

# Study on sustainable agriculture and dimension of needs a case study patchouli farming in Aceh Jaya

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## Study on sustainable agriculture and dimension of needs: a case study patchouli farming in Aceh Jaya

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**Abstract.** Aceh patchouli is a global market-leading commodity that has a high economic value regarding the most superior quality characteristics compared to other varieties. However, this condition has not been able to make a real contribution to regional economic growth and to overcome poverty problems in Aceh. This study aims to examine the dimensions of sustainable patchouli farming and its implications for poverty alleviation. This study employed a descriptive explorative method by a case study approach, which focuses on patchouli farmers who engage in a small-scale plantation business in Aceh Jaya, Aceh Province by field observation, in-depth interviews focused group discussions. This study found that the economic condition of the community has stagnated to grow well, even though the performance of patchouli productivity is relatively good. Several crucial issues in patchouli farming practices show a pattern that illustrates the weak support for strengthening the community's economy. This study emphasizes the urgency of strengthening the supporting elements of the integrated Aceh patchouli upstream-downstream business. Therefore, the goal is increasing welfare and growth must be based on changes in behavior to enhance productivity and value chain through the development and strengthening of an innovation system.

### 1. Introduction

Aceh patchouli has long been a leading commodity in the world market that has very high economic value. The results of the distillation of the patchouli plant herb produce oil that functions as a binder in industrial fragrances such as perfume, cosmetics, hygiene products, pharmaceuticals, and many other products. History records that the Aceh patchouli oil trading market was well received and highly demanded because of its distinctive characteristics and best quality in the world [1]. The high-grade component of Aceh patchouli oil is closely related to Aceh's natural geographical conditions that are very favorable for the growth of patchouli plants and produce different levels and quality of patchouli oil from others. Aceh patchouli has become the world's best variety with 2.5-5.0% oil content, patchouli alcohol level above 30%, and has a very intense aroma, namely dry, woody, sweet and soft [2], [3]. It is what makes Aceh patchouli oil commodity the primadonna of the global market for end-use industries.



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However, the performance of the Aceh patchouli agricultural sector has experienced ups and downs, especially the continuity and sustainability of production. In the last three decades, Aceh patchouli production fluctuated and has shown a downward trend in production. Statistically, in the 90s, the Aceh patchouli production figure reached 811 tons with a patchouli oil-selling price of around 1.2-1.4 million rupiahs per kilogram [4], and then slowly decreased. Currently, the average production is only about 10 tons/ha of wet leaves or 2 tons/ha of dry leaves with an oil content of 2-3%. This condition is exacerbated by the decreasing quality of the products due to the cultivation system and the use of simple techniques is very vulnerable to pests and diseases. Low production quality and unstable prices affect the interest of farmers in the intensive cultivation of patchouli and switch to other commodities. Hence, this will have an impact on the sustainability of Aceh patchouli agriculture.

Currently, an effort to increase the productivity of Aceh patchouli in a local economic development program has been intensively promoted. The program aims to encourage regional economic growth through increased production, which will have an impact on reducing the poverty rate. The phenomenon of poverty in Aceh remains dominated by rural communities, the majority of whom work as farmers. The poverty reduction rate is also relatively slow, around 0.59% per year. Aceh is facing an ironic condition; it has a relatively substantial development budget and even the largest among the provinces on the island of Sumatra, but on the other hand, is also the poorest province in the region. According to the ratio of regional independence, Aceh is also still far from the national average of 24.2 percent [5]. It implies that the poverty reduction approaches carried out so far have not yet touched on an integrated and sustainable mechanism and orientation.

Looking at the root of the problem and the phenomenon of poverty in Aceh, intervention strategies and initiatives must be able to measure issues of sustainable production and the dimensions of the need for poverty eradication. Sustainable farming focuses on producing long-term crops, which aims to reduce the environmental impact and improve the livelihoods of the communities [6]. A quadruple helix approach strategy - a synergistic collaboration between patchouli industry players, namely the government, farmers, industry, and universities in the framework of the Aceh patchouli innovation cluster - can develop the performance of the integrated Aceh patchouli upstream-downstream industry. It is also to create enabling conditions through strengthening institutional capacity and coordination. The core of this activity is a combination of activities related to research, training, and new technology in overcoming problems in the Aceh patchouli supply chain. This applied aspect makes it possible to explore new potentials for the various needs of the Aceh patchouli industry and improve the economy of rural communities [7]. In terms of the needs, the priority for poverty reduction actions must emphasize increasing patchouli farmers' access to the sustainability and sustainability of their livelihoods [8]-[10]. The goal is to enable farmers to stimulate, overcome, and optimize the potential for strength, access, and control of the material and production resources available in it [11]-[13].

## 2. Methods

This study employed a descriptive explorative method by a case study approach. The study focuses on patchouli farmers who engage in a small-scale plantation business in Aceh Jaya, Aceh Province. It is a relatively wide location for patchouli cultivation in the province. The data was collected through field observation, in-depth interviews with six key informants -namely farmer, community leader, collector trader, patchouli refining industry, cooperative and extension agent-, and three focused group discussions with farmer groups.

The study used both primary and secondary data. At the initial level, to understand the figures of poverty and production activity, the study used secondary data from the statistics office. The primary data consisted of a qualitative set of data, which focuses inventory of the needs and problems faced by farmers by understanding sustainability aspects of patchouli farming and capacity development. The dimensions of sustainability consist of three magnitudes namely economic empowerment, environmental sustainability, and social development. Furthermore, to understand the connections between sustainable farming and development capacity, this study analyses elements for sustainable patchouli farming that are integrated activities from each level of the production system, natural

resources, and external inputs. Eventually, an analysis of the dimensions of the needs for poverty alleviation was carried out by discovering farming behaviors such as farmer's attitude towards patchouli farming, group norms influences on their farming, perception of the risk farming, and support of government policy.

### 3. Result and discussion

#### 3.1. Poverty and patchouli production in Aceh Jaya

The statistic shows that the poor in Aceh Jaya has decreased by 2.57 percent from 2015-2019. However, if we look at the intensity of poverty, the index Aceh Jaya's poverty depth has increased from 2.37 in 2015 to 2.49 data in 2019. This condition shows that the average size of the expenditure gap of each poor person towards the poverty line is getting deeper. Meanwhile, indications of inequality in expenditure among the poor also increased. It shows that although the number of poor has decreased, the economic conditions of the people tend to indicate the opposite situation. Structurally, the economic condition of rural communities has stagnated and is difficult to grow well without any stimulus to increase the development capacity and empowerment of rural communities.

**Tabel 1.** Poverty in Aceh Jaya 2015-2019.

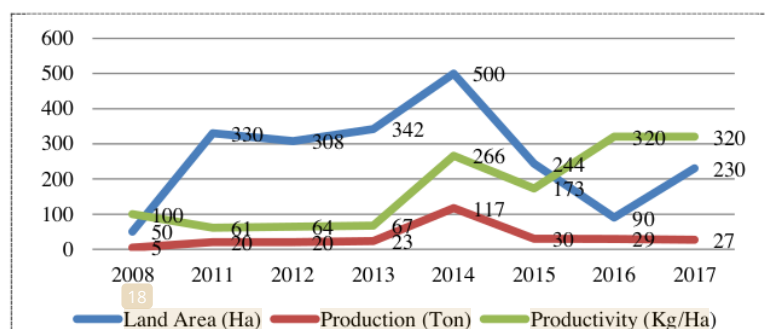
Year	Poverty Rate				
	Number of poor people (000)	Percentage of poor population	Poverty Gap Index	Poverty Severity Index	Poverty line (Rp/capita/month)
2015	13.85	15.93	2.37	0.55	316304
2016	13.10	15.01	3.04	0.87	331940
2017	13.23	14.85	2.29	0.50	356060
2018	12.85	14.16	2.40	0.73	373690
2019	12.35	13.36	2.49	0.65	391677

Source: BPS Aceh Jaya, 2020 (processed)

Looking at the economic structure in the 2015-2019 periods, the dominance of the agricultural sector is still the mainstay contributing 31.32 percent to GRDP in 2019 or an increase of 0.16 percent from 2015. Therefore, the local development focuses on improving the welfare of the farming community through expanding employment opportunities through the empowerment and development of a commodity-based local economy. This effort has been demonstrated to be the main foundation in overcomes the root causes of poverty. The program focuses and focuses on changing behavior and development capacity to access livelihood sources. However, the challenge is the extent to which the embodiment of this policy can be implemented through collaboration and synergic partnerships between local government, community, business and market institutions, and universities as innovation partners.

The growth and development of the patchouli-farming sector in Aceh Jaya has experienced very volatile conditions in the last decade (Figure 1). From 2008 to 2014, the area of patchouli commodity growth showed an upward trend. However, after that, it experienced a downward trend and tended to be stagnant. According to farmers, the low motivation of farmers to cultivate is due to the problem of limited access to livelihood capital resources, especially finance, technology, and information. So, the quality of the product produced is not able to boost the economic system of the local community, which is very vulnerable to the poverty line conditions. The problem is not only in the cultivation sector but includes all aspects of livelihood involving education, health, and infrastructure to support economic activities that support business development.





**Figure 1.** Land area, production and productivity of patchouli in Aceh Jaya.

Source: Ministry of Agriculture, 2019 (processed)

The study finds that the problem of the patchouli farming community's development has high complexity. The core aspect of poverty is unresponsive business behavior and culture, which can be influenced by limited business capital, land, and lack of knowledge and technology capacity. Even though patchouli oil has a high economic value in the market, farmers are not able to get maximum results from their sales margins. The feature of community cultivation land ownership is relatively small. With this narrow land area, they can only produce a small amount of patchouli oil and price. It depends on the quality of the oil produced. If the quality is good, the selling price is high. However, the price relatively unstable, the farmer is less motivated to pass through production. If this problem is not immediately overcome, the production sector's performance will become increasingly weak.

This study identifies that the fundamental issues of patchouli farmer empowerment are evenly distributed across all agribusiness subsystems. This condition affects the low interest and motivation of farmers to cultivate intensively. Some of the factors are the availability and affordability of superior seeds that are suitable for local natural conditions. In many cases, the quality of seedlings is very susceptible to attack by pests and plant diseases that are difficult to control, such as 'budok'. On the other hand, land structure; land tenure, and land ownership affect the behavior of the cultivation system, which encroaches on the forest and shifts (shifting cultivation). This condition causes the performance of production factors to become out of control, particularly land conditions and irrigation systems. Moreover, the location of the land, which is open and scattered, makes it hard to control the entry of animals into the farm, thus damaging crops.

In terms of cultivation technology and innovation, the community's patchouli business production system is carried out traditionally. In general, farmers do not manage and care for their plants properly, which results in low productivity and quality of production value. It shows, for instance from the harvesting system, which is carried out by tripping out in one harvest, that the yield and the amount of production are limited. Then, post-harvest handling, drying techniques, are also traditionally carried out in open areas, which allow the resulting product to be mixed with dust and water. In the refining process, the use of used drums results in low-quality oil. Thus the value of patchouli leaves and patchouli oil in the market is low. The incentives received by farmers for low production yields, which have implications for the low income. Also, limited access to market information has caused farmers to lose a very high economic margin.

All of these components require a touch of innovation in the process chain. One of the most urgent innovation points to develop is to increase the productivity and quality of patchouli oil and to produce derivative products through the application of technology and innovation. Thus, the empowerment effort is how to increase the capacity of knowledge, skills, and good mastery of information technology to facilitate quality cultivation activities. Therefore, the success of the current local economic development

model will depend heavily on the process of changing farmer behavior individually, in groups, and building partnership networks with various other partner institutions.

### 3.2. Sustainable patchouli farming

As a major foreign exchange contributor to the essential oil trade balance, Aceh patchouli oil has the best quality characteristics sought by the world market. The pattern of patchouli cultivation in Aceh Jaya is entirely community plantations. The total area of patchouli plantation in Aceh Jaya reaches 147 ha or around 12.2% of the total land area in Aceh. This farming business involves more than 380 family heads that are actively involved in cultivation activities. The contribution of patchouli production in Aceh Jaya is also very high, around 30 tons per year with a productivity of 275 kg/ha.

Structurally, patchouli production activities in Aceh Jaya have experienced various challenges from time to time. History shows that Aceh Jaya experienced the triumph of patchouli oil production in the 1920s. The geographical conditions and structure of natural environment make this area a very potential for the growth of patchouli. The cultivation has been carried out from generation to generation. However, the unstable and relatively cheap price has caused many farmers to lose their motivation to continue their business, that production has a downward trend from year to year. The complexity of this problem arises from all subsystem lines. Moreover, there is almost limited innovation made by various parties in integrated business development activities.

Farmers face several complex problems that have an impact on the productivity and quality of the oil. The constraints on the availability and affordability of superior seeds are still main issue. Moreover, plant growth is weak and fragile to diseases. To ensure good growth, farmers tend not to use fertilizers for soil fertility and crop protection. If any, chemical fertilizers are still very dominant due to the limited availability of organic fertilizers and expensive. In many cases, the agricultural system applied by farmers includes encroaching on forests, cropping patterns once harvest, and shifting cultivation. Thus, land fertility and environmental ecosystems are not well controlled.

In terms of business scale, the area of arable land is relatively small and uneconomical. An unstable market also contributes to the behavior of farmers who do not make patchouli cultivation their main livelihood commodity. Therefore, many farmers are not too focused on plant care. At the post-harvest handling level, the system for drying leaves and twigs is not carried out properly, including the conditions where the herbs are stored are improper and mixed with dust.

In the past decade, initiatives to develop the integrated Aceh patchouli industry have been mobilized. The local authority in partnership with the patchouli industrial components involved - farmers, businesses, and universities/research institutions - have begun to take corrective steps. This effort targets the structural transformation of the Aceh patchouli agribusiness system through the patchouli innovation cluster under the local economic development program for sustainable patchouli agriculture. The main target is integrated efforts from upstream to downstream, in particular increasing the capacity of farmers to ensure the sustainability and sustainability of production, innovation and technology, improvement of the industrial sector, and a wider market reach.

The pilot project of the program initiative was carried out by the Atsiri Research Center (ARC) Universitas Syiah Kuala supported by the Bank Indonesia of Aceh representative office. The program focuses on research, training, and new technology intervention, including the development of the industrial sector to address various issues in the supply chain and the value of patchouli in Aceh. Efforts to increase farmer capacity are the main center of intervention through good agricultural practices (GAP) and good distillation practices (GDP) to support increased production and income, and strengthening farmer institutions, as well as mitigating environmental impacts. In sum, farmers receive intensive assistance encouraging active community participation in cultivation, processing, innovation and refining technology, and the Aceh patchouli oil derivative product industry.

It is also to ensure the process of knowledge transfer and skills development through the field school program. Field schools are designed for every level of production and processing activities starting from land preparation, fertilization, irrigation systems, pest and disease control, harvest and post-harvest handling, and processing. These activities are facilitated by experts, conducted in the field, with a classroom system and direct demonstration practices. Field schools are also made with an interactive

system that encourages farmers' active participation, observes environmental conditions and cultivation sites, to cope with problems faced in the field, and make important decisions in farming activities. Through learning from experiences in the field, the school aims in building the character of farmers to be active and persistent in identifying their problems and collectively finding solutions and decision-making in addressing the issues.

The program has shown good progress, in particular to the motivation and behavior of environmentally friendly cultivation. Assistance and capacity building also help farmers to improve production quality. It can be observed from the indication of the improvement in the selling value of the oil in the market today with an average level of between Rp. 600,000 to Rp. 700,000 per kilogram from the previous price range of Rp. 250,000-350,000 per kilogram. Motivational growth has also grown from improvements in various infrastructures, both physical and non-physical, that support continuity and sustainable production activities.

*3.2.1. Economic empowerment.* The economic aspect is still a major obstacle in patchouli cultivation activities in Aceh Jaya. Apart from the problem of land and scale, the poor welfare of farmers makes it difficult for them to provide and get business capital. The need for investment costs and production costs are still relatively high for the community with an average per capita expenditure of the poor Aceh Jaya of Rp. 391,000 per month. Thus, the sustainable patchouli-farming program is directed to a group cultivation system with a total of 5-9 people per hectare. Each group is given assistance and financial support as investment and capital, including support for cultivation infrastructure.

The main challenge for this aspect of economic empowerment is that farmers are often unable to efficiently identify their agri-input needs. This condition is exacerbated by the weak attitude of farmers in responding to mentoring and empowerment support. Instead of getting the capacity building, the financial support provided makes many farmers weak and lacks the initiative to develop. So, there is a tendency to depend on the intervention of program implementers. It may be influenced by conditions of poverty, marginalization, and isolation during periods of prolonged conflict, including the syndrome of post-tsunami recovery.

Assistance and training are carried out to ensure the ability and capacity to manage production cost components effectively and efficiently. The program does not directly provide financial capital to farmers but through support from the production components. Farmers are targeted to be able to plan their needs and optimize business implementation through proper business investment management. The aim is to increase the financial literacy and profitability of farming through viable and sustainable good farm management practices.

*3.2.2. Social development.* Sustainable patchouli farming also emphasizes aspects of social empowerment through strengthening farmer institutions, social capital, and participation. The introduction of the business pattern in groups aims to strengthen the capacity for cooperation and collectivity in farming. Therefore, farmers can share experiences and learn together to overcome the problems they face. However, often the initiative to work in a group jointly managing land has not become a culture in patchouli farming in Aceh Jaya. So far, cultivation businesses tend to be carried out separately from one another. Groups are usually only used as a means to access external sources of assistance and distribute them individually after getting them. Thus, the cohesiveness and collectivity in groups tend to be weak.

Understanding this condition, the program also aims at strengthening social capital and group cooperation by emphasizing the participation of all farmers as the main component of the intervention. The weak resilience of social resources has implications for weakening the capacity to function so that productivity is not optimal. As a result, the empowerment and independence of farmers will be weak internally. It will also have an impact on business sustainability after the program is completed. In summary, social factors must become the fulcrum and become a priority to enter the process of aging and improving the institutional capacity of patchouli farmers sustainably.



*3.2.3. Environmental sustainability.* Patchouli cultivation patterns that encroach on forests and shifting systems have contributed to environmental damage and degradation. The program applying the GAP aspect leads to increasing awareness of farmers to always maintain the ecosystem. The program targets farmers and refiners to implement environmentally friendly practices and technology transfer. Field schools help farmers to design a continuous intensification of the production system into a circular system with a rotation system so that soil nutrients and nutrients are maintained.

For this reason, farmers are taught to consider and prioritize the sustainability of the ecosystem through the use of environmentally friendly agri-inputs. Field schools train farmers to make and utilize organic composts and biopesticides that are widely available in the environment, such as leaves and plant waste. Organic patchouli waste from distillation can also be used as high-quality compost or applied as mulch [14]-[16]. It is economically very profitable because it can save costs and increase production [17]. Thus, the ecosystem and environment will be better preserved. However, the challenge is that the attitude is not yet convincing, so this process needs to be carried out intensively, in particular through the transfer of innovation and technology for composting machines and organic pesticides that are simple, compatible, and can be operated easily.

### *3.3. Element for sustainability farming*

Sustainable patchouli agriculture contains several key elements as the main foundation of its support. Firstly, it is an integrated activity in all levels of intervention. It involves the government as a policymaker, business sector, society, and to the level of production units -including the role of research institutions. Second, production resources include natural conditions -such as land, water, and biological ecosystems-, business capital, and human resources. The third is the external inputs of production factors such as production patterns, seeds, fertilization, farming institutions, industrial processing, and the value chain. All of these elements are interrelated and connected, in particular as supporting aspects of agricultural sustainability in terms of economic, social, and ecology.

*3.3.1. Integrated activities.* Cohesiveness and synergy are the main pillars to create an effective and efficient environment from elements of sustainable agricultural development. To ensure the synergy between interested components, each party must understand and carry out its roles and functions appropriately, namely the synergy between authorities, entrepreneurs, banks, research institutions and universities, and the patchouli farming community itself.

This integrated patchouli business development strategy should be the main concern in the context of optimizing patchouli commodities that can encourage regional economic growth and development. The authority must ensure a good investment, production, and business climate for the growth and development of the Aceh patchouli industry innovation cluster. The policy targets are the application of long-term sustainable patchouli agricultural practices, such as roadmaps and blueprints as a guide and strategy for developing innovation clusters, adequate infrastructure, access to finance, access to resources and land tenure, social inclusion, supporting institutions, and a stable market. Concretely, budget optimization must be a priority in supporting the addition and enhancement of the institutional capacity of the patchouli economy and industry, including the development and improvement of connectivity infrastructure, which has a positive impact on productivity and smooth distribution.

Another goal of this activity is to improve the patchouli business model with an integrated upstream-downstream value chain concept. In this case, the farmer group institution is a forum for farmers to cooperate in sustainable production activities through technical guidance on good agricultural practices and good financial practices. Patchouli products from farmers can be distilled by them or directly sold to collector traders - including cooperatives. The function of this agent is as marketing in expanding marketing access to traders' institutions or the processing industry through trade agreements to ensure supply and demand, as well as price certainty. Thus, each party will feel benefited by these trading methods and practices. The integrated activity must also ensure the problem of limited capital, which is the main obstacle for many business actors in the patchouli industry. Therefore, the role of financial

institutions through the sharia-financing scheme must be a priority for the development of the patchouli cluster development.

Regarding the growth, the strengthening of innovation and technology systems is to act as an accelerator for quality production processes and results. GAP and GDP are continuously initiated and introduced by research institutes and universities through development, strengthening, and assistance for business actors from upstream to downstream. The development of this innovation and technology system includes an innovation ecosystem for a conducive environment such as infrastructure, regulations, and culture. Innovation is also directed at creating and increasing the added value of products, including cooperation and innovation networks as a means for the strategic development of the patchouli industry business and growth.

*3.3.2. Production resources.* The farming practices that penetrate the forest for production activities and the shifting cultivation system are another challenge in sustainable patchouli farming because it involves behavior and culture. This activity has been practiced for a long time from generation to generation and has become a habit. Currently, the GAP approach in cultivation systems continues to be promoted through the optimization of production factors, especially changes in attitudes and behavior of environmentally friendly farmers [18]. Good land conservation and irrigation systems are introduced to farmers through assistance, including the use of organic agri-inputs. This practice will have positive implications for production, income, safety, and environmental sustainability [19]. Farmers are also introduced to the patchouli crop rotation system with other crops to maintain and **maintain soil fertility and break the life cycle of pests and diseases**. A rotation system is strongly recommended after two years of planting with other plants that do not deplete soil nutrients such as secondary crops [20] and can cut the life cycle of the patchouli plant growth-disturbing fungi [21].

*3.3.3. External inputs.* Many factors cause the low production and quality of patchouli oil produced by farmers in Aceh Jaya. First is the constraint on the availability of superior and certified seeds, which are still difficult to obtain. Second, farmers are also facing the problem of the availability of organic fertilizers for good crop growth. Third, the issue of controlling pests and plant diseases that is difficult to take over in particular 'budok' disease. This condition disrupts good patchouli plant growth and low production. In post-harvest institutions, a less standardized handling system, including storage of herb contaminated with soil and dust also contributes to the poor quality of the patchouli oil produced. Refining equipment that uses used drums so that the oil quality is low exacerbates this condition. All of this has direct implications for the farmer's income. Therefore, increasing the quality of production can only be done through a touch of innovation and technology throughout the process chain activities.

#### *3.4 Dimension of needs for poverty alleviation*

How will the implementation of sustainable patchouli agriculture have implications for alleviating poverty problems faced by farmers today? For this reason, the farmer behavior approach becomes the basis for analysis that leads to increased **capacity**, motivation, and diffusion of innovation. Some of the dimensions of this **need** include attitude **towards farming behavior**, **group norms influences on farming behavior**, perception **of the risk farming**, and **support of government policy**.

*3.4.1. Attitude towards farming behavior.* Attitudes towards farming behavior will affect farmers' motivation in determining patterns and actions to be taken to realize the desired expectations. When farmers understand that their farming activity is not only exploiting the nature, but also how to ensure economic, social, and environmental sustainability for their next generation, the hopes that are built will lead to the rationality of action. It includes efforts to achieve a balance in maximizing various production resources effectively and efficiently. Thus, the optimization of production factors will be largely determined by some desires and intentions to do farming, including supporting efforts to accelerate the adoption of innovation [22]. The speed of the innovation adoption process will be largely determined by five factors: first, whether the introduced behavior will provide a relative advantage for increasing the productivity of the farm; second, the compatibility of behavior that affects the speed at which farmers

accept and adopt consistently; third, the level of ease for farmers to implement and implement; fourth, can the behavior be tested so that it is easy for farmers to understand its implementation; and the five farmers will easily accept behavior based on the results of observations that are seen directly and have implications for the desired changes.

*3.4.2. Group's norms influences on farming behavior:* The group as an institution, solidarity, and social capital will be a reference for farmer productivity. Group norms can influence farmers' motivation and attitudes in acting. The group will become a reference for the behavior of its members [23], including mobilizing solidarity, cooperation, and social capital. Each group will usually have its own rules, habits, and expectations regarding production activities. Structure, patterns, and communication within the group will determine the effectiveness of achieving common goals. Through groups, various problems faced and fulfillment of needs will be carried out collectively. This will provide space for all members to share and work together in achieving goals. Therefore, strengthening group institutions to overcome problems faced by farmers and facilitate decision making in production activities will be easier to achieve. Hence, the exchange of information and cooperation will help reduce the burden on individuals and be shared.

*3.4.3. Perception of the risk farming.* Agricultural production highly depends on nature will have several risks in their activities. Farmers' perceptions of risks will help to guide their behavior to carry out mitigation and adaptation measures. With a level of awareness, there will be behaviors of preparedness and vigilance. Henceforth this will affect their behavior to reduce the impact that will be caused by affecting plant growth, productivity, and cost risks. Farmers who are aware of the importance of ecosystem sustainability will try to apply a conservative production pattern, including land use, land control, irrigation systems, balanced fertilization, and the application of environmentally friendly technology. On the other hand, understanding the production risks associated with market demand and prices will also determine changes in farmers' behavior in carrying out the production system, especially the selection of varieties and cropping patterns [24].

*3.4.4. Support of government policy.* It is to ensure a good production climate will also have implications for production growth and accelerate the development of the patchouli industry innovation cluster that leads to increased welfare of farmers and regional economic growth. Several studies have shown that government policy support is driving the sustainability and sustainability of production, including ensuring the number of incentives received by farmers [25]-[27].

#### 4. Conclusions

Sustainable patchouli agriculture is an implementation of the concept of sustainable development in the agricultural sector. The target of sustainable patchouli agricultural development is to rely on three main pillars: economic, social, and ecological. Economic empowerment is optimizing the use of available resources through good practices in terms of production literacy, distillation, and management of assets, capital, and finance. The indicators are efficiency and an increase in the added value of production, which has implications for increased welfare and growth. Social development is strengthening group institutions to increase participation, solidarity, and social capital. Ecological sustainability leads to conservation and controls the environmental damage caused by production activities. Hence, the transfer of innovation and technology is a must to ensure the sustainability and sustainability of patchouli agriculture.

In practice, it is necessary to integrate and synergize all the supporting pillar components through integrated activities. The goal is to strengthen the patchouli innovation cluster business institutions from downstream to upstream. Sustainable patchouli farming practices must also ensure the efficacy of production resources. The quality and value of commodity production also require comprehensive intervention in institutional external inputs to ensure the sustainability of farming.

Through understanding the context and concept of sustainable patchouli agriculture and its contribution to poverty alleviation, it is necessary to pay attention to several dimensions of needs as a basis for capacity building, motivation, and diffusion of innovation and technology. The determinants of the needs and expectations for this behavior change refer to several attitudes ranging from farmers, group institutions, perceptions of risk, and support for government policies. All these elements do not stand alone, but are an integrated unity and influence each other.

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