



# Supply Chain for Horticultural Agribusiness With Reference to Indonesian Processed Potato Industry

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**Abstract.** The government's alignment has not been optimally in encouraging the development of domestic processed potato seed industry. Thus, processed potato seeds have to be imported from overseas annually. The method used to support this study is by analyzing the statistical imported industrial processed potatoes, references related the issue of domestic industrial potato supply chain, and interviews processed potato players. The supply chain for continuous production of processed potato seeds (GO, G1, and G2) requires major investment such as development of certified processed potato seeds, tissue culture laboratory, smart glasshouse, dedicated cold storage, cold chain logistic facilities, and smart field potato productions. In addition, strengthens partnerships with Farmer's Groups and Small Medium Enterprises (SME's) for potato productions could be fulfilled domestically, thus the dependence on imported processed potatoes can be reduced gradually. To ensure that the supply chain of the processed potato industry could develop, intervention of the government and local governments are required. Regulatory umbrellas are necessary for the development of processed potato seed industry as well as local government regulations that must favor to the domestic processed potato seed industry and investment.

**Keywords:** Supply chain · Agribusiness · Potato industry

## 1 Introduction

Indonesia is a potential market for frozen processed potato products, especially French fries because it is supported by the growth of the middle-class community which in 2020 is projected to reach 85 million people. The rapid growth of the middle class, which is dominated by the young age group, supported by the fast pace of urbanization, has succeeded in making the demand for frozen processed potato products continue to increase. The potato processing industry is also growing rapidly in line with increasing awareness of improving nutritional quality of food, increasing welfare of urban communities and changing lifestyles. These industries require raw materials for potatoes in very large quantities.

The demand for raw materials for industrial potatoes is expected to reach over than 50,000 tons per year, not including chip factories which belong to home industry scales. It is estimated that the current demand for potato chips requires industrial raw materials

of 100 tons/day or a harvest of 5 ha/day. Domestic production capacity has not been able to meet the high demand for industrial potatoes, most of which are still imported [1].

The government and the private sector have made efforts to develop and increase domestic production so that they can meet market demand and improve the welfare of farmers. Efforts are being made to produce industrial potato seeds of Class G Zero (G0), propagation of industrial potato seeds from Class G Zero (G0), importing high quality potato seeds from Scotland (UK), Australia, and Canada as well as propagation of potato seeds from imported seeds. Various efforts have been made but there are still many constraints that need to be overcome, such as the alignment of various technical agencies related to the domestic processed potato industry from central and regional regulations, incentives, supply chain and logistics industry as well as a conducive investment environment.

Previous studies on the industrial potato supply chain on a small scale has been conducted in industrial potato planting areas in Java and West Nusa Tenggara [2, 3]. The results of this study can be used as a source of literature and also have important information that is very helpful in completing the preparation of this research report. Furthermore, Tulong et al. [4] argue that developing a sustainable agribusiness is essential to supply chain management, namely developing a network among business players who work together and are interdependent from producers to consumers. Thus, some of the results of these studies can be used as a reference in this study.

Based on the above mentioned, the purpose of this study is to evaluate the alignment of relevant institutions and agencies and the effectiveness of the supply chain related to the development of the domestic potato processing industry. The results obtained from this study are expected to assist policy makers in determining interventions to increase the production capacity of processed potatoes industry in the country.

## **2 Material and Methods**

This study is descriptive qualitative by observing the supply chain activities of industrial potato agribusiness. Observation of business activities from upstream to downstream of several actors involved in the supply chain of industrial potato agribusiness. The study was conducted from August to September 2021 in several industrial potato planting locations. Primary data in this study were obtained through interviews with parties involved in the potato supply chain consisting of suppliers, distributors, industry representatives, and potato farmers. Interviews were conducted with only a few key players in the potato industry. The secondary data in the study is obtained from SBC and IQFAST. Other information is obtained from various literature, such as books, scientific articles, previous research, and the internet. The data obtained were analyzed using descriptive analysis to identify the supply chain of potato commodities. The next analysis is using SWOT to identify internal and external factors of potato commodity consisting of strengths, weaknesses, opportunities, and threats.

## **3 Results and Discussion**

The supply chain management system is an approach that is applied to efficiently integrate suppliers, entrepreneurs, warehouses, and other storage places so that the resulting

**Table 1.** SWOT analysis of industrial potato agribusiness

Factor	Criteria	Remarks
Internal	1. Potential for Industrial Potato growing areas 2. High demand for processed potato industry 3. Farmer availability	Strength
	1. Limited quality potato seeds 2. Limited seed potato facilities 3. Potato industry regulations and conditions are not in favour to potato agribusiness players 4. Inadequate cool chain facilities 5. Inefficient of supply chain logistics	Weakness
External	1. Government policy supports industrial potato 2. Skilled potato farmers 3. Processed potato food industry increase 4. Availability of potato seed investors	Opportunity
	1. Increased competition in potato industry 2. Plant pest and diseases infestations 3. Climate changes 4. Potato price fluctuations	Threats

products can be distributed in the right quantity, place, and time. A supply chain is a group of actors (companies or individuals) that are interrelated with each other and participate to add value to the flow of inputs (inputs), turning these inputs into final products or services demanded by end consumers [5].

Based on the observations and interviews with several main players in the potato industry indicated internal factor was determined by strength factor of agribusiness such as highly demand of industrial potato and potential development of industrial potato in the country (Table 1). However, some weakness factor determined such as limited quality potato seeds, Potato industry regulations and conditions are not in favor to potato agribusiness players, inadequate cool chain facilities, and inefficient of supply chain logistics. To overcome this situation, external factors might be considered such as the Government policy supports industrial potato, skilled potato farmers, processed potato food industry increase, and availability of potato seed investors (Table 1). However, some considerations on potential threat to agribusiness such as increased competition in potato industry, plant pest and diseases infestations, climate changes, and potato price fluctuations.

### 3.1 Import and Production of Processed Potato Industry

In the last five years (2016–2020), the horticulture sub-sector has grown to become a source of growth for new economic forces as an economic driver in rural and urban areas. Currently, the role of the horticulture sub-sector is quite significant in national economic development. This can be shown by looking at the contribution of horticultural

agriculture to GDP which tends to increase. In 2019 the GDP of fruit horticulture agriculture was 132.01 trillion, increasing to 153.69 trillion in 2014, with an increased rate of 5.63%. Meanwhile, the GDP of vegetable horticulture increased from 56.82 trillion in 2009 to 73.78 trillion with an increased rate of 9.86%. With the development of fast-food restaurants and snacks in the form of chips, the benefits of potatoes are diverse, not only as vegetables. French fries are currently much favoured by the people of Indonesia. These conditions need to be balanced with efforts to increase industrial potato production in meeting national needs. National potato production increased 6.90%/year which is the resultant of an increase in the harvested area of 3.26%/year and productivity of 4.16%/year [6].

The trend of potato production for the last 5 years (2016–2020), it can be seen that vegetable and industrial potato production is still fluctuating in the range of 11,647 Tons to 13,147 Tons. Even the highest production was obtained in 2019 with a volume of 13,147 Tons. However, this production is still far below the realization of imported industrial potato, which ranges from 55,275 Tons to 64,838 Tons or with a ratio of 430%–505% (Table 1). Even the highest import of processed industrial potatoes reached 64,838 Tons or had a ratio of 505.44%. These data show that the demand for processed industrial potatoes increases very significantly every year and has not been able to be fulfilled by domestic industrial potato production.

Sustainability of national industrial potato agribusiness can be built with the support of various aspects ranging from provision of infrastructure, inputs for production/production inputs, fostering and increasing capacity of farmers, strengthening capital and marketing. Pattern of partnerships and public-private cooperation in supporting the development of industrial potatoes has been established starting with handling from the upstream aspect, production activities, downstream aspects and supporting activities. Most of these efforts are carried out by individuals/private sectors and partly by economic institutions at the village level, but they are still not considered optimal.

In the case of horticultural commodities, institutional development of business partnerships on horticultural commodities suggests, among others, in the Farmer - Entrepreneur Partnership Model, large entrepreneurs-entrepreneurs, product processing entrepreneurs, exporters or traders of horticultural products make partnerships with

**Table 2.** Potato productions and import of potato industry

Years	Potato Production (Vegetable and Industry) (Tons)*	Import of Potato Industry (Tons)**	Ratio (Percentage)
2016	12,130	Not available	–
2017	11,647	Not available	–
2018	12,848	55,275	430.22
2019	13,147	62,433	474.88
2020	12,828	64,838	505.44

\*) CBS (modified); \*\*) IQFAS of Quarantine

producer farmers, by forming price agreements and quality of product purchases. Partnerships are carried out with farmer groups so that production activities can be carried out in a more coordinated manner in one area or area with a certain business scale [7].

### 3.2 Potato Agribusiness Regulation and Supply Chain

Horticultural development has the aim of developing optimal, responsible and sustainable resources, meeting the needs, desires, tastes, aesthetics and culture of the community for horticultural products and services, increasing production, productivity, quality, added value, competitiveness and market share, increasing consumption products, utilization of horticultural services, providing employment and business opportunities, providing protection to farmers, business actors and national horticulture consumers, increasing the country's foreign exchange sources and, improving the health, welfare and prosperity of the people [8].

Efforts to improve the competitiveness of horticultural products for Fruit and Vegetables, which is a reference for all horticultural stakeholders, especially products that will be marketed to special markets. It is hoped that GAP will be applied to commodities so as to improve farmers' welfare through efficiency in production costs and increasing farmers' income. The government will make GAP a cultivation trend that continues to be developed following market demands so that the products produced by farmers are in line with the products of other countries (Table 2). However, need more assistance to potato seed growers on the GAP applications by the potato seed growers.

Based on observations and interviews conducted with several main players in the potato industry regarding the implementation of role and regulation related to industrial potatoes in Indonesia. The main policy for horticultural development, there is a seed regulation regarding the provisions for the import of processed potatoes industrial. In the context of controlling imports and accelerating exports, the seed sector is also carried out. Efforts to encourage exports and control the import of seeds (Table 2). This regulation optimally supports the acceleration of exports and suppresses the import of plant seeds that can be produced by domestic private sectors so that the horticultural seed industry can develop properly to support the growth of national horticultural production (Table 3).

Seeds are produced through a certification process as regulated Minister of Agriculture concerning Production, Certification and Supervision of Horticultural Seed Circulation (Table 2). Seed certification is carried out by individuals and legal entities, so the producer has obtained a quality system certificate. To support the implementation of policies in the field of increasing the supply of quality horticultural seeds, the existence of seed institutions is very much needed in every province. Furthermore, the quality assurance agency can provide quality system certification to private seed companies that meet the requirements to conduct quality system certification independently (Table 3).

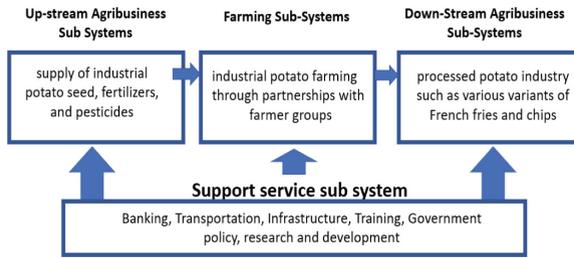
In order to import potato seeds from the processed industry, in addition to various administrative requirements, it must also be accompanied by recommendations from local Government as well as the area of land and members of farmer groups who are partners with the company. Thus, the import of industrial potato seeds is only allowed to meet shortage of seeds that have been obtained through the development of their own seeds by a company concerned or through cooperation and partnerships with domestic

**Table 3.** Implemented regulation for supporting industrial potato agribusiness

No	Regulation	Remarks
1.	Law No. 18 of 2012 concerning Food	Well implemented
2	Law No. 13 of 2010 concerning Horticulture	Well implemented
3	Minister of Agriculture No. 48 of 2009 concerning Guidelines for Good Agriculture Practices (GAP) for Fruit and Vegetables.	Lack of assistance to potato seed growers
4	Minister of Agriculture No. 48 of 2012 in conjunction with Minister of Agriculture No. 34 of 2017 concerning Production, Certification and Supervision of Horticultural Seed Circulation.	Need more consistency and transparency in the implementation
5	Minister of Agriculture Number 02 of 2020 in conjunction with Minister of Agriculture No. 39 of 2019 concerning Horticultural Products Import Plan.	Need more consistency and transparency in the implementation
6	Minister of Trade Regulation Number 27 of 2020 in conjunction with Minister of Trade Regulation Number 44 of 2019 concerning Provisions for the Import of Horticultural Products	Need more consistency and transparency in the implementation
7	Minister of Agriculture No. 15 of 2017 concerning Import and Export of Horticulture.	Need more consistency and transparency in the implementation

industrial potato seed breeders. It is different with other institutions that will import industrial processed potato raw material products, it is regulated in the Minister of Agriculture Number 02 of 2020 in conjunction with Minister of Agriculture No. 39 of 2019 and Minister of Trade Regulation Number 27 of 2020 in conjunction with Minister of Trade Regulation Number 44 of 2019 concerning Provisions for the Import of Horticultural Products (Table 3).

Of the various horticultural regulations, there are two regulations regarding import of industrially processed potatoes, so in a series of agribusiness systems where supporting agency is the key to the success of the horticultural agribusiness process. If support of the supporting agency does not run smoothly in providing support for upstream process (procurement of industrial potato seeds), it is conceivable how industrial potato agribusiness system can run smoothly if the industrial potato agribusiness actor gets administrative manner at the level of supporting system on agribusiness, then other agribusiness systems will disrupt, and product supply chain will also be disrupted (Fig. 1). On the other hand, competition between industrial potato companies also causes problems. Industrial potato investors still need potato imports to be used as raw materials for the development



**Fig. 1.** Agribusiness systems of processes potato industry.

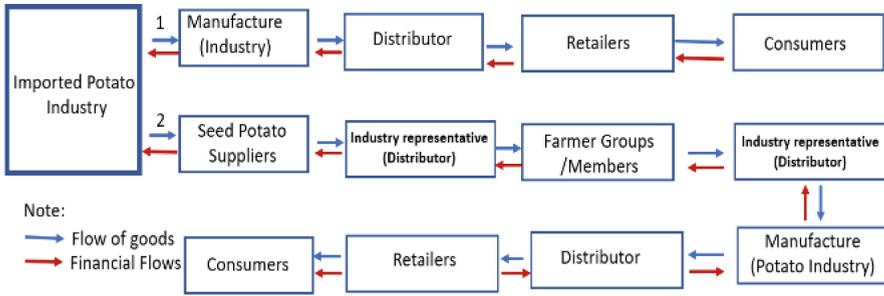
of industrial potatoes from on-farm to off-farm systems. These companies that import raw materials for industrial potatoes still require a long process of agribusiness supply chain such as, transportation of potato raw materials to partner locations in various potato centres in Indonesia, such as in Java, NTB and Sumatra (Fig. 1).

The Potato Supply Chain is a major requirement in increasing the competitiveness of potato commodities. The supply chain structure is dynamic and describes the parties involved and their roles as well as the flow of information, products, and money contained in them [9]. The highland vegetable supply chain states that upland vegetables in Indonesia have different chain characteristics. The main difference between the vegetable distribution system is the type of vegetables and the quality they produce. The difference in quality is caused by the use of seeds that are not standardized by farmers. To improve the quality of potatoes, farmers are expected to use standardized seeds [10]. The results of the identification of the supply chain structure of potato commodities production in several industrial potato-producing areas have two patterns of trading activities, namely contract farming patterns, and manufacture demand. In this study, two structures were identified, namely the supply chain structure for potato seeds and the supply chain structure for potato commodities.

Figure 2 shows the Supply Chain structure of imported industrial potatoes as raw materials for potato processing industry and as potato seeds which will be propagated through partnerships with farmer groups in various potato growing areas. The potato industry supply chain is as follows:

### 3.2.1 Supply Chain 1. Raw Material (Potatoes) – Manufacture – Distributor – Retailer – Consumer

The supply chain structure in case 1 only involves 4 stages of the supply chain to reach consumers. Imported potato products upon arrival in Indonesia are directly transported to the potato processing factory until they are finished, then distributed by distributors to various retailers in the country until they are finally enjoyed by consumers (Fig. 2).



**Fig. 2.** Supply chain of the processes potato industry.

**3.2.2 Supply Chain 2. Raw Materials (Potatoes) – Suppliers – Seed Distributors – Farmers Group – Distributors – Potato Processing Factories – Distributors – Retailers – Consumers**

The supply chain structure in Case 2 involves 6 stages of supply chains to reach consumers. Imported raw materials (as seeds) carried out by suppliers, then distributed by distributors to partner farmer groups, then planted until harvesting and grading and sorting by farmer groups/farmers in accordance with the agreement with the company. Furthermore, the harvest is received by the Distributor who acts as a representative of the industry (factory), then transported to the factory to be processed until the packaging and labelling is complete. Various products of the potato processing industry are then distributed by distributors to retailers before reaching consumers (Fig. 2). The structure of supply chain of the processes potato industry (Fig. 2) is relatively in line with the study conducted by Marianti et al. [2].

From these two examples, it can be seen that various risks to the agribusiness system can occur in the second case. Failure in the aspect of distribution of raw materials and supporting sub-systems such as the availability of fertilizers, pesticides as well as land readiness, and the on-farm planting process can cause failures up to 100%. However, the supply chain of industrial potato agribusiness that is run can provide multiplayer effects in terms of economic turnover, employment, and market certainty for industrial potato farmers through empowering farmer groups. Therefore, technical institutions/agencies in charge of horticultural development policies, especially the processed potato industry, can provide adequate support and assistance to encourage the development of national industrial potato production, which in turn can meet the needs of industrial potatoes, reduce dependence on imports and improve welfare of potato farmers. After planting and calculating the production, the production quality is sorted that can be accepted by the industrial potato company, transportation to the potato industrial factory. Meanwhile, business actors who import potato raw materials in large quantities only require a limited supply chain, through transportation to enter the processing industry. In other words, the risk of failure is very small. But this is precisely what has not received attention from the relevant agencies. So, there is an impression that the import of industrial potato raw materials is very large from year to year but less attention is given to the development activities of the domestic potato agribusiness industry.

One of the efforts to improve food security system is to design a food agriculture industrialization system that is capable of producing food products with high added value for farmers, ensuring the smooth supply of food, controlling high quality, and ensuring the safety of food products and the affordable prices of food products by the community. This can be done through the development of a supply chain management strategy that integrates actors from all supply chain segments both vertically and horizontally [11].

The supply chain management system is an approach that is applied to efficiently integrate suppliers, entrepreneurs, warehouses, and other storage places so that the resulting products can be distributed in the right quantity, place, and time [12]. In order to distribute industrial potato seeds to farmers, they must request the number of potatoes to be planted through farmer groups. From the farmer groups, information regarding the number of requests will be sent to company representatives who will send the number of requests for seeds abroad through suppliers who are associated with overseas potato seed breeders.

Preckel et al. [13] define a supply chain is a set of sequentially interdependent companies that work together to control, manage, and improve the flow of goods, money, and information from the upstream supplier side to the end-user side (The role of the supply chain in principle is to add value to the product, by moving it from one location to another or by making changes to it [14]. Added value can be applied to aspects of quality, costs, delivery time, delivery flexibility, and innovation [15].

In terms of industrial potato agribusiness, there are three components in the supply chain, namely: Upstream supply chain, which includes various company activities with suppliers, including procurement of raw materials and complementary materials; Internal supply chain, which includes all processes of entering goods into the warehouse that are used in the production process. Its main activities include production and inventory control; and downstream supply chain, includes all activities that involve delivering products to customers. Good Distribution Practices-GDP and Good Trading Practice-GTP. Basically, application of supply chain management (SCM) is an effort to build a network of business actors in an integrated system, namely: cultivation process to produce production; transforming production of raw materials into quality products through good harvest and post-harvest handling; and delivery of products to consumers through a good distribution system. Thus, the application of SCM includes the application of good crop cultivation (Good Agricultural Practices - GAP), application of good post-harvest handling (Good Handling Practices-GHP), good distribution practices (Good Distribution Practices-GDP) and good marketing methods. (Good Trading Practice-GTP).

In line with that, success of building a sustainable supply chain is largely determined by commitment of each actor to the agreed rules. Supply chain for continuous production of processed potato seeds (GO, G1, and G2) requires major investment such as development of certified processed potato seeds, tissue culture laboratory, smart glasshouse, dedicated cold storage, cold chain logistic facilities, and smart field potato productions. In addition, strengthens partnerships with Farmer's Groups and Small Medium Enterprises (SME's) for potato productions could be fulfilled domestically, thus the dependence on imported processed potatoes can be reduced gradually.

### 3.3 The Government's Support on Agribusiness of Processed Potato Industry

The Ministry of Agriculture, especially the Directorate of Horticultural Seeds, has not optimally encouraged industrial potato seed agribusiness in the country. In addition, there are several policies and regulations against, among others:

- Provisions and regulations on the development of domestically processed potato industry are very necessary to ensure the sustainability of the national potato industry business. In making policies, all relevant stakeholders have not been included. In addition, for implementation and socialization of every policy and decision regarding implementation of Horticulture, and seed business players.
- The government's support for domestic potato industry is still minimal, especially in increasing capacity of seedling through coaching, training, and mentoring for potato seed business players in the processed industry and partners spread across all potato cultivation centers.
- Other supporting facilities such as Cold Storage Warehouses in various potato producing centers are still limited.
- The government in making policies to remain transparent and accountable. Regulations must be clear and domestic security must be guaranteed.
- The policy on the import of industrial potato raw materials is considered not optimal in favor of business actors who import industrial potato seeds to be developed through partnerships with farmer groups in various potato planting centers. Through partnerships between entrepreneurs and farmer groups in producing raw materials for industrial potatoes, it is very necessary, because this partnership model it will almost certainly create supply chain and value chain mechanisms. When compared with the import of raw materials for industrial potatoes in large quantities every year. The impact of the large import of industrial potato raw materials will impact on domestic potato agribusiness.
- It is increasingly difficult to obtain land in high altitude areas that are suitable for potato cultivation, so the idle lands in every province in Indonesia can be opened and used as horticultural land so that agriculture will develop and farmers can earn better.
- For incentives, the government has provided a lot of convenience and understanding because the Indonesian government is trying as much as possible to attract foreign investors to invest in Indonesia. The main constrain for foreign investors is regulation must be clear and transparent, and domestic security must be guaranteed.

## 4 Conclusion

The conclusions in this study are:

- The need for processed industrial potato seeds has not been able to meet the high domestic demand so that it must be met through imports of industrial potato raw materials for both manufacturers and domestic development.
- The results of identification of distribution channels in the industrial potato supply chain found that there are two supply chain structures for imported raw materials, namely supply chain structure of raw materials that go directly to the manufacturer

and then distributed through retailer before reach to consumer. Other supply chain structures for imported raw materials carried out by suppliers are then implemented through agribusiness system (on-farm and off-fam).

- The government needs to gradually continue to encourage development of domestic potato industry and then gradually limit the import of industrial potato raw materials.

### Policy Recommendation

From the explanation above and in order to provide business certainty in the development of the domestically processed potato industry, several policy recommendations are proposed to the government, among others:

- The need for partiality from the Government through regulatory support that is more in favor of domestic processed potato industry business players.
- The need for increasing capacity, and mentoring support in development of agribusiness of processes potato industry from upstream to downstream supply chain.
- In order to encourage industrial potato seed industry in the country, the Government should limit imports of fresh potatoes (industrial raw materials), so that the potato seed industry can develop so that the business environment of potato seed industry can grow and develop both for export purposes and to fulfill the needs of domestic industrial.

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