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Persimmon fruit downstream prospects: a promising solution to increase farmer income in Malang Regency, East Java, Indonesia

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Abstract. This study explores the potential and benefits of persimmon fruit (*Diospyros kaki*) for human health and the prospects for producing and downstream this fruit in Indonesia. Persimmons have rich nutritional content, including vitamin A, vitamin B6, vitamin C, and vitamin K, as well as essential minerals such as potassium. This content has been known to have various benefits, including its ability to lower blood cholesterol levels, maintain eye health, and even potentially as an antiviral agent. In Indonesia, persimmons are less popular, but some regions such as Malang (East Java) and Toba (North Sumatra) produce them to increase farmers' income. This research also explores the downstream potential of persimmon fruit products. This step is part of the community's economic empowerment strategy by utilizing the potential of environmentally sound natural resources in East Java, Indonesia. This study uses the SWOT analysis method to determine internal and external factors that can see the prospects of persimmon farmers and factors that affect the downstream development of persimmon fruit products. This study aims to identify the prospects of persimmon farmers and components that affect farmers' income through sustainable downstream of persimmon fruit products.

1. Introduction

Persimmon fruit has many benefits for human health. For example, because of the vitamin content, this fruit is known to lower blood cholesterol levels and treat eye pain. Persimmon fruit also has potential as an antiviral agent. The largest persimmon-producing countries in the world are China, Japan, and Korea. Although persimmon fruit is less popular in Indonesia and rarely found in fruit shops or supermarkets, some regions, such as Malang East Java, Indonesia, also produce persimmon fruit.

Persimmons are easy to find and have a variety of nutrients that are beneficial to life. The bioactive compounds in persimmons serve as medicine. Persimmon fruit is one of the beneficial fruit plants. It is



possible that persimmons can grow anywhere at low temperatures and high humidity, and the sun's intensity is not 100%. So, persimmon fruit is grown in Indonesia by farmers in East Java. This fruit is grown in the high mountain region [1], slopes of Mount Semeru in East Java [2–4].

2. Materials and methods

Research methods or strategy analysis to increase the added value of persimmon fruit farmers' income are carried out using SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. SWOT analysis includes internal and external factors; a matrix of internal and external strategy factors (IFAS) and EFAS is created. Furthermore, persimmon product development strategies are made using IFAS and EFAS matrices.

According to research, persimmons, loquat, or Japanese plums have a long history involving various countries worldwide before finally arriving in East Java. Seek are arranged chronologically from their source to spread. Some people say that persimmons originated in the mountainous regions of the Qinling region in Southern China. Persimmons were grown wild and then cultured since ancient times. They are also known to have ancient traditional Chinese culture and medicine.

3. Results and discussion

3.1. Downstream prospect of persimmon fruit

Persimmon fruit or, in English, *Diospyros kaki*, which is also called oriental persimmon or Japanese persimmon. This persimmon fruit is round like a tomato. When ripe, it changes colour from green to orange to reddish. Persimmon fruits have two types. The former can be eaten directly, while the latter cannot be eaten directly due to its astringent taste.

The high tannin content in persimmons causes its astringence. The content of these tannins will decrease with the ripening of the fruit. Soaking the fruit in lime solution, using alcohol, carbon dioxide, hot water, cooling, and irradiation are some ways to reduce the persimmon taste. Persimmon fruit contains various essential nutrients, anti-toxic and even anti-cancer. Persimmon is a sub-tropical plant, so in Indonesia, persimmon only adapts at an altitude of ± 1400 meters above sea level [5,6]. Persimmons contain various nutrients such as vitamins and minerals, antioxidants such as β -carotene, β -cryptoxanthin, lutein, zeaxanthin and lycopene, as well as pro-vitamin A [7,8]. Persimmon fruit can function as a drug to prevent cancer and heart disease and even function as a drug to reduce high blood pressure [9,10]. Persimmons contain antiproliferative activity as anti-cancer [11].

A persimmon juice is said to have the ability to weaken the coronavirus. Studies conducted at Nara Medical University in Japan show that persimmon fruit juice is useful as a corona medicine. Persimmon juice makes the coronavirus safe [12]. It is believed that persimmon fruits originated in China and have been grown by the Chinese for many years. About 1,300 years ago, this fruit became one of Japan's national fruits. The United States Department of Agriculture introduced persimmon (known as Japanese persimmon) to California in the mid-19th century. Persimmon fruit in Indonesia began to be cultivated in the early 20th century. It is produced in East Java, Central Java, West Java, West Sumatra, and North Sumatra. In Israel, persimmons are also known as Sharon and in Italy as cachi.

The increasing commercialization of persimmon production then shifted to spread and expanded to New Zealand, Australia and Israel. In the export area of Israel, this plant is named Sharon fruit. As for the ASEAN region such as Indonesia, Malaysia and Thailand, most persimmon production is only for local consumption. An example in the North Sumatra region, especially the Brastagi region, in ancient times, had routinely sent persimmons to Singapore. However, it has stopped because its quality rival's persimmons from other countries. If you monitor persimmons at the local level in Indonesia, areas with persimmon producers include West Java and East Java. Generally, this fruit is grown in high mountain areas [3,13].

Persimmon trees grow well at altitudes up to 1000 meters above sea level in tropical and subtropical climates. The plant can adapt to different soil types with a pH between 5.5 and 7.5. Persimmons are rich in fibre, minerals, and vitamins, such as vitamin A, vitamin B6, vitamin C, and vitamin K. They help maintain eye health, lower blood cholesterol levels, and serve as antiviral agents. The *diospyros kaki*

plant produces persimmon fruit, also known as persimmon or foot. This round tomato-like fruit, when ripe, changes colour from green to orange to reddish. Persimmon fruits have two types. The former can be eaten when cooked, while the latter should not be eaten directly because it tastes very astringent.

Persimmon trees originated in China and arrived in Japan about a thousand years ago. In Japan, persimmons are called "foot fruits" and are considered national fruits. The United States Department of Agriculture brought persimmons from Japan to California in the mid-1850s. This fruit is called Japanese persimmon in the United States. Persimmons entered Southeast Asia in Indonesia in the early 1900s and began to be cultivated in Thailand, Indonesia, and Malaysia. In Indonesia, many places produce persimmons, such as East Java (Malang, Magetan), Central Java (Boyolali, Temanggung, Magelang), West Java (Garut, Majalengka), West Sumatra (Solok), and North Sumatra (Tanah Karo, Brastagi, Toba). So, the prospect of persimmon fruit growers is very good because this fruit contains many benefits for human health. Persimmons are rich in fibre and contain vitamin A, vitamin B6, vitamin C, and vitamin K, as well as essential minerals such as potassium. It also has a variety of nutrients that are good for human health, such as vitamin A and vitamin K. It is known that persimmon fruit has many benefits, including lowering blood cholesterol, maintaining eye health, and having potential as an antiviral agent.

East Asian countries such as China, Japan, and Korea produce mostly persimmons. In Indonesia, persimmons are less popular and are usually only sold in traditional markets. However, persimmons are also shipped from Indonesia to Singapore and New Zealand. Persimmons are sub-tropical plants, so in Indonesia, persimmons only adapt to \pm altitude of 1400 meters above sea level, such as Alahan Panjang [5,6]. Farmers usually use saplings for propagation, so the plant takes a long time to bear fruit, more than eight years. This activity aims to transfer shoot splicing technology using root-suckers as rootstock to get fast persimmon propagation and fruiting plants.

3.2. Downstream and increase income of persimmon fruit farmers

One of the concrete steps that can be taken to increase farmers' income is to increase the added value of agricultural products through downstream persimmon fruit products or the development of upstream-to-downstream industries. Production factors remain under the control and management of the community with the One Village One Product (OVOP) program, where the industry must be side by side with farmers. It is one of the strategies of community economic empowerment that explores the potential of people's independence through strategic economic development in environmentally sound natural resource management in Malang Regency as a source of persimmon fruit ingredients and in Tulungagung, East Java, as a place for production management.

Persimmon fruit is found in Tirtoyudo District and Ampelgading District, Malang Regency, East Java. Persimmon fruit is a traditional and superior food. When the persimmon fruit ripens, the flesh is orange, and the skin is yellowish. It has a fairly large size and tastes sweet and slightly sour. Due to its delicious taste and the authenticity of its persimmon flavour, this fruit is often consumed as fresh fruit and processed products such as juice, jam, and other foods. It is the character of the Tirtoyudo persimmon, while the Ampelgading persimmon is a yellowish-green ripe persimmon with orange flesh and fairly small seeds. The taste of Ampelgading persimmons is sweet and slightly sour, although it is smaller than Tirtoyudo. When ripe, medium persimmons Ampelgading are yellowish-green with orange flesh and fairly small seeds. Although Ampelgading persimmons are smaller than Tirtoyudo, they are sweet and slightly sour. This persimmon can also make jam, juice, and other processed products.

Persimmons have two types that can be distinguished based on how they are consumed: persimmons that can be eaten immediately fresh and persimmons that cannot be eaten immediately because of their astringent taste. High levels of tannins cause astringent taste. Tannins will decrease when persimmons enter the ripe phase, so the astringent taste is generally found in young fruits. So that the astringent taste can be removed, Indonesian people usually soak persimmons in lime solution. In addition, other ways to reduce astringent taste are alcohol, carbon dioxide, hot water, cooling techniques and radiation techniques [15–17].

The production capacity of East Java Province is 1500 tons more than level II, along with Malang Regency, Batu City and Tulungagung, areas with the highest persimmon fruit production rate. However, several other places produce this fruit as well. Persimmon fruit produced in the Tirtoyudo District reaches 1,500 tons per season. Persimmon fruit growers can produce amazing fruit even in the harvest season. Persimmon fruit production in Junggo Village in Batu City reaches 200-500 kg annually. Persimmons in this village are unique because they are very beautiful and shiny.

The SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is a suitable tool for analyzing and assessing internal and external factors that can identify existing strengths and opportunities to utilize the downstream of persimmon fruit products to increase economic benefits for persimmon fruit farmers. In the meantime, efforts should be made to address weaknesses and threats that may arise through training, education, and effective marketing strategies.

The results of this research in the SWOT analysis can be seen in the table below:

Table 1. SWOT analysis results of persimmon downstream prospects in increasing farmer income.

Dimension	Indicator	Description
Strengths	Abundant natural resources	East Java has an ideal climate and geographical conditions for persimmon fruit growth.
	Progressive environmental policy	In East Java, awareness and support are increasing for environmental protection.
	Farmer experience	Farmers in East Java have a long experience growing persimmons.
Weaknesses	Limited infrastructure	Supporting infrastructure such as transportation networks, irrigation, and product processing can be an obstacle.
	Lack of knowledge and skills	This weakness requires adequate training and education.
Opportunities	Growing market demand	High-quality and eco-friendly persimmon products are increasingly in demand in domestic and international markets. It opens up opportunities to improve the economy of persimmon fruit farmers.
	Government support	Downstream development of persimmon fruit products can be supported by policy support, incentives, and technical assistance from the East Java government and the central government. It can lead to profitable opportunities.
Threats	Market competition	The success of downstream East Java persimmon fruit products can be threatened by competition with similar products from other countries or regions. It is necessary to require the right marketing strategy to beat the competition.
	Climate change	Climate change can affect the growth and productivity of persimmons. It can compromise production stability and product quality.

Source: Data processed by author

The results of this SWOT analysis can contribute as a basis for policymakers, entrepreneurs, and farmers to take various strategic steps in encouraging the improvement of downstream persimmon fruit, including maintaining the availability of persimmon raw materials through the provision of fertilizer, seeds and adequate land so that farmers can maintain the amount and quality of fruit produced so that the supply of persimmon fruit is always guaranteed. Then, a good understanding of downstream techniques through an active role in seminars, counselling and mentoring to improve knowledge and skills in managing and packaging persimmon products in various products. Furthermore, through good digital access, market expansion can be conducted by increasing farmers' ability to sell persimmon downstream products in domestic and international markets. Next, carry out marketing strategies,

branding, pricing, distribution, and promotion of persimmon products. In addition, there needs to be engagement with the government, research institutions, food manufacturers and distributors. Then, implementing environmentally sound agricultural practices and certification of environmentally friendly products to maintain the environment to remain excellent and sustainable. In addition, there needs to be government support in the form of policies that support the downstream of agricultural products.

The downstream process in persimmon fruit farming also highlights sustainability by encouraging organic farming that avoids using fertilizers and chemical pest killers but switches slowly to using more natural raw materials. In addition, drainage management is also a focus in managing sustainable persimmon farming because this plant will grow well on land with good drainage. In addition, persimmon farmers need to improve the persimmon fruit cultivation system by understanding minimum maintenance so that planting can be carried out more widely by various levels of society around the agricultural area. A sustainable system of persimmon farming will positively impact the supply of persimmons in the future. In addition, a sound land management system can naturally increase agricultural productivity, indirectly increasing farmers' income. Sustainable agriculture systems not only benefit farmers but also provide tolerance in land management that is more friendly and less dependent on chemicals because agricultural land use is long-term. The better the land is managed naturally, the longer the period of land can be optimized for the agricultural sector.

4. Conclusions

Persimmon Fruit as a Source of Nutrition: Persimmons have many nutrients that are good for health, such as vitamins A, B6, C, and K, as well as minerals such as potassium. This fruit also has the potential to lower blood cholesterol levels, help maintain eye health, and has antiviral properties. Many varieties of persimmons have certain characteristics, such as a sweet or astringent taste. Persimmon fruits can be soaked in lime solution or used other methods to reduce the taste. Because of these many benefits, the prospect of downstream persimmon fruit is very good because it can increase farmers' income. While in East Java is one of the regions in Indonesia that produces many persimmon fruits.

Developing the downstream industry of persimmon products can help increase farmers' income by processing them into products such as juice, jam, and other processed foods. It can be achieved by involving farmers in the development of upstream industries, such as approaches such as "One Village One Product" or OVOP. SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) can assess internal and external factors to identify the downstream prospects of persimmon fruit in increasing the income of persimmon fruit farmers, namely 1). Strengths: Abundant natural resources, Progressive environmental policies, Farmer experience. 2). Weaknesses: Limited infrastructure, lack of knowledge and skills. 3). Opportunities: Growing market demand and government support. 4). Threats: Market competition, Climate change.

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