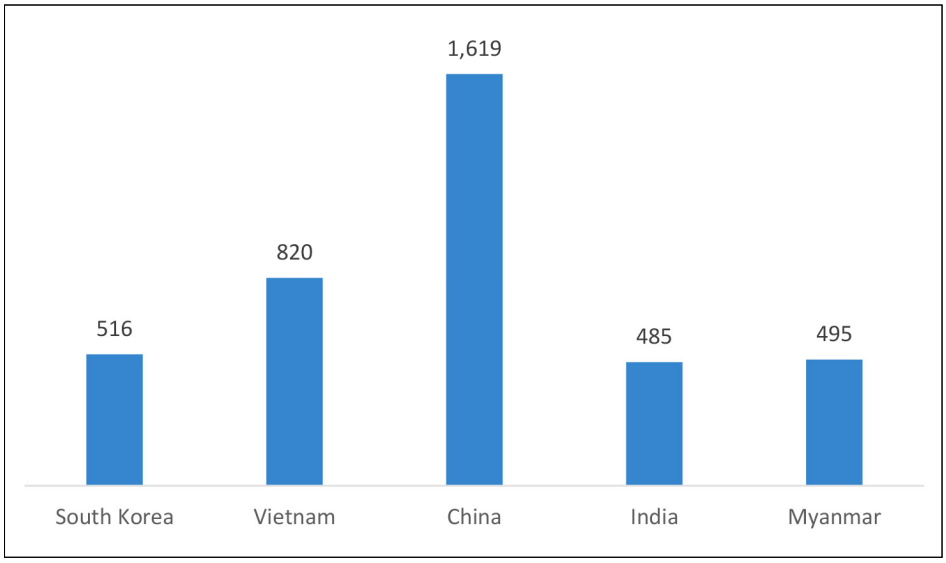
〈Figure 17〉 Sesame seed production in Korea



Source: FAOSTAT

The sesame seeds yield in Korea is relatively low compared to major producing countries, and it fluctuates largely depending on climate change. For example, when the rainy season prolonged in 2020, the yield was 296 kg/ha and the total production quantity stalled at 6,795 t, which was the lowest ever. As of 2018, the yield was 516 kg/ha in Korea, which is higher than India or Myanmar, but much lower than China (1,619 kg/ha) and Vietnam (820 kg/ha). As such, it is low in Korea not because its cultivation technology falls back behind but largely because the climatic factor is not appropriate for the growth of the seeds although Korea possesses high yield breeds.

〈Figure 18〉 Yield of major producing countries of sesame seeds (as of 2018,kg/ha)

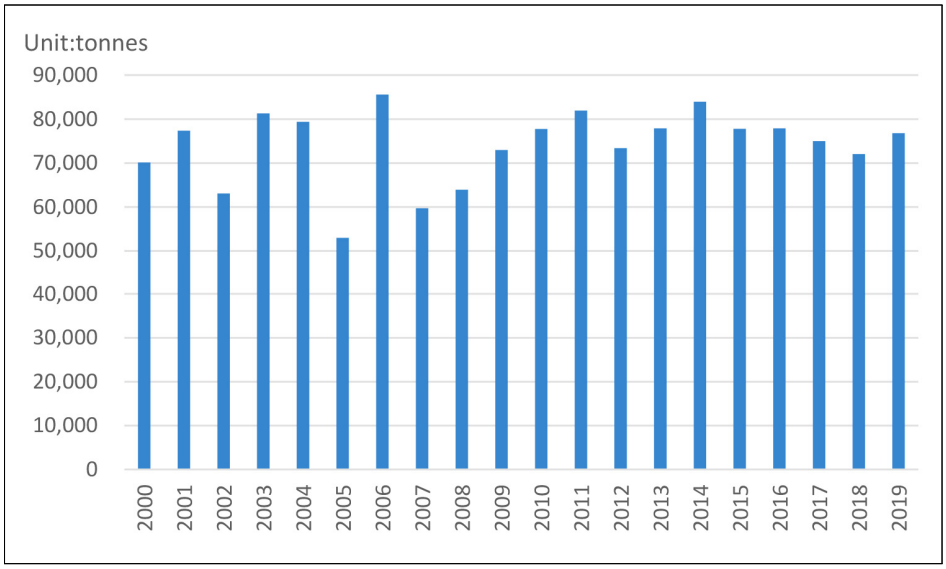


Source: FAOSTAT

2) The Current State of Trade

Korea relies on imports because of a lack of domestic supply of sesame seeds, which is dropping. There was a high fluctuation in the imported quantity in the early 2000s, jumped for some time after 2007, and then slowly dropped after 2014. As of 2018, the quantity of sesame seeds imported in Korea was 76,812 t. While the quantity produced in Korea is declining, the imported quantity is not clearly growing because it is estimated that their consumption has either stalled or dropped. The quantity of sesame seeds exported from Korea is insignificant compared to the import. It was 1,244 t in 2018 but dropped to 42 t in 2019.

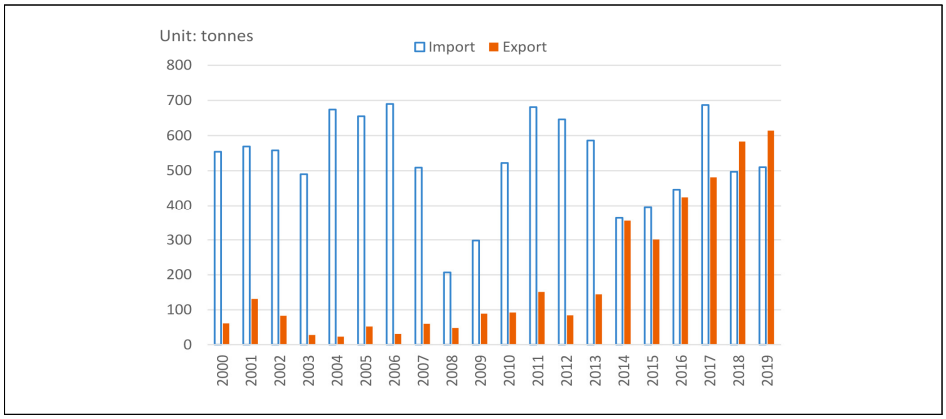
〈Figure 19〉 Import trends of sesame seeds in Korea



Source: FAOSTAT

While the import quantity of sesame oil largely fluctuated, its export is growing recently. The imported quantity varies from year to year, but it surpassed 600 t during numerous years. The exported quantity of sesame oil recorded 583 t in 2018, and Korea became a net exporter with export increasing to 614 t in 2019. As such, although the import of sesame seeds is increasing, the export of sesame oil is also growing because Korea produces the oil with advanced technology for processing imported seeds and exports the oil. That is, it processes inexpensive sesame seeds to export high value-added oil.

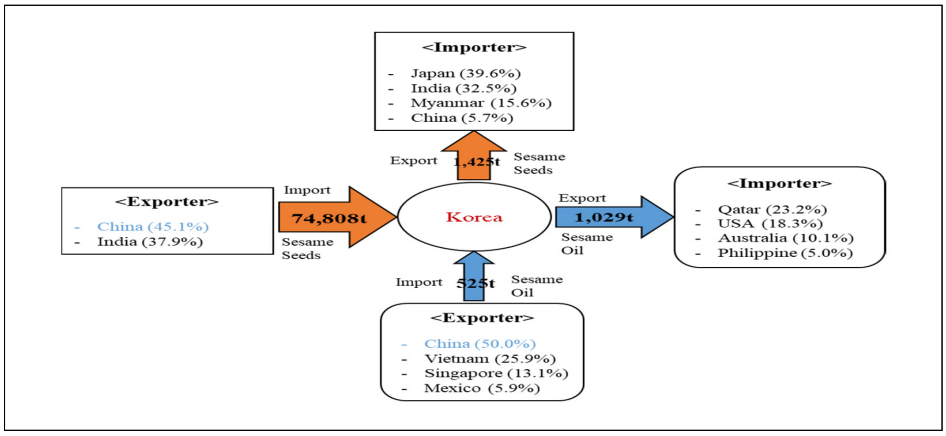
〈Figure 20〉 Import trends of sesame oil in Korea



Source: FAOSTAT

If we examine the trade partners of sesame seeds and sesame oil of Korea based on the country's import and export data of 2018, Korea imported the seeds mainly from China and India, and exported them mainly to Japan, India, Myanmar, and China. As for the oil, Korea imported mainly from Japan, Vietnam, Singapore, and Mexico, and exported mainly to Qatar, the United States, Australia, and the Philippines.

〈Figure 21〉 Import and Export sesame seed and sesame oil of Korea



Source: Ji (2019)

3) The Current State of Consumption

We can estimate the consumption volume of sesame seeds by examining the production, import, and export quantity of the seeds in Korea, as well as the import and export quantity of the oil. Since 2010, the consumption volume of the seeds in Korea differed from year to year, but it reached approximately 90,000 t and recorded 88,583 t in 2019. Of the total consumption volume, the share of import is clearly high that Korea's self-sufficiency is rather low. As of 2019, Korea's self-sufficiency of the seeds was 14.5%. Since 2010, it has somehow recovered.

〈Table 51〉 Korea's Consumption Volume and Self-Sufficiency of Sesame Seeds

(Unit: tonnes, %)

Year	Domestic Production	Import		Export		Consumption Volume	Self-Sufficiency
		Sesame Seeds	Sesame Oil	Sesame Seeds	Sesame Oil		
2010	12,703	77,747	522	1,110	92	90,057	14.1
2011	9,515	81,941	681	314	151	92,025	10.3
2012	9,690	73,401	646	583	84	83,445	11.6
2013	12,392	77,881	586	688	144	90,322	13.7
2014	12,158	83,943	363	1,490	355	94,624	12.8
2015	11,678	77,796	396	780	301	88,852	13.1
2016	13,575	77,906	446	304	424	91,214	14.9
2017	14,258	74,993	687	74	481	89,520	15.9
2018	12,727	72,063	497	1,244	583	83,403	15.3
2019	12,986	76,812	510	42	614	89,583	14.5

Source: FAOSTAT

Footnote: The oil's yield was set at 60%. That is, if 100 kg of sesame seeds are processed, it can obtain 60 kg of sesame oil.

4) The Current State of Prices

The price of the seeds produced in Korea is higher than the imported ones. As of 2020, those produced in Korea recorded KRW 599,523 and

KRW 566,885 for 20 kg of the high- and mid-quality, respectively. That is, it was KRW 43,739/kg (USD 36.4 as of USD 1 = KRW 1,200) and KRW 41,316/kg (USD 34.4), respectively. As for the mid-quality, it is 3.4 and 4.2 times higher than those produced in China and India, respectively. The price of the seeds produced in Korea has recently dropped and then jumped largely in 2020 because of the prolonged rainy season and poor yield that year.

〈Table 52〉 Price Comparison of Sesame Seeds Produced in Korea and Those Imported from China and India

(Unit: KRW/20 kg)

Year	South Korea		China	India	Ratio	
	High-quality	Mid-quality (A)	Mid-quality (B)	Mid-quality (C)	A/B	A/C
2010	508,276	482,175	182,962	-	2.6	-
2011	579,513	545,957	171,549	-	3.2	-
2012	584,506	545,558	175,082	-	3.1	-
2013	569,038	540,887	172,078	135,699	3.1	4.0
2014	528,296	500,296	172,180	143,167	2.9	3.5
2015	529,839	506,484	194,879	130,566	2.6	3.9
2016	529,124	503,027	181,915	127,627	2.8	3.9
2017	515,016	483,547	154,157	122,087	3.1	4.0
2018	497,671	472,230	148,764	118,126	3.2	4.0
2019	496,873	471,189	160,180	133,552	2.9	3.5
2020	599,523	566,885	167,939	134,426	3.4	4.2

Source: KAMIS

5) Import Price

A comparison of the prices of major countries exporting sesame seeds to Korea showed the following characteristics. First, the prices mostly increased year-on-year in 2019. Second, the prices are higher for seeds from Asia than from Africa and South America. As of 2019, the prices of

seeds from China and India were 48.0% and 33.0% higher, respectively, than those from Nigeria. Third, the price of Vietnamese seeds was clearly higher than those from other Asian countries. As of 2019, the export price of Vietnamese seeds was 19.1%, 32.5%, and 17.9% higher than those from China, India, and Myanmar, respectively.

〈Table 53〉 Prices of Sesame Seeds Exported to Korea from Major Exporting Countries

2018				2019			
Exporter	Volume (t)	Value (USD 1,000)	Price (USD/kg)	Exporter	Volume (t)	Value (USD 1,000)	Price (USD/kg)
China	35,796	67,929	1.90	China	42,073	81,623	1.94
India	27,844	41,533	1.49	India	19,841	34,598	1.74
Myanmar	7,575	12,217	1.61	Nigeria	8,659	11,354	1.31
Pakistan	4,406	7,573	1.72	Myanmar	7,911	15,504	1.96
Ethiopia	2,715	3,904	1.44	Pakistan	3,341	5,381	1.61
Nigeria	2,034	2,402	1.18	**Vietnam**	**717**	**1,657**	**2.31**
Vietnam	**1,443**	**2,918**	**2.02**	Ethiopia	414	674	1.63
Paraguay	48	69	1.43	Paraguay	84	139	1.65

Source: UN Comtrade

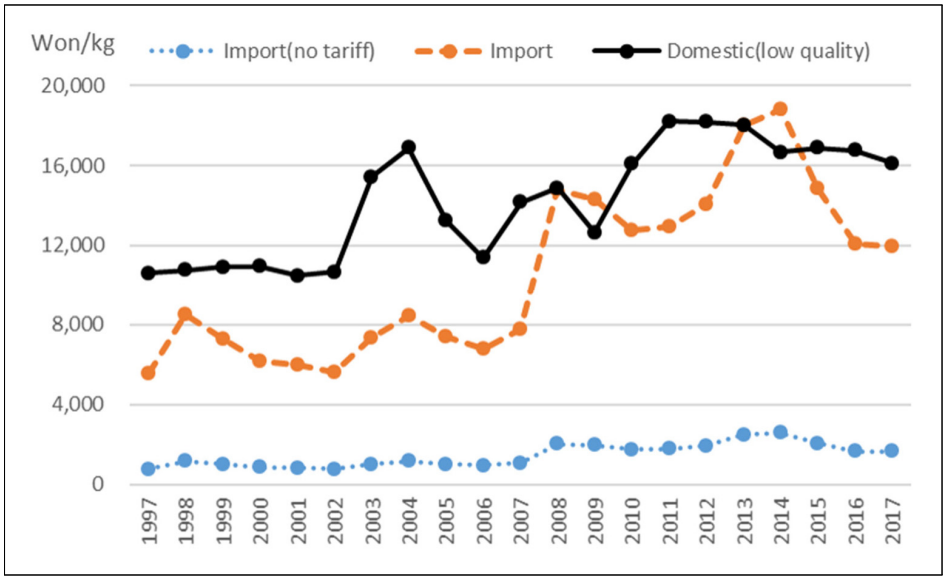
6) Tariffs

As of 2021, the Korean government applied a tariff rate quota (TRQ) for 6,731 t of imported sesame seeds. In other words, it applied a low-rate tariff of 40% to the imported quantity within the quota. For imports outside the quota, it imposes an ad valorem duty of 630% or specific duty of KRW 6,660/kg. Of course, this standard varies depending on the exporting country. If sesame seeds were included in the bounded tariff items during the signing of Free Trade Agreements (FTAs), the tariff is applied at a lower rate. For example, the seeds are included in the items for bounded tariff for

FTAs forged with ASEAN, Central America, European Union, United Kingdom, Peru, the United States, and Vietnam. Among them, except for FTAs with ASEAN and Vietnam, Korea decided to slowly reduce the tariff rate for sesame seeds for other FTAs. In the case of the FTAs with ASEAN and Vietnam, the one-time tariff rate has been reduced by 20% to maintain 504% or KRW 5,328/kg (Customs Law Information Portal).

As the figure below shows, if 40% of the tariff is imposed on imported quantities within the quota, the price difference is very large compared to Korean seeds. On the other hand, if the tariff of 630% is imposed for imported quantities outside the quota, the price of imported seeds rises as high as the Korean ones in some years, but the imported ones are still more competitive in price than the Korean seeds.

〈Figure 22〉 Import and Export sesame seed and sesame oil of Korea



Source: Ji Seongtae (2019)

7.6. Korean Technology for Cultivating Sesame Seeds

Mechanization for the processes before sowing, such as plowing and sheathing, is rather high in Korea, but the mechanization of the sowing, planting in the field of seedlings cultivated in hotbeds, cutting, husking, and foreign substance picking is very low. Therefore, Korea is recently developing and supplying diverse machines led by the Rural Development Administration of Korea to raise the mechanization of the processes after sowing. Sesame seeds are a labor-intensive crop requiring much labor at the sowing and harvesting stages. Because of the aging of Korea's farmers and labor shortage in the countryside, the cultivation of labor-intensive crops such as sesame seeds has largely shrunk. As such, Korean farms are becoming increasingly more dependent on foreign workers. However, because of the prolongation of COVID-19 and limitations on the entry of foreign workers, Korean farms are suffering from a labor shortage. That is why the development and supply of machines that can replace human labor are urgently called for in the sesame seed industry as well. Recently, various small farming machines for planting in the field of seedlings cultivated in hotbeds, cutting, husking, and foreign substance picking are being developed, thereby reducing the need for human labor. According to the Rural Development Administration, if mechanization is applied to the entire process of producing the seeds, it has the effect of largely reducing the necessary workforce and production cost. Direct planting and planting in the field of seedlings cultivated in hotbeds both enjoy reduced labor by

about 67.0% and 56.4%, respectively, which in turn reduce the production cost by 39.3%–49.0%. The administration is thus introducing sesame seed breeds to which the production mechanization that it has developed can be applied, the mass cultivation method by breed, and mechanization technologies, using brochures. The sesame seed breeds that boast of highly stable cultivation and can be cultivated and harvested using machines are "Geonbaek" and "Milyang No. 72," among others.

〈Figure 23〉 Current State of Mechanization of the Korean Sesame Seed Industry

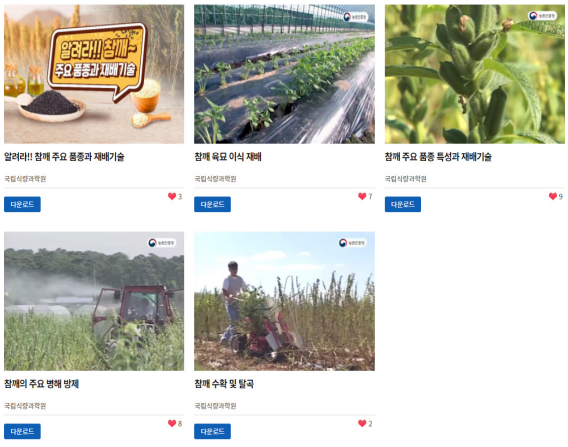
Source: newsAM (newspaper on agricultural equipment) (October 13, 2021)
Footnotes: 1) Upper left: Sowing sesame seed seedlings using a planting machine.
2) Upper right: Cutting sesame seed plants using a pedestrian cutting machine.
3) Bottom left: Husking seeds using a husking machine, 4) Bottom right: Picking foreign substances from husked sesame seeds

〈Figure 24〉 Demonstrating the Mechanization of Sesame Seed Sowing

Source: pressian (October 14, 2021)

The Rural Development Administration of Korea is providing diverse information and technologies related to sesame seed cultivation. It has produced a short video on major sesame seed breeds, technologies for sowing and cultivating the seeds, and ways to prevent damages from diseases and pests, harvesting, and husking, so that farmers may easily access them.

〈Figure 25〉 Information and Technologies related to Sesame Seeds that the Administration is Providing



Source: Rural Development Administration's Nongsaro (on sesame seeds)

7.7. The cases of the sesame seed development

1) The Case of the Sesame Seed Development Cooperation between Korea and Paraguay

Korea is pursuing diverse development cooperation projects with developing countries to hand down advanced agricultural technologies. In particular, the administration is establishing Korea Program on International Agriculture (KOPIA) centers in major developing countries and pursuing projects to develop, prove, and supply agricultural technologies customized to each country. As of 2021, KOPIA centers have been established in 22 countries worldwide (8 in Asia, 7 in Africa, 5 in Latin America, and 2 in the Commonwealth of Independent States).[1] Each center is pursuing projects divided into three stages. The first stage is the technological development stage, wherein the local adaptability of Korean breeds is tested so that customized technologies may be developed and packaged. The second stage is the proving and demonstrating stage, wherein the breeds that passed the adaptability test or were developed during the first stage are supplied, proven, and demonstrated in villages. The third stage is the stage wherein the Korea International Cooperation Agency (KOICA) and the Korean Ministry of Agriculture, Food and Rural Affairs cooperate to jointly pursue large projects on a greater scale based on the achievements made and technologies developed during the first and

1) Asia: Vietnam, Myanmar, Cambodia, the Philippines, Sri Lanka, Mongolia, Laos, and Pakistan
Africa: Kenya, Algeria, Ethiopia, Uganda, Senegal, Zimbabwe, and Ghana
Latin America: Paraguay, Bolivia, Ecuador, the Dominican Republic, and Nicaragua
CIS: Uzbekistan and the Kyrgyz Republic

second stages.

KOPIA projects are making visible achievements. The productivity of diverse agricultural crops, such as rice, onions, potatoes, sesame seeds, and peanuts, as well as poultry and cow farming, and other livestock products, have largely improved in the project demonstration villages in each country.

〈Table 54〉 Achievements Made in Project Demonstration Villages by KOPIA Country

Country	Period	No. of Villages	Breed	Main Achievements
Cambodia	'15–'17	5	Poultry farming	Raised the survival rate of cinnamon by 11.6% (85.0%→94.9%)
The Philippines	'15–'17	4	Rice	Increased the rice harvesting quantity by 18.4% (3.8 t/ha→4.5 t/ha)
Sri Lanka	'15–'17	3	Onion	Increased onion production quantity by 10.0% (30 t/ha→33 t/ha)
Kenya	'16–'18	4	Poultry farming and potato	Raised the chick survival and hatching rate by 79% (42.5%→76.2%) Increased the potato harvesting quantity by 206% (3.2 t/ha→9.8 t/ha)
Paraguay	'16–'18	3	Sesame seed	Increased the sesame seed harvesting quantity by 37.5% (600 kg/ha→825 kg/ha)
Vietnam	'17–'19	3	Peanut	Increased the production quantity of high-quality peanut seeds by 19.5% (2.34 t/ha→2.80 t/ha)
Senegal	'18–'20	3	Peanut and poultry farming	Increased the peanut production quantity by 71.4% (0.7 t/ha→1.2 t/ha) Increased the egg laying rate by 17.3% (1.96 eggs/day→2.30 eggs/day)
Uzbekistan	'18–'20	6	Livestock	Increased the cow weight by 12.1% using total mixed rations (TMR) feed technology (330 kg→370 kg)
Ecuador	'19–'21	7	Potato	Increased the potato production quantity by 65.0% (12.0 t/ha→19.8 t/ha)

Source: Rural Development Administration of Korea (2020)

Problems of the Sesame Seed Industry in Paraguay

The cultivation of sesame seeds as an alternate income-generating crop started to grow after 2000 in Paraguay, mainly in regions cultivating cotton. Sesame seeds are drawing attention as a labor-intensive but income-generating crop for small-scale farms. Only, they do not have any own developed breeds, and breeds introduced from Japan are mainly cultivated. However, the Japanese breeds are not appropriate for the environment in Paraguay and vulnerable to diseases and pests that they are evaluated as having low productivity. Furthermore, no standardized cultivation method exists for seedling density, fertilization, and pest control. As such, it is necessary to enhance productivity by handing down standardized cultivation technologies, as well as selecting and supplying to the farms breeds that are highly adaptable to the local environment (Yongjin An et al., 2020).

The sesame seed cultivation area in Paraguay has recently grown to 55,000 ha, the production quantity to 37,338 t, and the yield to 679 kg/ha, as of 2020. This is higher than the yield in Korea (516 kg/ha) but still lower than major Asian sesame seed producing countries of China (1,619 kg/ha) and Vietnam (820 kg/ha).

〈Table 55〉 The Current State of the Sesame Seed Production in Paraguay

Year	Area harvested (ha)	Production (t)	Yield (kg/ha)
2010	69,185	40,135	580
2011	83,304	50,396	605
2012	85,000	27,965	329
2013	50,000	30,000	600
2014	60,000	41,400	690

Year	Area harvested (ha)	Production (t)	Yield (kg/ha)
2015	63,000	43,790	695
2016	55,000	21,450	390
2017	55,000	30,250	550
2018	30,000	18,002	600
2019	40,000	24,000	600
2020	55,000	37,338	679

Source: FAOSTAT

Main Details of the Sesame Seed Demonstration Village Project in Paraguay

The Korean Rural Development Administration's Paraguay KOPIA Center pursued the demonstration project called "superior sesame seed production and dissemination complex establishment." The project period was from 2016 to 2018, and a total of USD 1.2 million was invested. The main details of the project are as follows. First, the center supplied high-quality seeds. IPTA-K07 was registered with SENAVE, a breed registration agency of Paraguay, in 2015, and bred and supplied as a high-quality seed. It was a breed introduced in Korea and whose adaptation in Paraguay was tested since 2010 before being selected. Second, a cultivation manual was produced and used to train the farmers. Training was provided on how to increase fertility using green manure crops, introduce a crop rotation system, inject the appropriate quantity of fertilizers, and other cultivation technologies. In addition, a simple portable manual with mainly color photos was produced and distributed to the farmers. Third, the center provided 100 sowing machines. Using the sowing machines improved the productivity, and the sowing was changed from the scattering of seeds to sowing in clusters to reduce the amount of

seed input. Fourth, an earthworm breeding farm was built to produce liquefied fertilizers and create an organic cultivating environment (Ahn Yong-jin, et al., 2020).

During the three years of the project, the participating farms and cultivation area steadily expanded. In 2016, 240 farms participated, the cultivation area was 300 ha, and the quantity of provided seeds was 900 kg. In 2018, the number of participating farms increased to 1,776, and the cultivation area and quantity of provided seeds grew to 2,712 ha and 8,700 kg, respectively.

〈Table 56〉 The Current State of the Sesame Seed Cultivating Demonstration Villages that Received Assistance

	2016	2017	2018
Area Harvested (ha)	300	1,600	2,712
No. of Farms	240	390	1,776
Seeds Applied (kg)	900	4,500	8,700

Source: Ahn Yong-jin, et. al. (2020)

The Achievements Made by the Sesame Seed Demonstration Village Project in Paraguay

Based on the premise that the business situation and achievements made by the treatment farms and control farms were the same before the pursuit of the project, we compared the yield and sales prices of the two groups after the pursuit of the project. The yield of the treatment farms was much higher, as was its sales unit price. As a result, the average profit made, obtained by multiplying the yield and sales unit price, was equally higher among the treatment farms than the control farms. As of 2018, the yield, sales price, and average profit made by the treatment farms were 18.7%,

33.2%, and 58.2% higher, respectively, than the control farms. This shows that both productivity and quality improved thanks to the supply of high-quality seeds.

〈Table 57〉 Comparison of Profit Made by the Treatment Farms and Control Farms

	Year	Yield (kg/ha)	Price (Gs/kg)	Benefit (Gs/ha)
Treatment Farms	2016	771.1	4,695	3,620,315
	2017	820.0	5,390	4,419,800
	2018	825.0	9,650	7,961,250
Control Farms	2016	522.5	4,687	2,448,697
	2017	494.8	5,187	2,566,244
	2018	695.0	7,243	5,033,538

Source: Ahn Yong-jin, et. al. (2020)

If the difference in profit made by the treatment and control farms is multiplied by the cultivated area that received support, we can confirm the total profit created by the project. We thus confirmed that the total profit increased thanks to the enlargement of the cultivated area receiving support. In 2016, the total profit made was USD 62,067, and this grew to USD 541,768 and USD 1,225,381 in 2017 and 2018, respectively. If we were to divide the total profit created by the project pursued for three years by the number of participating farms, the average profit made by each farm was about USD 760. This is 19% of the per capita Gross Domestic Product (GDP) of USD 4,020 of Paraguay.

〈Table 58〉 Total Profit Growth of Treatment Farms Compared to Control Farms

	2016	2017	2018	Total
Scale (ha)	300	1,600	2,712	4,612

	2016	2017	2018	Total
Total Effect (1,000 Gs)	351,485	2,965,690	7,939,956	11,257,132
Exchange Rate (Gs/USD)	5,663.00	5,474.10	6,479.58	
Total Effect (USD)	62,067	541,768	1,225,381	1,829,216

Source: Ahn Yong-jin, et. al. (2020)

Given that most of the control farms were also supported with seeds, fertilizers, and plowing while contract cultivating for companies exporting sesame seeds just as the treatment farms were supported with seeds, fertilizers, and agricultural machines, the investment made to manage both groups could be said to be not all that different. Only, the fact that the treatment farms were small new farms with short farming experience proves that the effect of the project was even more positive.

If we were to convert and compare the benefits and costs enjoyed during the three years of the project to 2018 values, the benefits were 1.52 times higher than the costs at USD 1,831,216 and USD 1,204,806, respectively. This means that the project is highly justifiable.

〈Table 59〉 Benefit/Cost Analyses of the Sesame Seed Demonstration Village Project

(Unit: USD)

	Benefit	Cost	B/C Ratio
2016	62,067	400,000	1.52
2017	541,768	400,000	
2018	1,225,381	400,000	
Total	1,829,216	1,200,000	
Total Present Value	1,831,216	1,204,806	

Source: Ahn Yong-jin, et. al. (2020)

Factors that Contributed to the Success of the Sesame Seed Demonstration Village Project

The project is considered a representative project with high benefits among the various projects pursued by the about 20 KOPIA centers of the Rural Development Administration of Korea. The factors that led to its success are as follows.

First, a breed appropriate for the region was selected. Breeds must be selected by sufficiently considering the relevant local cultivating environment, and the local farms must be willing to adopt them. That is, it must be a crop that the farms can produce by efficiently allocating its resources. The appropriate breeds must be selected based on the farm scale, workforce, capital, and agricultural machines possessed by the farms. In addition, the commerciality of the relevant breeds must be considered. The opening of sales routes must be easy, and the breeds must guarantee a reasonable level of income generation through sales.

Second, the center supplied high-quality seeds with strong local adaptability. The breed with strong adaptability to the local environment was selected after test cultivating diverse breeds over numerous years. One of the reasons the agricultural productivity is low in developing countries is that they insist on cultivating traditional breeds that have low productivity. They must, in the end, use new excellent breeds that are highly productive to enhance the overall productivity. One of the main missions of the KOPIA centers is to select breeds that can excellently adapt to the local environment by test cultivating Korean breeds locally. Then, it must register the breed with the relevant country's breed registration agency and supply it to general farms.

Third, the center provided agricultural equipment necessary for cultivation. Most of the equipment was small such as manual sowing machines and sprays that do not require additional energy such as fuel or electricity and are easy to manage afterward. Therefore, no follow-up costs were necessary, and while the productivity improved, the necessary workforce dropped. In general, programs that support mainly agricultural machines to large-scale farms can be difficult to manage and sustainably use because they require fuel supply or the procurement of parts.

Fourth, farming training was provided on how to appropriately fertilize, use eco-friendly foliar spray, and reasonably rotate crops. This helped reduce the number of pesticides and fertilizers used and enhance the product quality by preventing diseases and pests. Eco-friendly manure was used, and green manure crops were introduced to realize eco-friendly and sustainable farming. A public-private committee with the participation of about 420 members from private companies, the Korean government, local governments, administrative agencies, industrial associations, nonprofit organizations (NPOs), and government ministries was formed to pursue the strategies.

2) The Sesame Seed Development Cooperation Case of Japan and Myanmar

Japan has drawn up a Global Food Value Chain (GFVC) strategy and pursues agricultural produce trade connected with international development cooperation in the agricultural field and the global advancement of its farming and food companies. The main goals of GFVC are as follows. First, develop a food value chain by tapping on the unique

advantages of the Japanese food industry and by having the public and private sectors, and academe, cooperate. Second, promote the economic growth of developing countries by having the Japanese food industry officially economically cooperate with and invest in them. Third, promote the export of the Japanese food and food-related infrastructure and support the overseas business of the Japanese food industry. Channels for cooperation and discussions with main partner companies have been prepared, and strategies customized to them have been drawn up. For example, in its road map for a food value chain with Myanmar, it classifies measures for cooperation largely based on items and those that encompass all items. The selected items for cooperation include rice, beans, oilseed crops, and garden products (MAFF, 2019). Sesame seeds are included in the oilseed crops.

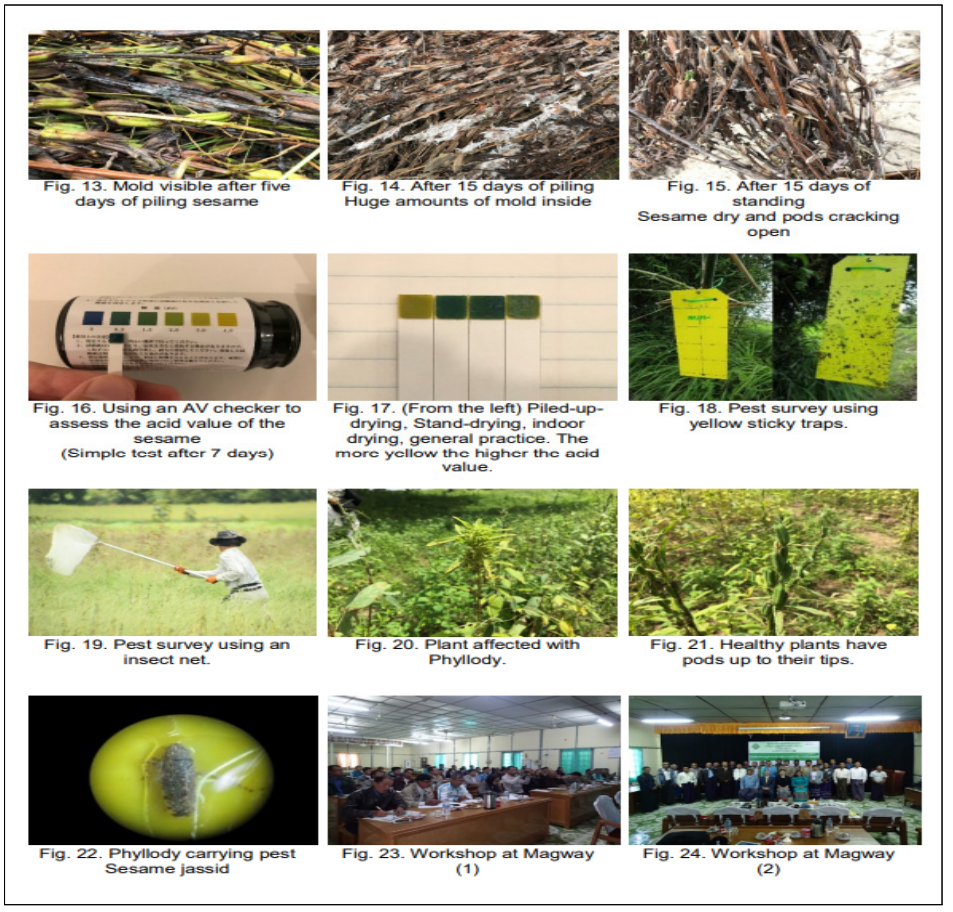
As part of its Overseas Development Assistance (ODA), Japan hands down technologies for cultivating sesame seeds to farms in Myanmar or approaches them as academic research subject to supply effective technologies. For example, the Japan Association for International Collaboration of Agriculture and Forestry (JAICAF) (2019) compared the degree of mold generation in the drying process of sesame seeds by either piling them up on bare grounds, or having them stand on bare grounds or indoors, after their harvesting and then investigated and analyzed the pests to enhance the quality and productivity of the seeds in Magway, Myanmar. As such, the supply of breeds to farms in Myanmar and the handing down of cultivation technologies increased their productivity and improved their quality. This is not unrelated to the demand of Japan, which mainly imports high-quality black sesame seeds. Japan almost does not produce

any sesame seeds in their own country that it must depend on import. It is, therefore, very important for it to stably import high-quality sesame seeds at low cost, process them, and then export them with high added value as part of its GFVC strategy.

〈Figure 26〉 Technical Cooperation Project for Agricultural Productivity and Quality Improvement in Myanmar (1)

Source: JAICAF (2019)

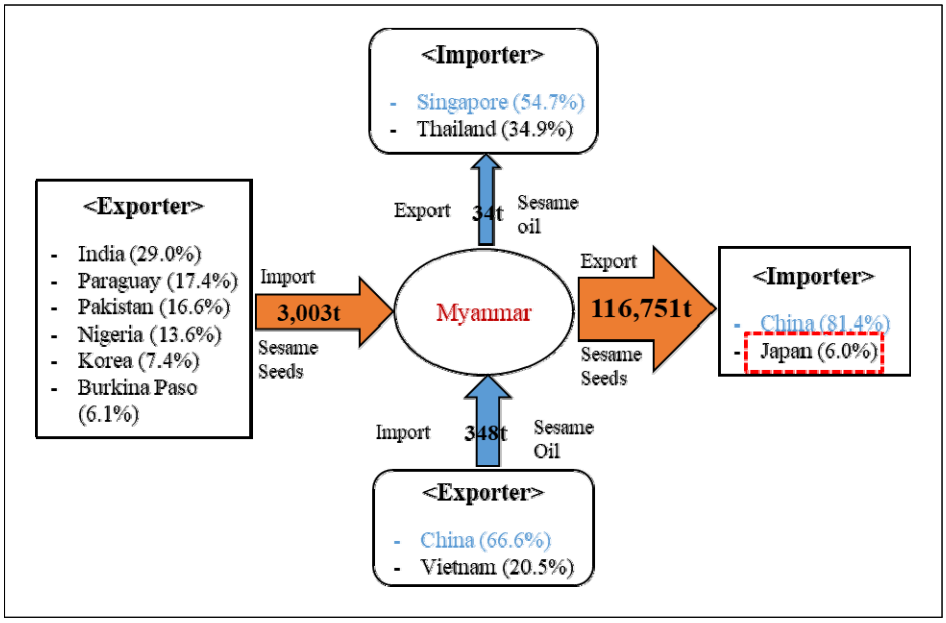
〈Figure 27〉 Technical Cooperation Project for Agricultural Productivity and Quality Improvement in Myanmar (2)



Source: JAICAF (2019)

Myanmar's export partners of sesame seeds are China and Japan. Of course, export to Japan accounts for about 7,000 t and only 6% of the total exported quantity from Myanmar. However, its geographical proximity to Myanmar and the high potential for bilateral cooperation for the development of Myanmar's sesame seed industry offers great potential for expanded bilateral trade between Japan and Myanmar in the future.

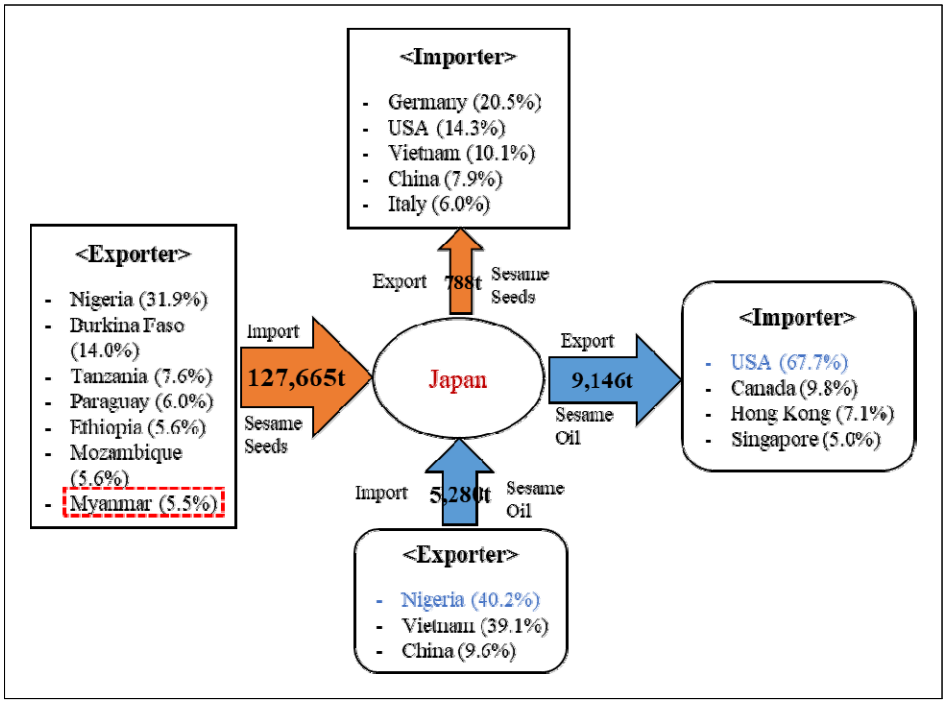
〈Figure 28〉 Export and Import of Sesame Seeds and Sesame Oil to and from Myanmar (2018)



Source: Ji (2019)

Myanmar accounts for only 5.5% of the sesame seeds imported to Japan, and Japan still imports most of its sesame seeds from African countries. This must be because the quality and price are more competitive there. Although Japan is a country net importing sesame seeds, it exported about 9,000 t of sesame oil. This shows that Japan enjoys added value by trading processed seeds and that it is dutifully executing its GFVC strategy.

〈Figure 29〉 Export and Import of Sesame Seeds and Oil from and into Japan (2018)



Source: Ji (2019)

3) Lessons Learned for the Pursuit of a Development Cooperation Project in the Field of Sesame Seeds between Korea and Vietnam

Korea's low sesame seed yield is not at all because it lacks cultivation technology. It is rather because it cannot reach the expected yield because of the rainy season damages during the growth period of the seeds. In fact, it has developed and possesses diverse, high-quality seeds of high productivity. It has recently developed and supplies diverse machines for the mechanization of the entire production process of the seeds to solve the problem of labor shortage. Therefore, Korea can enhance productivity by supplying high-yielding, high-quality seeds to developing countries and replacing traditional breeds of low productivity. In addition, Korea can

save on labor costs and enhance the work efficiency of farms in developing countries that are still relying most of its processing on manual labor by providing them with the machines that it has recently developed.

Only, to enjoy achievements like the project in Paraguay, the factors that contributed to its success should be actively reflected in the project with Vietnam. That is, breeds that fit the local conditions should be selected through test cultivation. This can be jointly pursued by collaborating with the KOPIA center in Vietnam (The center plans to test cultivate sesame seed breeds to check their adaptability in 2022). In addition, the demand of the local farms should be actively reflected, and most of all, marketing strategies should be prepared so that they may sell the produced seeds at reasonable prices. For the cultivation process, measures to respond to abnormal climates such as heavy rain and dry spells should be prepared. When investing financially, mainly agricultural equipment that is easy to follow-up manage should be provided, such as manual sowing machines. Furthermore, information and technology for making eco-friendly manure and liquefied fertilizers that can be produced by procuring raw materials locally, pest control, and reasonable crop rotation systems should be handed down through farming training.

As in the case of Japan, development cooperation projects should not be pursued independently but connected to farmed produce trade and related companies' business in Korea for the comprehensive pursuit of GFVC strategies and enjoyment of synergistic effects. That is, Korea should not only consider improving the quality of life of Vietnamese farms producing sesame seeds or increasing their income generation through development cooperation projects, but also support the advancement of Korean

companies related to sesame seeds in Vietnam so that they may directly and indirectly participate in the project and expand their business ecosystem. In addition, given that Korea heavily relies on the import of sesame seeds, it should sufficiently devise measures to secure high-quality, low costing seeds by vitalizing bilateral trade between Korea and Vietnam. If Korea adopts this approach, upgrading the overall value chain from production to the processing, distribution, export, and consumption of the Vietnamese sesame seed industry can be expected.

8 Suggestions

8.1. Suggestions on sesame production associated with new rural development in Dong Thap and Nghe An

8.1.1. Establish raw material areas associated with new rural communes

It is necessary to build a concentrated raw material area while promoting the application of high technology to improve productivity and product quality, and protect the ecological environment, which result in improving sesame yield and product quality.

Farmers must carefully prepare the stage of soil preparation, selection of varieties, fertilizing regime, and reasonable spraying. Planting density is

suitable, it is necessary to treat seeds. Learn from experience from good farmers in the area, follow the seasonal schedule and recommendations from extension staff as well as staff of the plant protection company.

It is also imperative to limit the use of fertilizers and pesticides in the production process, not only reducing input costs, protecting the environment, improving soil, protecting the health of production participants and people around.

8.1.2. Organizing production through cooperatives and enterprises

Promoting the formation and development of production links along the value chain in the province helps strengthen linkages between farmer households, enterprises, cooperatives, cooperative groups to expand production scale and form closed chains from production to processing and consumption of agricultural products, applying advanced technology and producing large goods.

In addition, it is needed to support for initial facilities, professional training, organization and operation guidance for organizations, support for training, education, and complete the organization of the associations/industry association to guide and mobilize members to fully comply with the provisions of the supply chain of safe agro-forestry-fishery products.

8.1.3. Human resource training

In recent years with the decline of varieties, leading to reduced productivity and product quality, household owners mainly use chemical fertilizers, rarely use organic fertilizers - degraded, barren soil. In the coming time, the cooperative will guide the associated households to use new techniques according to the process and use microbial fertilizers and manure, thus leading to improving the capacity of existing suppliers to produce the required quantity of raw materials.

Training and educating farmers on the production process and use of pesticides should be carried out when participating in agricultural production.

For farmers involved in sesame production, it is necessary to actively participate in agricultural extension work, technical training courses to capture production experience, actively approach science and technology and introduce new farming methods into production to increase profits for producers.

For local authorities, it is vital to open agricultural extension classes, regular training courses for farmers to help farmers improve production efficiency as well as be ready to cope with the complicated situation of pests and diseases and extreme weather.

In order to strengthen the capacity of management agencies and professional organizations, they are required to invest in upgrading facilities, working equipment, rapid testing equipment at the scene, laboratory equipment for the agency system.

For safety management of local food, it is necessary to regularly inspect

and strictly manage fertilizers as well as pesticides on the market to avoid counterfeiting, which is costly for farmers. Simultaneously, prices of fertilizers as well as pesticides should be stabilized, enabling farmers to feel secure in production.

As a result, the project intervention activities with technical supports can improve the production knowledge and practices at different levels. For instance, at the farm level, the involved farmers can gain the knowledge and apply in their farms and train the neighbours to replicate. The training activities are provided to both farmers and other stakeholders including extension staff so that they can scale up the project model in the future to obtain a long-term goal of the local production systems transition to be more effective and more sustainable.

8.1.4. Production linkage

Farmers have linked together to form cooperatives, clubs or farmers' associations to share production experiences and support each other when facing difficult problems in the production process. It is necessary to help each other in the production process, share and contribute ideas to improve the production process of farmers in the production area. There should be a link between 4 houses: farmers, the state, banks and product consumers to help, support capital or technology and have a place to consume products when producing. Promulgating and implementing policies will encourage and create favorable conditions for production linkages along the value chain.

8.1.5. Solutions on cooperation and linkage between production and consumption

The implementation of the model of linking production with consumption will be convenient and highly effective when the partners participating in the model have had a trading relationship with each other before and the enterprise has good business capacity. The linkage model exists and develops sustainably only when the trading relationship between enterprises and farmers is built on a voluntary basis and mutually beneficial.

The traditional purchasing locations of enterprises and the distance from the production area close to the purchasing enterprises also contribute significantly to the process of building cooperative relationships between enterprises, cooperatives and farmers. If necessary, having legality and binding responsibility in the performance of production association contracts associated with product consumption between enterprises, cooperatives and farmers would be supportive.

The capacity and business strategy of the enterprise have a great impact and influence on the results of building the affiliate model. The market is expanding, exporting in the direction of official channels creates conditions for businesses to do stable and sustainable business, so that farmers trust and feel more secure in businesses.

Local regulatory agencies must often play a mediating role in listening to opinions when there are problems with the association model, especially in the field of buying and selling or mediating conflicts. between farmers and businesses.

Creating favorable conditions to participate in market surveys, safe agricultural product fairs, or product identification weeks organized by provinces and cities also enables companies and entreprenuers to introduce theirs safe agricultural products and promote the increase of its consumption.

There are five steps of development and exploitation strategy for each market as follows; First, improve production capacity, help the stages of production, preservation, processing and consumption to identify target customers and target customers' requirements. Second, build a production system to meet the needs of target customers. Third, develop practice rules for pre-harvest processing of products. Fourth, build and sign contracts to sell manufactured products. Lastly, build a brand and an electronic traceability system for the product.

8.2. ODA project proposal

Project title: Sesame Production Associated with New Rural Development in Vietnam

8.2.1. Application information

Applicant Information	
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8.2.2. Basic project information

1.1	Country	Vietnam
1.2	Title	Sesame Production Associated with New Rural Development in Vietnam
1.3	Location(s)	Nghe An and Dong Thap provinces
1.4	Duration	48 months (2023–2026)
1.5	Budget (total)	2,970,000 USD
1.6	Objectives	The sesame value chain is stably developed in the project area, Public human resource capacity is enhanced to support actors of the sesame value chain, The cooperative' capacities are equipped with improved knowledge and practices, supported facilities, machines, and improved seeds to reduce production input costs and enhance sesame quality for better value chain performance. The distribution of sesame is stably established in the project area.
1.7	Beneficiary	– Agriculture Cooperatives (around 2 cooperative /2districts per province) total 8 cooperatives in 2 provinces – 10,000 farmers – Extension Staff in the target area – The staff of NAEC/DARD of the target area
1.8	Implementing organization	Name : National Agriculture Extension Center

8.2.3. Project rationale

Current situation of sesame production in Nghe An province

Nghe An has the largest sesame production area in the North, accounting for 30% of the area and nearly 40% of the national output, concentrated in districts such as Dien Chau, Nghi Loc, Nam Dan, Vinh City, and Tan Ky, Quynh Luu... in which Dien Chau district has the largest area, accounting for 50 - 60% of the Province's area; Sesame is grown in 2 seasons of Winter-Spring and Summer-Autumn. In recent years, the area of sesame in the whole province has remained about 3,000 ha/year,

specifically: 3,653 ha in 2019 with an average yield of 0.74 tons/ha, an output of 2,700 tons; In 2020 the area was 3,270 ha; average yield 0.4 tons/ha, an output of 1,300 tons; In 2021, the province's planting area is 2,974 ha, the average yield of 0.70 tons/ha, and the output will be 2,200 tons.

In the 3 years from 2019 to 2021, the sesame growing area has decreased compared to previous years, the yield fluctuated and reached the lowest level in 2020 at only 0.4 tons/ha; Output in 2019 reached the highest at 2,700 tons.

Regarding the use of varieties, Nghe An province mainly uses local sesame varieties (black sesame, yellow sesame...) and new sesame varieties such a V6; VD11; VD16... Local sesame seeds are planted by farmers themselves, degraded, susceptible to pests and diseases, and low yield. New sesame varieties V6; VD11; VD16 has been selected by research agencies with a high and stable yield that can reach from 0.8 - 1.0 tons/ha, depending on the variety and the level of cultivation; has a growing period of 80-90 days, in which the variety VD11 excels in disease resistance, fruit separation, spill resistance and good drought tolerance.

Thus, sesame varieties produced in Nghe An are still poor, mainly are local sesame varieties, which farmers have planted themselves, have many disadvantages, and low productivity. New sesame varieties V6; VD11; VD16 has a high yield and is more resistant to diseases than local varieties, but the planting area is not much because farmers have not had access to it.

For distribution of sesame, most sesame seeds are selling in local markets through middle collectors or being collected by small enterprises located in the Dien Chau and Yen Thanh districts, the stable distribution system has not been established.

Current situation of sesame production in Dong Thap province

Dong Thap is a province located upstream of the Tien River, with an alluvial land area of 164,541 ha, accounting for 48.63% of the natural area, abundant fresh water, so it is very convenient for the development of dry crops. especially cash crops (corn, sweet potato, sesame, legumes, etc.), agro-forestry plants (sugar cane, jute, sedge, tobacco...) and ornamental flowers.

In addition to the areas with dykes for thorough flood control, it is very convenient for three-crop rotation farming on rice land such as 02 rice crops, 01 vegetable crop, or 02 rice crops, 01 crop crop for high economic efficiency, the province Dong Thap also has advantages for cultivating specialized vegetables or cash crops (sesame, soybeans, corn...) on the islets, high dunes, fertile soil and convenient to apply advanced technology to create quality products.

With favorable soil and climate conditions, short growing period, average sesame yield of 1.0 - 1.4 tons/ha, low investment cost, stable selling price of raw materials on average 40,000 - 40,000 VND/kg, etc., the profit brought by sesame is 2-3 times higher than that of rice.

Most of the sesame varieties planted by farmers themselves are similar to those of floating origin, leading to confusion and degradation.

〈Figure 30〉 Sesame planted by farmers

However, the area of sesame in Dong Thap province has decreased gradually in recent years, to only 1,091 hectares in 2021. The main reason is the lack of labor (there is no mechanized machinery in sesame production); degraded, poor quality varieties; price of raw sesame decreased (the highest was 65,000 VND/kg in the years 2015-2016 and the lowest was 30,000 VND/kg in the last 2 years).

The main channels of purchasing sesame products in Dong Thap province is through traders. At the time of sesame harvest, after the households dry the products, traders or collectors come to the households to purchase. Traders are the main subjects that decide the price of products. The price is offered by the trader, and the farmer agrees and will sell it to the trader at a reasonable price, without close cooperation in

production to consumption, farmers selling to traders often face price pressure, selling to collectors is only temporary, not a long consist.

Country development strategy and policies

The National target program on New Rural Construction called the New Rural Program is an overall program on socio-economic development, politics and national security, including 11 contents as follows:

1) New rural construction planning
2) Socio-economic infrastructure development
3) Restructuring, economic development, income improvement.
4) Poverty reduction and social security.
5) Innovating and developing effective forms of production organization in rural areas
6) Development of education and training in rural areas
7) Medical development and health care for rural residents
8) Building cultural life, information and communication in rural areas.
9) Clean water supply and rural environmental sanitation
10) Improve the quality of Party, government and socio-political organizations in the locality.
11) Maintain security and social order in rural areas

Among the above contents, developing value chains at the national, provincial and local levels with a comprehensive supporting package proposed like this ODA project can strongly help to achieve most of the program contents, which are the content number 2, 3, 4, 5, 6, 8 and 11.

According to the reported summary of the program during 2016-2020, there were different funds to support the achievement of the program in

which the local one plays an important role, focusing on local value chain development. According to the summary, this development investment capital has been concentrated by localities on several essential works, in which the local value chain was accounted for 26.8% - higher than other fields.

In 2021, Deputy Prime Minister Pham Binh Minh has just signed Decision No. 1689/QD-TTg promulgating the implementation plan for the implementation of Resolution No. 25/2021/QH15 dated July 28, 2021, of the National Assembly on approving the investment policy of the National Assembly. submit the national target for building new rural areas for the period of 2021-2025.

Therefore, this project to improve the sesame value chain is directly linked to the National target program, and its activities can contribute to the local achievement, which will draw the attention and involvement of the local related agencies and the value chain stakeholders. This may facilitate the feasibility of the project implementation and results.

Justification for intervention

The project is determined to cover the following areas:

Establish raw material areas associated with new rural communes:

Building a concentrated raw material area while promoting the application of high technology to improve productivity and product quality, and protect the ecological environment. Improve sesame yield and improve product quality.

Farmers must carefully prepare the stage of soil preparation, selection of varieties, fertilizing regime, and reasonable spraying. Planting density is

suitable, it is necessary to treat seeds. Learn from experience from good farmers in the area, follow the seasonal schedule and recommendations from extension staff as well as staff of the plant protection company.

It is necessary to limit the use of fertilizers and pesticides in the production process, not only reducing input costs, protecting the environment, improving soil, protecting the health of production participants and people around.

Organizing production through cooperatives and enterprises

Promote the formation and development of production links along the value chain in the province: strengthen linkages between farmer households, enterprises, cooperatives, cooperative groups to expand production scale and form closed chains from production to processing and consumption of agricultural products, applying advanced technology and producing large goods.

Support for initial facilities, professional training, organization and operation guidance for organizations, Support for training, education, and complete the organization of the associations/industry association to guide and mobilize members to fully comply with the provisions of the supply chain of safe agro-forestry-fishery products.

Production linkage

together to form cooperatives, clubs or farmers' associations to share production experiences and support each other when facing difficult problems in the production process. It is necessary to help each other in the production process, share and contribute ideas to improve the production process of farmers in the production area.

There should be a link between 4 houses: farmers, the state, banks and

product consumers to help, support capital, technology and have a place to consume products when producing.

Promulgating and implementing policies to encourage and create favorable conditions for production linkages along the value chain.

Cooperation and linkage between production and consumption

The implementation of the model of linking production with consumption will be convenient and highly effective when the partners participating in the model have had a trading relationship with each other before and the enterprise has a good business capacity.

The linkage model exists and develops sustainably only when the trading relationship between enterprises and farmers is built voluntarily and mutually beneficial.

8.2.4. Lessons learned

Lessons Learned for the Pursuit of a Development Cooperation Project in the Field of Sesame Seeds between Korea and Vietnam

Korea's low sesame seed yield is not at all because it lacks cultivation technology. It is rather because it cannot reach the expected yield because of the rainy season damages during the growth period of the seeds. In fact, it has developed and possesses diverse, high-quality seeds of high productivity. It has recently developed and supplies diverse machines for the mechanization of the entire production process of the seeds to solve the problem of labor shortage. Therefore, Korea can enhance productivity by supplying high-yielding, high-quality seeds to developing countries and

replacing traditional breeds of low productivity. In addition, Korea can save on labor costs and enhance the work efficiency of farms in developing countries that are still relying most of its processing on manual labor by providing them with the machines that it has recently developed.

Only, to enjoy achievements like the project in Paraguay, the factors that contributed to its success should be actively reflected in the project with Vietnam. That is, breeds that fit the local conditions should be selected through test cultivation. This can be jointly pursued by collaborating with the KOPIA center in Vietnam (The center plans to test cultivate sesame seed breeds to check their adaptability in 2022). In addition, the demand of the local farms should be actively reflected, and most of all, marketing strategies should be prepared so that they may sell the produced seeds at reasonable prices. For the cultivation process, measures to respond to abnormal climates such as heavy rain and dry spells should be prepared. When investing financially, mainly agricultural equipment that is easy to follow-up manage should be provided, such as manual sowing machines. Furthermore, information and technology for making eco-friendly manure and liquefied fertilizers that can be produced by procuring raw materials locally, pest control, and reasonable crop rotation systems should be handed down through farming training.

As in the case of Japan, development cooperation projects should not be pursued independently but connected to farmed produce trade and related companies' business in Korea for the comprehensive pursuit of GFVC strategies and enjoyment of synergistic effects. That is, Korea should not only consider improving the quality of life of Vietnamese farms producing sesame seeds or increasing their income generation through development

cooperation projects, but also support the advancement of Korean companies related to sesame seeds in Vietnam so that they may directly and indirectly participate in the project and expand their business ecosystem. In addition, given that Korea heavily relies on the import of sesame seeds, it should sufficiently devise measures to secure high-quality, low costing seeds by vitalizing bilateral trade between Korea and Vietnam. If Korea adopts this approach, upgrading the overall value chain from production to the processing, distribution, export, and consumption of the Vietnamese sesame seed industry can be expected.

8.2.5. Project description

The project goal

Sustainable sesame production is established in the project area, contributingng to the development of the National Target pprogram on New Rural Development in Vietnam

The project objectives

The sesame value chain is stably developed in the project area, public human resource capacity is enhanced to support actors of the sesame value chain, the cooperative' capacities are equipped with improved knowledge and practices, supported facilities, machines, and improved seeds to reduce production input costs and enhance sesame quality for better value chain performance. The distribution of sesame is stably established in the project area

Outcome: Sesame value chains are strengthened in the project area

Output 1: Human resources are developed to promote the extension of quality sesame production and commercialization

Output 2: Production and management capacities of the target cooperatives are improved to produce qualified sesame

Output 3: Partnership among value chain stakeholders are improved

Output 4: Enhancing domestic and exported markets of target cooperatives in the high-end market in Vietnam, in Korea and other countries

Activities:

To achieve the output 1 following activities are recommended:

- **Activity 1.1**: Develop training material on sesame cultivation techniques, post-harvesting, processing, and sesame production organization (for cooperative management and the value chain development…);
- **Activity 1.2**: Conducting TOT training courses for extension staff at different levels;
- **Activity 1.3**: Study-tours visiting Korea to learn Korean experiences on sesame production and commercialization;
- **Activity 1.4**: Expertise exchange between Korea and Vietnam on sesame production and commercialization.

The following activities will be implemented to achieve the output 2:

- **Activity 2.1**: Testing Korean sesame varieties in the project area, if it is successful, the varieties will be planted in the target area of the selected cooperatives; (KOPIA in association with VAAS has introduced some Koreal Sesame varieties in Vietnam, These varieties will be tested accordingly)
- **Activity 2.2**: Supporting Korean machines for sesame cultivation, post-harvesting, storing and processing accordingly;(It is necessary to consider and select suitable machines such as land preparation machines and post -harvesting equipments)
- **Activity 2.3**: Support cooperatives with sesame cultivation techniques;
- **Activity 2.4**: Technical guiding for target cooperatives in using the provided machines;
- **Activity 2.5**: Providing training for cooperative staff on the co-op management, marketing and negotiation with other stakeholders

The following activities are recommended to achieve output 3:

- **Activity 3.1**: Identify the need of the stakeholders to enhance their business
- **Activity 3.2**: Preparing the plan to support them to meet their needs
- **Activity 3.3**: Building linkages between the key stakeholders (producers, traders, processors, and exporters)

To target output 4 the following activities are recommended

- **Activity 4.1**: Establishing the distribution line to Korea, thereby the Korean experts will support the business promotion, marketing;
- **Activity 4.2**: Supporting traders (Korean companies) for collecting sesame;
- **Activity 4.3**: Supporting the cooperatives to access super markets and shops in the value chain;
- **Activity 4.4**: Marketing promotion through branding, organizing events and broadcasting through the national and local levels

8.2.6. Stakeholder analysis

Both core stakeholders or value chain and supporting function stakeholders will be beneficiaries of the project. The value chain stakeholders are the ones can significantly improve the efficiency of the value chain, including farmers/producers, traders, processors. The supporting stakeholders involved in the project can be at the central or local level, especially the provincial extension centres in two targeted provinces.

- About 10,000 farmer households in 6 communes selected in 2 provinces are the direct beneficiaries of the project
- Related agency in the value chain (enterprises, processing facilities, local governments, socio-political organizations ...) are indirectly beneficiaries of the project

- Beneficiaries participating in all project components
- The beneficiary selection criteria will be implemented in a fair and inclusive manner. This project will focus on women's participation. In particular, we will support the participation of women headed families. The total direct beneficiaries of this project are estimated at 20,000 people in the three provinces,

(a) smallholder farmers and women and agricultural workers

(b) small and medium-sized farmers

(c) the value chain actors (wholesalers, retailers)

(d) agricultural workers

(e) farmers cooperatives, agricultural entrepreneurs, agricultural enterprises, exporters

(f) consumers, etc.

Ministry of Agriculture and Rural Development: Leading Agency

- Ministry of Industry and Trade: Collaborator
- People's Committee of 02 provinces: Collaborators
- Agriculture Extension System including National Agriculture Extension Center, and Provincial Extension Centers of Nghe An and Dong Thap provinces

8.2.7. Project management and implementation

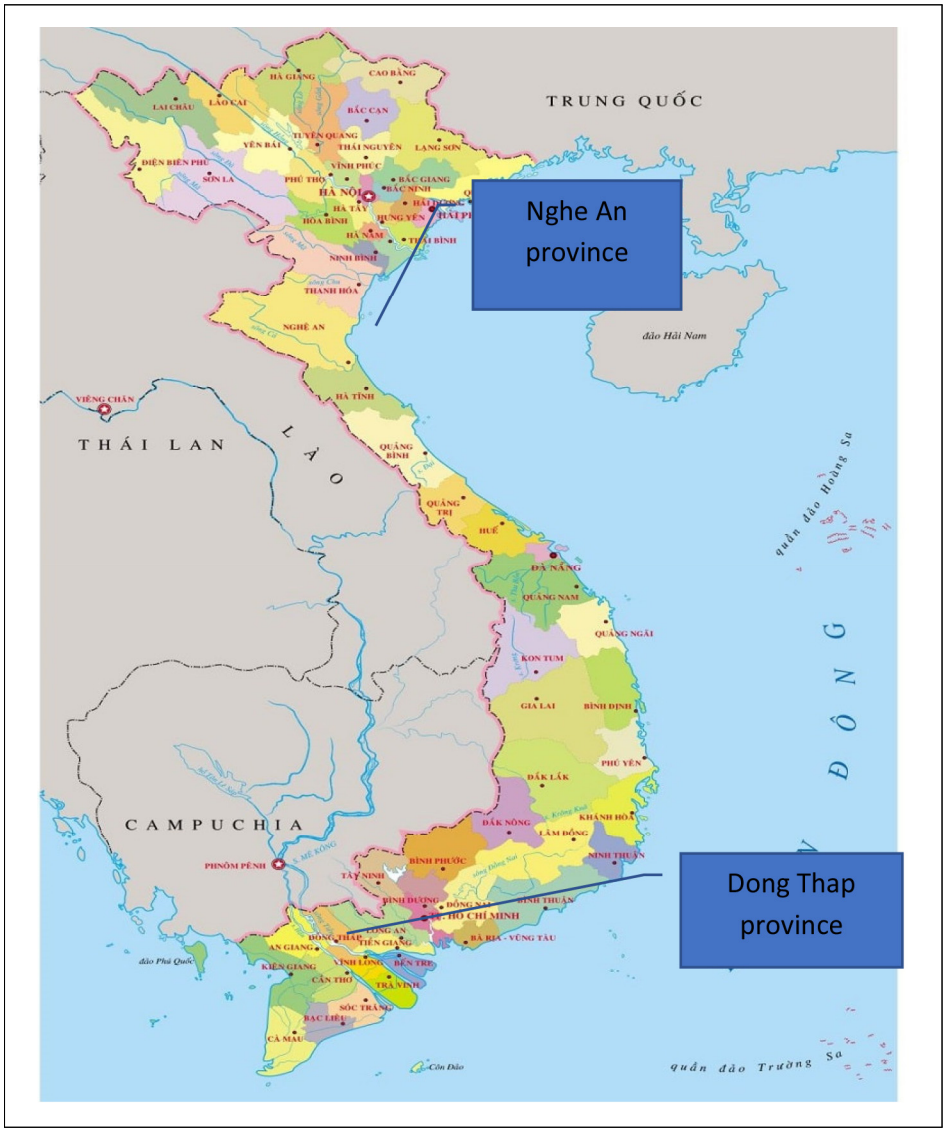
- MARD is responsible for planning and management of the Project operations as well as coordinating other organizations and associated with the Project
- A Project Steering Board was established in MARD
- 02 local Project management board located at 02 DARD in 02 provinces under the Decision of the Chairman of the Provincial People's Committee

8.2.8. Budget estimation

Activities	2022	2023	2024	2025	Sum
Nghe An province	**120,000**	**120,000**	**300,000**	**250,000**	**790,000**
Output 1: Human resources are developed to promote the extension of quality sesame production and commercialization: Major Activities: Capacity building for extension staff, cooperative staff, technical staff	30,000	30,000	30,000	30,000	**120,000**
Output 2: Production and management capacities of the target cooperatives are improved to produce qualified sesame: Major activities: Supporting agriculture machines and equipments to cooperative s	50,000	50,000	50,000	10,000	**160,000**
Output 3: Partnership among value chain stakeholders are improved: Major activities: Capacity building for stakeholders (training/workshops/ field visits)	10,000	15,000	200,000	200,000	**425,000**

Activities	2022	2023	2024	2025	Sum
Output 4: Enhancing domestic and exported markets of target cooperatives in the high-end market in Vietnam, in Korea and other countries: Major activities: establishing distribution line accordingly	20,000	25,000	20,000	10,000	**75,000**
Dong Thap province	**90,000**	**80,000**	**265,000**	**255,000**	**690,000**
Output 1: Human resources are developed to promote the extension of quality sesame production and commercialization: Major Activities: Capacity building for extension staff, cooperative staff, technical staff	20,000	15,000	20,000	20,000	**75,000**
Output 2: Production and management capacities of the target cooperatives are improved to produce qualified sesame: Major activities: Supporting agriculture machines and equipment to cooperative	30,000	25,000	200,000	200,000	**455,000**
Output 3: Partnership among value chain stakeholders are improved: Major activities: Capacity building for stakeholders (training/workshops/ field visits)	25,000	20,000	30,000	25,000	**100,000**
Output 4: Enhancing domestic and exported markets of target cooperatives in the high-end market in Vietnam, in Korea and other countries: Major activities: establishing distribution line accordingly	15,000	20,000	15,000	10,000	**60,000**
Personnel/project implementation	150,000	300,000	200,000	100,000	750,000
Value chain study	150,000	150,000	–	–	300,000
Site office expenses	100,000	100,000	100,000	100,000	400,000
Monitoring and evaluation	20,000		20,000		40,000
Total					**2,970,000**

8.2.9. Project Location Map



8.2.10. Project Design Matrix

- **Project Title**:
- **Period of Project**: Four (4) years (April 2022 to April 2025) (TBC)
- **Implementing Agency**: National Agriculture Extension Center (NAEC)
- **Project Area**: Nghe An, Dong Thap provinces
- **Direct Beneficiaries**: Officers of MARD (NAEC) and DARD, target extension staff in the project area
- **Indirect Beneficiaries**: Target agricultural cooperatives in the project area, and other extension staff and cooperatives in the project area who receive trainings.

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Important Assumptions
Overall Goal: Sustainable sesame production is established in the project area, contributed development of National target program on new rural development in Vietnam	1. Sesame area which applied project technology in the project area is increase by 50%, since the end of the Project. 2. Target agricultural cooperatives contracted to sale their sesame products (the number of contracts increased 20%)	- Monitoring Sheets - Agricultural statistics gathered and followed up by project - Questionnaire/Interview to MARD/DARD/extension staff/agricultural cooperatives	
Project Purpose: Sesame value chain is stable developed in the project area, public human recourse capacity is enhanced to support actors of existing sesame value chain, the cooperatives are equipped facilities, machines to reduce production input cost. The distribution of sesame is stable established in the project area.	1. Gross profit per unit area of sesame produced by the target agricultural cooperatives is increased by 20% compared to the time before project implemented. 2. More than 20% of agricultural cooperatives expanded their sales channels compared to the time before project implements	- Baseline survey / Endline survey - Monitoring - Reports produce in the Project - Record farm management by target cooperatives - Questionnaire/Interview to agricultural cooperatives.	Sufficient budget and personnel is not secured by MARD/DARD to implement the action plan. Serious economic crisis will not occur in Viet Nam.
			Crop production is not severely
Output 1:	1-1. More than XX	- Baseline survey / Endline	

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Important Assumptions
Human resources are developed to promote extension safe sesame	extension staff are trained in the project area. 1-2. Knowledge of the target extension staff on sesame cultivation (new sesame varieties) is increased by 40%, compared to before attending the trainings by the Project. 1-3. Knowledge of target extension staff on the market needs and marketing is increased by xx % compared to before attending the training. 1-4. The number of extension staff in the project area who have knowledge of sesame is increased by xx people from the time of the project implemented 1-5. The number of farmers who replied that they have received effective instructions on sesame cultivation from extension staff is increased by % compared to the time before project implemented 1-6. The number of farmers who replied that they have received effective instructions on market needs and marketing from extension staff is increased by 50% compared to the time project implemented	survey - Reports produce in the Project - Monitoring sheets - Results of the tests conducted to extension staff - Questionnaire/Interview to extension staff/farmers in agricultural cooperatives	affected by the extreme climates and spread of pests and diseases. Serious economic crisis will not occur in Viet Nam.
Output 2: Production and management capacities of the target cooperatives are improved to produce qualified sesame	2-1. More than 4 cooperatives are equipped machines (land preparation, tending, harvesting, processing) 2-2. Storing houses and processing sesame manufacture of cooperative established 2-3. The number of	- Baseline survey / End line survey - Reports produce in the Project - Monitoring sheets - Record farm management by target cooperatives (including area - Questionnaire/Interview to extension staff/agricultural cooperatives	

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Important Assumptions
	cooperatives applying sesame cultivation technology (new varieties, improved techniques is increased by 20 % compared to the time before the project implemented 2-4. The area of target agricultural cooperatives' field which applies Korea technology is increased by 20% compared to the time before the project implemented		
Output 3: Exported sesame/sesame products of target cooperatives to Korea and other countries	3-1. 20 % sesame products of target cooperative are exported to Korea and other countries 3-2. Target cooperatives accessed to sesame collectors/traders 3-3. Sesame value chain improved	- Reports produce in the Project - Monitoring sheets - Questionnaire/Interview to value chain stakeholders	
Activities: **Activity 1** 0-1. Review the market and cultivation status of safe crops in the project area. 0-2. Set the selection criteria and select target cooperatives (candidates). 0-3. Organize orientation meetings to the candidates and select cooperatives who agrees with the Project activity as the final target groups. 0-4. Conduct the baseline survey. 0-5. Monitor the farm management (cultivating area, sales volume, selling price etc. of sesame) of the target cooperatives in each cropping season. 0-6. Conduct the end-line survey.	**Input**		
Activity 2 1-1. Prepare draft curriculums and training materials on Sesame extension (i.e. market survey method, farm management planning skills, production skills.) 1-2. Conduct Trainings for Trainers (TOT) for NAEC/Provincial agriculture extension centers (AECs). 1-3. NAEC/Provincial AECs conduct	**Korean Side** • Korean experts (long-term/short-term) • Trainings in Korea • Office equipment • Korean agriculture machines • Others, if necessary	**Vietnamese Side** • Allocation of counterpart personnel (Project Director, Project Manager, Project Officer, CPMU/PPMU members, Safe Crops WG members) • Project office • Budget for operational cost for the Project implementation (electricity, water, internet access of the project office, travel allowance for the Vietnamese counterpart personnel etc.)	Personnel of CPMU/PPMU does not change frequently. Field activities (i.e. face-to-face events and trainings) are severely not limited due to COVID-19. Sufficient counterpart budget/personnel is not secured by MARD/DARD.

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Important Assumptions
trainings for extension staff in charge of the target cooperatives. 1-4. Extension staff conduct trainings to target cooperatives. 1-5. Revise the draft curriculums/ teaching materials as necessary based on the training results (understanding of extension staff farmers, etc.). 1-6. Project formulate work plan to promote extension of safe crops in project area. 1-7. Project conduct and monitor activities in the project area, based on work plan developed under 1-6.			
<u>Activity 3</u> 2-1. Extension staff, conduct trainings on the market survey to the target cooperatives. 2-2. Extension staff, support target cooperatives to conduct cooperative needs on infrastructure/facilities/ machines for sesame production 2-3. Korean experts provide training to cooperatives. 2-4. Korean side providing the machines/equipment imported form Korea to cooperative.			

8.2.11 . Project Work Plan

Description	2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Signing R/D																				
Establishment of Project Implementation Plan																				
Project management Selection of PC and dispatch of PM																				
Output 1: Human resources are developed to promote the extension of quality sesame production and commercialization:																				
Activity 1.1: Develop training material on sesame cultivation techniques, post-harvesting, processing, and sesame production organization (for cooperative management and the value chain development…).																				
Activity 1.2: Conducting TOT training courses for extension staff at different levels.																				
Activity 1.3: Study-tours visiting Korea to learn Korean experiences on sesame production and commercialization.																				
Activity 1.4: Expertise exchange between Korea and Vietnam on sesame production and commercialization.																				
Output 2: Production and management capacities of the target cooperatives are improved to produce qualified sesame																				
Activity 2.1: Testing Korean sesame varieties in the project area, if it is successful, the varieties will be planted in the target area of the selected cooperatives.																				
Activity 2.2: Supporting Korean machines for sesame cultivation, post-harvesting, storing and processing accordingly.																				
Activity 2.3: Support cooperatives withsesame cultivation techniques.																				
Activity 2.4: Technical guiding for target cooperatives in using the provided machines.																				

Description	2022				2023				2024				2025				2026			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.5: Providing training for cooperative staff on the co-op management, marketing and negotiation with other stakehoders.																				
Output 3: Partnership among value chain stakeholders are improved																				
Activity 3.1: Identify the need of the stakeholders to enhance their business.																				
Activity 3.2: Preparing the plan to support them to meet their needs.																				
Activity 3.3: Building linkages between the key stakeholders (producers, traders, processors, and exporters).																				
Output 4 : Enhancing domestic and exported markets of target cooperatives in the high-end market in Vietnam, in Korea and other countries																				
Activity 4.1: Establishing the distribution line to Korea, thereby the Korean experts will support the business promotion, marketing.																				
Activity 4.2: Supporting traders (Korean companies) for collecting sesame.																				
Activity 4.3: Supporting the cooperatives to access super markets and shops in the value chain.																				
Activity 4.4: Marketing promotion through branding, organizing events and broadcasting through the national and local levels.																				

Annexes

Annexe 1. Enterprises, cooperatives providing inputs and trading sesame in Dong Thap and Nghe An

#	Name and position	Detailed Information
I	Dong Thap	
1	Mr. Nguyen Tan Tien Director	- Representative of Tan Tien Dong Thap Agricultural Products One Member Co., Ltd - Add: 639 Nguyen Thai Hoc, Khom Thuan Phu, Hoa Thuan Ward, Cao Lanh City, Dong Thap - Mobile: 0983 856689
2	Mrs. Vo Thi Kieu Owner	- Representative of sesame purchasing - Add: Group 6, Hamlet 3, Binh Hang Trung commune, Cao Lanh district, Dong Thap - Mobile: 0932 986324
3	Mrs. Nguyen Thi Tuyen Agent Owner	- Representative of input supply: seed, fertilizer - Add: Hamlet 4, Binh Hang Trung commune, Cao Lanh district, Dong Thap - - Mobile: 0917268639
4	Mr. Nguyen Ngoc An Agent Owner	- Representative of input supply: seed, fertilizer - Add: Hamlet 4, Phong My commune, Cao Lanh district, Dong Thap - Mobile: 0979231125
5	Mr. Nguyen Đang Khoa Agent Owner	- Representative of input supply: seed, pesticide - Add: Hamlet 4, Binh Hang Trung commune, Cao Lanh district, Dong Thap
6	Mrs. Nguyen Nhat Linh Agent Owner	- Representative of input supply: seed, pesticide - Add: Hamlet 2, Binh Hang Trung commune, Cao Lanh district, Dong Thap - Mobile: 0979244117
7	Mrs. Nguyen Thi Kim Oanh Agent Owner	- Representative of input supply: seed, fertilizer, pesticide - Add: Hamlet 6, Phong My commune, Cao Lanh district, Dong Thap - Mobile: 0918782250

#	Name and position	Detailed Information
8	Mr. Tran Minh Thuan Agent Owner	- Representative of input supply: seed, fertilizer, pesticide - Add: Hamlet 1, Phong My commune, Cao Lanh district, Dong Thap - Mobile: 0919363443
9	Mrs. Huynh Thi Nga Agent Owner	- Representative of input supply: seed, fertilizer, pesticide - Add: My An Hung B commune, Lap Vo, Dong Thap - Mobile: 0907935955
10	Mr. Le Van Ha Agent Owner	- Representative of input supply: seed, fertilizer, pesticide - Add: My An Hung B commune, Lap Vo, Dong Thap - Mobile: 0973.939.706
11	Mrs. Bui Thi Sang Agent Owner	- Representative of input supply: seed, fertilizer, pesticide - Add: My An Hung B commune, Lap Vo, Dong Thap - Mobile: 02773.663.281
II	Nghe An	
12	Mr. Duong Nam Director	- Representative for Dong Thinh Cooperative - Add: Dien Thinh commune, Dien Chau district, Nghe An - Mobile: 0374660703
13	Mr. Pham Ngoc Thang Director	- Representative for Sy Thang Agro-Forestry-Fishery Import and Export Company Limited - Add: Hamlet 1, Dien Thinh commune, Dien Chau district, Nghe An - Mobile: 0913.076.385
14	Mr. Hoang Cong Đinh Director	- Bac Thinh Cooperative - Add: Hamlet 1, Dien Thinh commune, Dien Chau district, Nghe An - Mobile: 0382576693 - Email: htxnnbacthinh@gmail.com
15	Mr. Phan Van Ha Director	- Add: Dien Hung Cooperative, Dien Chau district, Nghe An - Mobile: 0915832496
16	Mr. Tran Van Hieu Director	- Add: Nam Thinh Cooperative, Dien Chau district, Nghe An - Mobile: 0374752889

Annexe 2. 120 interviewed households in Nghe An and Dong Thap

1. Nghe An province

#	Name	Address	Mobil number	Gender (1 Male, 2 Female)	Age
1	Cao Ngọc Thắng	Dien Thinh Commune, Nghe An	984186424	1	62
2	Cao Trọng Nhâm	Dien Thinh Commune, Nghe An	334363916	1	59
3	Hoàng Văn Huệ	Dien Thinh Commune, Nghe An	372194657	1	65
4	Hoàng Thị Nguyệt	Dien Thinh Commune, Nghe An	865136676	2	40
5	Dương Ngọc Hiếu	Dien Thinh Commune, Nghe An	398934007	1	38
6	Nguyễn Hữu Hiền	Dien Thinh Commune, Nghe An	967381586	1	42
7	Cao Thị Ngọc	Dien Thinh Commune, Nghe An	338769911	2	56
8	Cao Đức Thịnh	Dien Thinh Commune, Nghe An	915227179	1	66
9	Phạm Hưng	Dien Thinh Commune, Nghe An	919476286	1	40
10	Nguyễn Hữu Thanh	Dien Thinh Commune, Nghe An	979281585	1	64
11	Cao Trọng Hợi	Dien Thinh Commune, Nghe An	986937125	1	62
12	Đậu Trung Thu	Dien Thinh Commune, Nghe An	386597302	1	67
13	Phan Thị Thông	Dien Thinh Commune, Nghe An	349276721	2	56
14	Nguyễn Thị Thắng	Dien Thinh Commune, Nghe An	362335295	2	51
15	Cao Huy Sáu	Dien Thinh Commune, Nghe An	982651242	1	45
16	Cao Đức Diệu	Dien Thinh Commune, Nghe An	978845872	1	45
17	Nguyễn Thị Trường	Dien Thinh Commune, Nghe An	382391240	2	55

#	Name	Address	Mobil number	Gender (1 Male, 2 Female)	Age
18	Phan Thị Sáu	Dien Thinh Commune, Nghe An	939874246	2	59
19	Cao Thị Thủy	Dien Thinh Commune, Nghe An	977245007	2	63
20	Cao Thị Hằng	Dien Thinh Commune, Nghe An	367308625	2	36
21	Hoàng Văn Thọ	Dien Thinh Commune, Nghe An	356785689	1	62
22	Cao Thị Năng	Dien Thinh Commune, Nghe An	976297276	2	38
23	Hoàng Công Hải	Dien Thinh Commune, Nghe An	972198116	1	41
24	Nguyễn Thị Hưng	Dien Thinh Commune, Nghe An	392680774	2	62
25	Trần Thị Lý	Dien Thinh Commune, Nghe An	985632167	2	50
26	Cao Hiếu	Dien Thinh Commune, Nghe An	989351203	1	57
27	Nguyễn Trường	Dien Thinh Commune, Nghe An	378702000	1	66
28	Cao Thị Hương	Dien Thinh Commune, Nghe An	346548285	1	49
29	Hoàng Văn Sơn	Dien Thinh Commune, Nghe An	365952103	1	56
30	Hoàng Mai Xuyền	Dien Thinh Commune, Nghe An	358277004	1	65
31	Cao Văn Tiến	Nghi Long Commune, Nghe An		1	58
32	Hoàng Văn Cường	Nghi Long Commune, Nghe An		1	51
33	Hoàng Văn Tuấn	Nghi Long Commune, Nghe An		1	55
34	Đinh Văn Nam	Nghi Long Commune, Nghe An		1	57
35	Nguyễn Viết Nam	Nghi Long Commune, Nghe An		1	51
36	Cao Xuân Lục	Nghi Long Commune, Nghe An		1	50
37	Đặng Khắc Giáp	Nghi Long Commune, Nghe An		1	70
38	Nguyễn Văn Hùng	Nghi Long Commune, Nghe An		1	48

#	Name	Address	Mobil number	Gender (1 Male, 2 Female)	Age
39	Hoàng Văn Hà	Nghi Long Commune, Nghe An		1	59
40	Hoàng Thị Sáu	Nghi Long Commune, Nghe An		2	54
41	Nguyễn Hồng Lâm	Nghi Long Commune, Nghe An		1	74
42	Nguyễn Công Tâm	Nghi Long Commune, Nghe An		1	53
43	Đặng Khắc Khoa	Nghi Long Commune, Nghe An		1	51
44	ĐinhVăn Lĩnh	Nghi Long Commune, Nghe An		1	44
45	Nguyễn Bá Trung	Nghi Long Commune, Nghe An		1	48
46	Đinh Văn Sương	Nghi Long Commune, Nghe An		1	53
47	Đinh Văn Bảy	Nghi Long Commune, Nghe An		1	48
48	Đặng Thị Hiên	Nghi Long Commune, Nghe An		2	61
49	Đinh Văn Thắng	Nghi Long Commune, Nghe An		1	52
50	Nguyễn Bá Dinh	Nghi Long Commune, Nghe An		1	61
51	Nguyễn Bá Ba	Nghi Long Commune, Nghe An		1	58
52	Đặng Khắc Nam	Nghi Long Commune, Nghe An		1	55
54	Nguyễn Thị Thủy	Nghi Long Commune, Nghe An		2	60
55	Nguyễn Bá Chính	Nghi Long Commune, Nghe An		1	41
56	Hoàng Văn Thắng	Nghi Long Commune, Nghe An	0332.439.560	1	53
57	Hoàng Văn Dũng	Nghi Long Commune, Nghe An	0973.490.729	1	55
58	Đặng Văn Thọ	Nghi Long Commune, Nghe An	0986.189.321	1	62
59	Nguyễn Thị Thảo	Nghi Long Commune, Nghe An	0376.359.959	2	56
60	Đinh Văn Ngọc	Nghi Long Commune, Nghe An	0943.738.388	1	44

2. Dong Thap province

#	Name	Address	Mobile number	Gender (1 Male, 2 Female)	Age
1	Lê Minh Dũng	Phong My Commune		1	51
2	Phạm Công Châu	Phong My Commune	0962999343	1	59
3	Nguyễn Thanh Trung	Phong My Commune	0375383601	1	49
4	Nguyễn Văn Lượm	Phong My Commune	0774177863	1	59
5	Nghê Văn Mạnh	Phong My Commune		1	58
6	Nghê Văn Chiến	Phong My Commune	0989224766	1	52
7	Nguyễn Hồng Xương	Phong My Commune		1	67
8	Phan Văn Mạnh	Phong My Commune		1	46
9	Lê Văn Út	Phong My Commune		1	39
10	Đào Hồng Dũng	Phong My Commune		1	70
11	Nguyễn Văn Thuận	Phong My Commune		1	67
12	Nguyễn Văn Phương	Phong My Commune		1	51
13	Võ Thanh Nhàn	Phong My Commune		1	34
14	Nguyễn Văn Phàn	Phong My Commune		1	69
15	Phan Văn Tiện	Phong My Commune		1	
16	Nguyễn Văn Béo	My An Hung B Commune	0767922089	1	48
17	Nguyễn Văn Nhơn	My An Hung B Commune	0703165006	1	48
18	Lương Văn Hoa	My An Hung B Commune	0785576890	1	55
19	Nguyễn Văn Tâm	My An Hung B Commune	0939820189	1	43
20	Trần Văn Bảy	My An Hung B Commune		1	50
21	Nguyễn Văn Dũng	My An Hung B Commune		1	53
22	Phạm Văn Bảy	My An Hung B Commune		1	36
23	Nguyễn Văn Năm	My An Hung B Commune		1	53
24	Lê Văn Biết	My An Hung B Commune		1	62
25	Nguyễn Văn Long	My An Hung B Commune		1	55
26	Lê Văn Tuấn	My An Hung B Commune	0784147729	1	44
27	Võ Văn Bảy	My An Hung B Commune	0855321329	1	50
28	Nguyễn Văn Út Nhỏ	My An Hung B Commune		1	40
29	Nguyễn Văn Lặt	My An Hung B Commune		1	60
30	Nguyễn Kim Tùng	My An Hung B Commune		1	62
31	Nguyễn Văn Ổn	My An Hung B Commune		1	47
32	Trần Văn Tài	My An Hung B Commune		1	27

#	Name	Address	Mobile number	Gender (1 Male, 2 Female)	Age
33	Nguyễn Văn Dỏ	My An Hung B Commune		1	53
34	Phạm Quốc Minh	My An Hung B Commune		1	50
35	Nguyễn Văn Huy	My An Hung B Commune		1	56
36	Nguyễn Hữu Chiêu	My An Hung B Commune	0379712976	1	60
37	Võ Quốc Nam	My An Hung B Commune	0347486135	1	63
38	Lương Văn Để	My An Hung B Commune	0989748433	1	41
39	Hồ Khắc Hoàng Thiên	My An Hung B Commune	0939865531	1	26
40	Võ Văn Chúng	My An Hung B Commune	0932153056	1	66
41	Võ Văn To	My An Hung B Commune		1	45
42	Võ Văn Nhỏ	My An Hung B Commune		1	47
43	Trịnh Xuân Lái	My An Hung B Commune		1	55
44	Võ Văn Ích	My An Hung B Commune		1	53
45	Mai Văn Long	My An Hung B Commune		1	60
46	Trần Văn Hùng	Binh Hang Trung Commune	0347817692	1	56
47	Phạm Văn Thành	Binh Hang Trung Commune		1	57
48	Đặng Văn Việt	Binh Hang Trung Commune		1	52
49	Trương Văn Hạo	Binh Hang Trung Commune	0378013170	1	60
50	Nguyễn Văn Toàn	Binh Hang Trung Commune		1	47
51	Phạm Văn Bữu	Binh Hang Trung Commune		1	57
52	Tăng Văn Khắc Vũ	Binh Hang Trung Commune	0363173972	1	32
53	Đặng Ngọc Nhẫn	Binh Hang Trung Commune	0973188311	1	31
54	Phạm Phước Minh	Binh Hang Trung Commune	0987943884	1	32
55	Nguyễn Ái Nhị	Binh Hang Trung Commune	0387369991	1	55
56	Đặng Văn Thanh	Binh Hang Trung Commune	0939187150	1	52
57	Đặng Ngọc Thúy	Binh Hang Trung Commune	0907347494	1	45
58	Trần Minh Thiện	Binh Hang Trung Commune	0973853957	1	30
59	Trần Văn Bằng	Binh Hang Trung Commune		1	49
60	Hồ Văn Phi	Binh Hang Trung Commune		1	44

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