Nutmeg determination as the main commodity in South Aceh; a literature review

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Abstract. This article tries to find natural resources that can be developed into a business industry and able to improve the welfare of local communities. Taking place in South Aceh, this article examines superior commodities that can be used as business opportunities both by farmers, entrepreneurs and surrounding communities. The commodity discussed is nutmeg. In general, this article presents information on the use of nutmeg and its application in life, alludes to some of the problems faced by farmers, presents several nutmeg industries that are already in particular in South Aceh, informs nutmeg demand on international markets and the unique nutmeg (Myristica fragrans Houtt) geography and some nutmeg derivative products.

Keywords: Superior commoditied, nutmeg derivatives product, Myristica fragrans Houtt

1. Introduction

Nutmeg (Myristica fragrans) is a tropical plant that has many benefits in life. Generally, nutmeg has been used as a spice because it has a distinctive odour that can mask the fishy or unpleasant odour of fish and meat. Also, nutmeg is believed to increase appetite. Other benefits of nutmeg are effective antifungal against pathogens such as Colletotrichum acutatum, Colletotrichum fragariae, Colletotrichum gloeosporioides [1] nutmeg extracts presented antihelmintic activity against anakissakis bacteria contained in fresh fish [2] the essential oil revealed a robust anti-microbial activity against the pathogens of Salmonella typhi and Staphylococcus aureus [3] the activity of DGHA and other constituents within nutmeg against 8 cancer cell lines [4]. In addition, [5] have tested the effects of volatile oil derived from dried nutmeg seeds that show anticonvulsant activity against penthylenetetrazole, strychnine, and bicuculline seizure tests. Moreover, [6] outlined some of the benefits of nutmeg, namely; nutritionally, as a source of energy, protein and fiber, vitamins A, C, E, reduce inflammation by phytosterols, brain booster, tonic for heart, detoxification of the liver and kidneys, induce sleep, helps care teeth, an excellent aphrodisiac, treat for stomach disorders, improves appetite, relieves cough and pain.

2. Benefits of nutmeg in life

Antioxidants are compounds that can slow down the oxidation process of free radicals. Free radicals can come from the rest of the body's metabolism and from outside the body such as food, UV rays and cigarette smoke. The number of free radicals that continues to increase in the body can increase cell oxidative stress. These will trigger degenerative diseases such as cancer, diabetes, inflammation and...
cardiovascular disease. For instance, [7] have tested the antioxidant activity derived from nutmeg plants using n-hexane solvent. The extracted part is the separate roots, barks, fruit, and seed crops. He has found the components of octadecanoic acid, linalool, eugenol, myristicin and methoxyeugenol as the main components contained in each part of the nutmeg. All of these compounds were thought to play an essential role in inhibiting free radicals, especially myristicin, which can inhibit DPPH and potentially as an antioxidant.

Some recent research showed that nutmeg is a recreational drug for teenagers used as a substitute for marijuana. Neuropharmacological properties contained in nutmeg can influence the activity of the central nervous system. Its ability to relieve pain has been recognized for a long time and has been traditionally used as a pain/pain regulation. It is an alternative where nutmeg can be used as a substitute for narcotics and morphine. Furthermore, trimiristin was reported to have anxiogenic and antidepressant activity in experiments with rats. Also, bioactive components in essential nutmeg oils are camphene, elemicin, eugenol, isoelemicin, iso eugenol, and metoksieugenol [8]. Nutmeg oil from Indonesia and Papua New Guinea have a different composition with other nutmeg variants from the same family. The composition of the aromatic ether fraction they contain is different. Particularly, Indonesian nutmeg oil contains 22.6% pinene, sabine 15.8%, myristicin 13.2%. The quality of nutmeg oil drug decreases with higher levels of myristicin in it [9].

Not only in medicine and herbs, but research related to the content of active substances in nutmeg is also being developed. Among the applications of nutmeg is the use of liquid smoke originating from nutmeg shells as a preservative in processing tuna fish [10]. It showed a significant different of tuna shelf life between with and without preservation of nutmeg shells. Moreover, it is safer than using chemical preservation.

3.  Problems faced by nutmeg farmers
Nutmeg is one of the high-value spice commodities, and an estimated 85% comes from Indonesia. South Aceh is one of the districts in South Aceh Province which is the second-largest nutmeg producer in Indonesia after Maluku. At this time the production of nutmeg has decreased, which is estimated to be caused by a disease of dead branches characterized by leaves wilting and yellowing and then dying. Based on preliminary research results, this disease was caused by pathogenic fungi with the isolate code CP1 [11]. Natural enemies, both predators and parasitoids play a role in controlling the pest population naturally. The abundance of natural enemies in each place vary depending on environmental factors and cultivation technical culture. Based on research conducted by [12] the composition and abundance of natural enemies in Meukek District were higher than that of Samadua District. The total number of families found in nutmeg in Meukek District is 13 families (9 parasitoids and four predators) with 135 individuals. While natural enemies found in the District of Samadua were five families and 36 individuals, consisting of 4 parasitoids and one family of predators. Planting patterns and crop management were estimated to influence the composition and abundance of natural enemies in both locations. The nutmeg plantations in Meukek tend to be heterogeneous which are planted with a variety of plantation crops (polyculture) while the nutmeg plants in the same two are relatively homogeneous (nutmeg monoculture).

4.  Proving nutmeg as a superior commodity in South Aceh
In addition to the benefits outlined previously, several studies have been carried out related to the study of determining leading commodities in North Sulawesi and South Aceh, the feasibility analysis of nutmeg business in several places in Indonesia, supply chain analysis and stakeholders involved in nutmeg block chain, existing products of nutmeg, and geographical indications even of issues currently facing nutmeg.

4.1. Potential nutmeg on the field
In general, agricultural development must be viewed from two central pillars in an integrated and inseparable manner, namely, first, the pillars of primary agriculture (on-farm agriculture/agribusiness)
that farming activities use production facilities and infrastructure (input factors) to produce primary agricultural products; second, the pillar of secondary agriculture (down-stream agriculture/agribusiness) as an activity of increasing the added value of primary agricultural products through processing (agroindustry) along with its distribution and trade. [13] in their article an analysis of the benefits and added value of candied nutmeg agroindustry in UD Putri Kota Bitung suggested to the industry to add variations in the packaging model and types of nutmeg flavours. The expansion of cooperation must also be carried out with other parties to increase production and market expansion. Candied nutmeg products continued to be developed because they could bring substantial benefits. Based on the added value obtained, it was expected that industry owners will be able to maintain or improve it in the future. Moreover, the nutmeg producing region was expected to increase the nutmeg meat products into candied nutmeg and other derivative products.

Furthermore, agricultural development has several objectives including increasing people's income, increasing state foreign exchange earnings, providing employment, absorbing much labour, increasing productivity, adding value, competitiveness, meeting consumption needs, and domestic industrial raw materials and optimizing sustainable management of natural resources. One of the plantation commodities that hold the role is Pala Banda (Mysristica fragrans houtt). This type of nutmeg is one of the mainstay potential export commodities of the government and is spread in the Indonesian region. Now, this commodity has expanded to all parts of Indonesia including Kalimantan, Sulawesi, Java and Sumatra. The majority of nutmeg farmers in Gisting District, Tanggamus Regency, Lampung cultivate plants not using special techniques, plants are only fertilized once a year. Fertilizers commonly used include manure and compost from the remnants of falling nutmeg leaves. Financial feasibility analysis uses the census method and is calculated through the ratio of revenue to cost (B/C), Payback Period (PP), Net Present Value (NPV), Internal Rate of Return (IRR), sensitivity analysis, and analysis of the feasibility of cultivation aspects, technical aspects, and market aspects [14].

[15] has tried to analyze the comparison of income and profits of farmers who sell nutmeg in the form of wet and dry beans in Tanjung Raya District, Agam Regency and find out the reasons for farmers choosing to sell nutmeg in the wet form and sell in the dry form. The method used a survey method. The results showed that the income and profits of farmers who sell nutmeg in the dry form are higher than the income and profits received by farmers who sell nutmeg in the wet form. Hidayati suggested that farmers who sell nutmegs in the wet form switch to sales in the dry form because the income and profits to be received are higher than the income and profits when selling in the wet form.

Moreover, Meukek Subdistrict, South Aceh Regency is a nutmeg producing centre in Aceh. [16] conducted a study that aimed to find out how the level of efficiency in each marketing channel on the nutmeg commodity and to find out how much the margin of nutmeg marketing obtained from each marketing institution involved in Meukek District, South Aceh Regency. The analytical methods he used are marketing channel analysis, marketing margin analysis and profit cost ratio. The results showed that; Efficient marketing channels for farmers are in channel two (farmers to district level traders who are then sold to end consumers), for efficient marketing traders there are in district level marketing institutions in channel two; The most significant marketing margin is obtained at marketing institutions at the district level. In other words, in this system, the maximum profit will be obtained by farmers when selling directly downstream.

South Aceh nutmeg oil has an essential role in the trade of essential oils from Indonesia. 70- 80% of Indonesia's nutmeg oil trade originates from South Aceh. On the other hand, the most prominent business risk of nutmeg oil lies with the traders at the regency level, so that this actor becomes a critical point in the business of nutmeg oil production. [17] reviewed the risk factors and risk mitigation design in the structure of the nutmeg oil supply chain in South Aceh using analytical techniques using Failure Mode and Effective Critically Analysis (FMECA). The results showed that the highest risk for farmers was the aspect of pest and disease attacks and price fluctuations, for village collectors, the highest risk for selling price fluctuations, for district collectors who were also as agro-industries in fulfilling product quality and overproduction in exporters. The exporters are in the form of fluctuations in world nutmeg/volatile oil prices. Overall mitigation must be carried out on farmer actors by improving the
cultivation system, that is applying seedling shoot top system that is relatively resistant to pests and diseases, while in agro-industry contract negotiations with exporters with the support of local governments. For excess production, it is necessary to establish a business entity policy, which was initiated by local governments with a purely profit-oriented business pattern implemented by business actors.

In addition, other nutmeg industries found in South Aceh are UD. Mestika located in Tapak Tuan. [18] studied the agro-industry development strategy because it was thought to have potential. Internal factors that influence the development of nutmeg agro-industry in UD. Mestika is the broad availability of raw materials, and there is support from the district government Aceh Selatan, high prices of processed nutmeg, and increasing market demand, instability of nutmeg prices, more and more competitors, and competitive product prices as well as development strategies suitable for developing UD. Mestika is a WO (Weaknesses-Opportunities) strategy.

One of the commodities that has existed for a long time in North Sulawesi is nutmeg. [19] have researched to analyze the comparative and competitive advantages of nutmeg seed samples in North Minahasa Regency, North Sulawesi Province. The study was hold from October to December 2012. Analysis of comparative and competitive advantage is a tool to measure the competitiveness of a commodity. Commodities with high levels of stability have the potential and ease of increasing productivity to achieve better levels of competitiveness. The government can intervene in the agricultural sector to increase agricultural productivity by using three forms of policy, namely price policy, public investment policy and macroeconomic policy. Individually, the impacts of these three forms are analyzed using the policy analysis matrix (PAM) method. It was found that the nutmeg farming in North Minahasa Regency was said to have advantages, both privately and socially. It means that nutmeg farming has competitiveness and efficiency because it benefits farmers and has a comparative advantage. The same analysis was also carried out by [20]. The results found did not show a significant difference to previous studies.

In 2014, a feasibility analysis of the nutmeg business was carried out, still in North Sulawesi Province but a different location, namely on Siau Island. Utilization of agricultural products is one of the business opportunities for entrepreneurs and investors. Nutmeg plantations are one of the leading commodities in the North Sulawesi Region, especially on Siau Island. The demand for nutmeg and mace seeds is quite high, but the price of nutmeg and mace often fluctuates. Frequent fluctuations pose risks for farmers, entrepreneurs, and prospective entrepreneurs of seeds and mace. Therefore to try in this field needs to be based on studies or business feasibility studies. Research conducted by [21] aims to find out the feasibility of the business of seed and mace nutmeg commodity on Siau Island. This research is descriptive by collecting and analyzing financial data for five years from Chandra Kiosk in Siau Island. The analysis was conducted using the cash flow method, Payback Period, ARR, NPV, IRR, and Profitability Index. The results of the analysis show the positive value of the final cash balance, the Payback Period which is smaller than the life of the investment, the ARR is higher than the investment interest, the NPV is positive, the IRR is higher than the investment interest rate, and the Profitability Index is more significant than one, which means that the commodity business nutmeg seeds and mace are feasible. The same thing was also expressed by [22] who had analyzed the feasibility of candied nutmeg business in Tapak Tuan City, South Aceh.

Furthermore, [23] have studied nutmeg plantations in the region and analyzed the plantation sub-sector in North Sulawesi. By using the location quotation (LC) method, the commander analyzes secondary data obtained from the North Sulawesi Provincial Plantation Office. LQ analysis in the research of nutmeg commodities in North Minahasa Regency and Sitaro Islands Regency in 2010-2014 shows LQ value > 1 negative proportional shift value and positive differential shift value. Based on the proportional shift value and the differential shift value of nutmeg commodity in North Minahasa
Regency, group II is the group that is developing. Pangalima also added that the superiority of nutmeg as a commodity that is already owned by North Minahasa Regency and Sitaro Islands Regency needs to be maintained. This effort can be made by increasing the annual production of nutmeg per hectare of land per year, increasing the quality of products such as the use of organic fertilizers and plant care and strived to increase the development of nutmeg.

4.2. Demand for nutmeg in the International Market

Generally, nutmeg from Indonesia has an advantage in the world market because it has a distinctive aroma and has a high oil rendement. Indonesia is a high suppliers of Nutmeg in the world, which is 60% (sixty per cent) of the world's needs. The nutmeg plant of South Aceh has many benefits for human life. The benefits not only have an impact on people's daily lives, but it also has an impact on economic life, such as the South Aceh Nutmeg plant commodity which has also had an impact on Indonesia's economic sector.

Unquestionably, cooperation between Indonesia and the European Union has been going on for a long time and has been able to contribute well to both parties. The cooperation in question covers the fields of trade, investment, economics and development. The market of the European Union, which is a set of trade rules, excise and joint procedures that apply in all 28 member countries. Meanwhile, Indonesia, including the economy that continues to grow in Southeast Asia is one of the essential partners for the European Union both in trade and investment. [24] explained the increase in EU nutmeg exports through a government program namely the TSP II Program, which has a period of four years that has been ongoing since 2011-2015, which focuses on strengthening the export quality of Indonesian products. One of the achievements of TSP II is ensuring the safety of spice products such as nutmeg, and developing information management systems for exporters to obtain information on standard and technical regulations. The increase in Indonesia's exports was evident in the value of EU imports in 2013 valued at the US $ 32.15 million and increased in April 2015 by 20.7% to the US $ 86,096 million.

Related to the demand, [25] provided the data about land area, production and productivity of nutmeg in Indonesia. The data are divided into smallholder, government and private estate. The data can be seen in the attachment. The data is then converted to a pie chart to help readers easily understand the contribution of nutmeg production in Indonesia. Generally, production centre located in 5 provinces, those are Aceh, Northern Maluku, Northern Sulawesi, Maluku and Western Papua. These five provinces gave a cumulative contribution to the amount of 86.71% of nutmeg, which was placed by Aceh about 25.46%. Reviewed from nutmeg production [26] has observed the development of nutmeg land area from 1980 to 2016. It showed a fluctuating trend, yet the overall land area increased. The average land area escalation was about 3.55% per year. Data from Direktorat Jenderal Perkebunan Indonesia stated that the land area of nutmeg plantation in South Aceh averages 15.821 Ha (71.76% from the total land area) with productivity about 7.713 tons per year (91.59% from total production). In accordance with the data, nutmeg can be avowed as a potential commodity for South Aceh. Expectedly improving in nutmeg processing will be increased and revealing not only one product but also other products based on nutmeg. So that agroindustries such as SMEs of nutmeg in South Aceh can be raised in amount and quality to escalate the economy of society in South Aceh.
4.3. Geographical indication

Obviously, geographical indications are often associated with the brand or name of a product that is used to the packaging of a product, serves to indicate the origin of the product. The origin of the product mentioned implies that the quality of the product is strongly influenced by the place of origin so that the product is of unique value in the community. They are providing benefits to consumers, so knowing that the place of origin of the product has particular advantages in producing a product. Also, geographical indications can be utilized by all producers who make their products in the places indicated by their geographical indicators and whose products have unique qualities and characteristics [29].

It should be noted that South Aceh nutmeg has different characteristics from nutmeg outside the region, such as Pala Tomadin Fak-Fak. Pala Aceh Selatan has round and small sizes. The content of South Aceh Nutmeg, namely South Aceh essential oil rendement is high, safrol content (toxic content) is lower than Nutmeg from outside South Aceh so that it can easily be distilled to be used as food and or drinks, and also contains myristicin. The content of myristicin which provides the quality of South Aceh Nutmeg, becomes the best nutmeg and includes superior seeds [30].
4.4. Existing nutmeg based enterprises

The existing nutmeg refining system has been carried out, but the problem that still occurs is that the nutmeg refining system does not take into account the energy used optimally. A modification system using controls is needed so that the regulation of energy requirements in the refining process can be controlled. Optimization of energy usage will have an impact on alternative solutions using renewable electricity-based fuels can be applied to the refining system. To optimize the use of energy is done by designing an electronic-based control system of the dominant parameters namely temperature and vapour pressure and the weight of the nutmeg to be distilled [30][31].

Apart from this, [32] studied the factors influencing the business of nutmeg plants carried out in Panjupian Village and Lhok Reukam Village in Tapak Tuan, South Aceh. The independent variables tested (variable capital, land area, labour and education level) partially or simultaneously affect the entrepreneurs in the nutmeg plant business. Usman said that nutmeg entrepreneurs should increase not only one of the factors mentioned above to increase the productivity of nutmeg plants. However, increasing all factors simultaneously and according to needs dramatically contributes to increasing profits for entrepreneurs.

Moreover, [33] revealed that nutmeg has good prospects as a type of plant for the development of community forests in Kemawi Village because there are factors that support its development, namely: 1) bio-physical land suitable for nutmeg plant growth, 2) socially acceptable by the community because far before many farmers had cultivated nutmeg on their land 3) economically has a high enough price and stable so as to provide additional income, 4) marketing conditions both fruits and seeds are very easy, and 5) government attention to the development of nutmeg at the level production to post-harvest processing is quite considerable as evident from the existence of several programs related to the development of nutmeg in this region.

Along with strategies and prospects for the development of the industry, nutmeg refined oil products are possible to be developed, especially for community empowerment in Bogor Regency by taking into account market feasibility analysis with market opportunity criteria (consumer needs for cosmetics and competition) analysis of technological aspects with criteria for technology management and infrastructure availability; analysis of HR aspects with the criteria for absorbing productive labor and improving the quality of HR; and financial feasibility. [34] looked at the development of nutmeg-based industries in Bogor Regency. He believes that the right strategy to be developed in order to empower the people of Bogor Regency through the development of the cosmetics industry made from nutmeg oil is the expansion of the nutmeg area and the partnership pattern. For flowchart of nutmeg potency can be seen in attachment. Furthermore, nutmeg enterprises in South Aceh, as expressed by, can be seen in the flowchart below.

**Figure 2.** The existing products of nutmeg-based industries in South Aceh [18].
5. Conclusion
The demands for nutmeg in the global market are as massive as explained in the article. Aspects that influence the amount of nutmeg demands are the existence of the industry that has long existed, the number of derivative products that lead to the many benefits that can be felt, the attention of international traders because of the value offered both as spices, snacks and drinks, and research related research that focuses on nutmeg from all points of view. In a very long period of time, nutmeg is recorded in history as one of the main livelihoods for people in certain areas. Various nutmeg processed products also support the position of nutmeg as a leading commodity in South Aceh. In contrast, there is a huge gap between stakeholders and customers so that the nutmeg industry in Indonesia is not developing, worsened by pests that attack raw materials. In this context, it is hoped that the government and academics will support the development of the potential of nutmeg in all parts of Indonesia. However, further research should be done to cope with the gap among stakeholders

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Appendix A

POTENCY OF NUTMEG-BASED INDUSTRY

Geographical indication
- High rendement
- Lower safrol (toxic contents)
- Easily be distilled
- High myristicin content

Export commodity
Main income in several district in Indonesia

Beneficial privately and socially
Antioxidants

component
Octodacanoic acid
Linalool
Eugenol
Myristicin
Phactor Vxugenol

Neuropharmacological

component
Camphene
Elemicin
Isoelemicin

Many industries (nutmeg-based)
- UD. Mestika, Tapak Tuan
- UD. Putri Kota Bitung
- Chandra Kiosk
- Meukak, South Aceh
- Panjupian, South Aceh
- Samadua, South Aceh
- Ginting
- Tanggamus
- Lampung
- Tanjung Raya
- North Sulawesi, Siau Island
- North Minahasa
- Lhok Raukam
- Bogor

Many derivative products
- Candied nutmeg
- Essential oil
- Syrup
- Spice

Preservation
Processing tuna fish

Quite high in demands
- Fulfill 86.71% of total global demands
- From 2013-2015 demand
- US $32.15M - US $86.096M

Problems
Pathogenic fungi
9 parasitoids and 4 predators
Disease (leaves are wilting, yellowing and dying

Many research in different parts in Indonesia