



Overview and Risk Identification of Garlic Seed Farming in Sembalun District, East Lombok Regency, Indonesia

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Abstract: Sembalun district has known as one of places with high potential to generate garlic seed that can support national demand for garlic seed in Indonesia. In this regard, it is important to identify the risk of garlic seed farming in order to reduce the probability of risk that might be occur. This research aims to view and identify the risk of garlic seed farming in Sembalun District. Data were collected using questionnaires from 35 respondents, consist of 30 farmers and 5 garlic seed stockmen. The respondents were choose using accidental sampling in two villages namely Sembalun Bumbung Village and Sembalung Lawang Village. Data were analysed using descriptive method to describe the condition of garlic seed farming in Sembalun District. Moreover, fishbone diagram was used to identify of the risk of garlic seed farming. The results showed that there were five main sources of risk in garlic seed farming in Sembalun District such as 1) risk of production, 2) risk of price and market, 3) risk of financial, 4) risk of social and law, and 5) risk of human resources. Risk of production, price and market were the biggest risk that they were faced in producing garlic seed in Sembalun District.

Keywords: Garlic; Risk; Seed; Sembalun

Introduction

Garlic as one of the horticultural commodities that is important for the people of Indonesia and other countries like China for its variety and number of benefits (Mardiana et al., 2022; Saptana et al., 2021; Ai et al., 2023), experienced a garlic deficit of 362.42 thousand tons in 2020 in meeting national needs (BPS, 2021). This fact explains that domestic garlic production is unable to meet national demand (Sandra et al., 2022). Garlic as one of Indonesia's imported commodities requires attention so that efforts need to be made to develop national production in a sustainable manner, otherwise the domestic market will be filled with imported garlic (Titisari et al., 2019). In line with the problem of the lack of availability of local garlic, it is necessary to develop garlic seed farms in several locations of garlic production centers.

The limited amount of domestic garlic production is due to the planting conditions required by garlic which tend to be in the highlands (700-1100 masl) so that not all provinces in Indonesia are able to cultivate garlic (Department of Agriculture of East Lombok Regency, 2022). Some of the garlic production centers in Indonesia are Central Java, West Nusa Tenggara, and East Java provinces (Danasari et al., 2022), contributing 40%, 30%, and 7% respectively to the national garlic production. Meanwhile, the provinces with the highest levels of garlic consumption in Indonesia are East Java, Central Java, West Java, North Sumatra, which consume 18%, 17%, 14%, and 5% of total consumption, respectively.

The Government of Indonesia continues to make efforts to increase the quantity and quality of garlic production through intensification and extensification. One of the problems faced was the lack of a seed industry so that the available local garlic seeds were very limited, while imported seeds were not suitable for the

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Indonesian climate (Ministry of Agriculture, 2020). In order to support government programs to reduce imports and meet national garlic needs, it requires serious efforts in the provision of quality garlic seeds. A good quality garlic seed is needed so that the quality of local garlic is not inferior to imported garlic.

Sembalun District as one of the national garlic production centers has two types of certified seed varieties, namely, Sangga Sembalun and Lumbu Putih (Kurmiaty et al., 2022). Both varieties are cultivated by local farmers in East Lombok Regency to produce garlic. Based on the National Garlic Development Program in 2017, apart from being a strategic area for garlic development, East Lombok Regency is one of the national suppliers of garlic with the Sangga Sembalun variety (Ministry of Agriculture, 2019; Titisari et al., 2019). In contrast to the garlic production process, garlic seed production takes a longer time where after harvesting special treatment is needed to produce quality garlic seeds (Noor et al., 2021; Danasari et al., 2023). According to Yakin et al., (2022), in farming activities will definitely be faced with several risks, the longer the farming is carried out, the greater the possibility of risks faced.

The risk in garlic seed farming is different from regular garlic farming. In garlic farming, after harvesting, farmers can sell their crops to middlemen or to the market. Whereas in garlic seed farming, in addition to taking a long time, farmers also give special treatment to harvested wet garlic. This causes a greater possibility of risks such as disease attacks while storing the harvest. These risks can affect the quality and even damage the garlic seeds, which in turn can be detrimental to farmers. Moreover, the volume of raw garlic (wet) has positive and significant impact to produce garlic seed. So that, one of important thing to produce high quality of garlic seed is its raw garlic (Danasari et al., 2023).

Based on the opportunities and potential of Sembalun District as a center of garlic development, especially as a national garlic seed supplier, it is very important to identify risks that can disrupt garlic seed farming. This is because risk management needs to be done to minimize the size of the risk and also the frequency of occurrence of undesirable circumstances (Sunaryo, 2007; Zakirin et al., 2013). So that handling of possible risks that occur can be done.

Method

The research was conducted in Sembalun District, East Lombok Regency, West Nusa Tenggara Province. Sembalun District was chosen because the area at the foot of Mount Rinjani is the center of garlic production

along with seeds with the mainstay variety Sangga Sembalun. The types of data used in this study were primary data and secondary data. Secondary data were obtained from the Department of Agriculture of East Lombok Regency, the Central Statistics Agency (BPS), journals, and various related literature. While primary data came from observations and interviews using questionnaires with farmers and stockmen who produce garlic seeds in Sembalun District.

Data were carried out by observations, interviews, and discussions of garlic seed farmers and stockmen. The observation technique was carried out for direct observation of the general description of garlic seed farming in Sembalun sub-district. While interviews and discussions with farmers and seed stockmen were conducted using a list of questions in the form of a questionnaire. There were 35 respondents consisting of 30 farmers and 5 garlic stockmen.

The method of analysis was descriptive qualitative. Qualitative analysis was used to describe the general description of farming and identification of risk sources of garlic seeds. Identification of risk sources was also explained using a fishbone diagram to facilitate the formulation of risk handling strategies.

Result and Discussion

Overview of Garlic Seed Farming

The stages of garlic production in Sembalun District are not much different from those in other areas. Likewise, in the cultivation of garlic seeds, the process takes more time which there is a drying process and a dormancy period that requires additional time up to 4 months. Before cultivating garlic seeds, adjustments should be made to the growing conditions and planting time, to maximize production. In general, the garlic production process goes through several stages as follows:

Land preparation is the he initial preparation that can be done of the land itself by clearing the land of everything that can interfere with plant growth. The aim is to obtain land that is ready for planting and free from physical (rocks, garbage, etc.) and biological (weeds or crop residues) disturbances. Furthermore, when the land has been cleared, the land can be cultivated, trenches and beds made. Tillage can be done by hoeing or plowing the soil to a depth of 20-30 cm until it is loose and then left for 7 days to improve soil air and aeration, and remove toxic gases. Beds are made with a height of 30-40cm and a width of 100-110 cm. While the trench for irrigation is made with a width of 30-40 cm and a depth of 40 cm.

Seedling preparation and plant propagation. the seedlings used are tubers that have completed their dormancy period (stored for 3-7 months), are of good

quality (certified), or after the growth point appears there are no physical defects and have a uniform tuber shape. Seedlings are generally prepared at around 700-1000 kg/ha depending on the sowing size used. Usually, certified and labeled quality seedlings have large (weight 1.5 - 2.0 grams), medium (weight 1.0 - 1.5 grams) and small (weight less than 1.0 gram, average 0.77 grams) sizes (Department of Agriculture of East Lombok Regency, 2022).

Basic fertilization is providing basic nutrients in the soil and placing the seedlings between the fertilizers on the prepared beds, with the aim that the available nutrients can be absorbed by the plants optimally and the seedlings are placed properly. Fertilizers can be applied using 10-20 tons/ha of compost such as NPK 250-300 kg/ha or KCl (200-300 kg/ha) and SP36 250-400 kg/ha. Dolomite application needs to be done if the soil pH is below 6.0 with a minimum of 600kg/ha. Furthermore, organic or bioorganic fertilizers can be used.

Planting by placing garlic seeds on the prepared bed can be done after 3-5 days of basic fertilization. The right seedlings to use as seeds are those that have passed the dormancy period and are characterized by the growth of stems on the bulbs as shown in Figure 1.



Figure 1. Garlic Seed

Irrigation is one of the important things during the growth and development of garlic, especially in maintaining soil moisture and helping in the absorption of nutrients. Until now, the irrigation system for the Sembalun community is through ponds, shallow water wells, and piping.

Supplementary fertilization is carried out to provide additional nutrients, this aims to increase the need for nutrients needed for plant growth and development as well as forming roots and garlic bulbs so that they can grow optimally. The first supplementary fertilization is done at the age of 15-20 DAP (Days After Planting), and the second at the age of 30-35 HST. In addition to this supplementary fertilization, fertilization can also be done through the leaves with leaf fertilizer. Supplementary fertilizer can be in the form of urea or ZA fertilizer.

Weeding is the maintenance and cleaning of beds from weeds, other nuisance plants, and diseased plants, this aims to maintain land cleanliness and plant health. This activity is carried out periodically or as needed depending on the level of disturbance found by farmers. Weeding can generally be done at the age of 25-30 HST, then 50-60 DAP and 70-80 HST, this is adjusted to the condition of the weeds encountered.

Plant maintenance is also closely related to the control of Plant Disturbing Organisms (OPT) by implementing an Integrated Pest Management (IPM) system with the aim that OPT is controlled without damaging the environment. Pests in garlic include armyworms, trips, and fungi.

Determination of harvest time can be done by looking at the physical development of plants on the stalk. In general, harvesting can be done after the plant is 105-110 days old with the physical characteristics of the leaves and the base of the plant stem yellowish and limp, besides that the bulbs also begin to come out and appear on the surface of the soil. Harvesting is done by pulling out the petiole until the tuber is completely lifted. Usually, the Sembalun community irrigates a few days before harvesting in order to facilitate the process of pulling out from the ground. Harvesting can be started in the morning and avoid conditions that will and when it rains.

Post-harvest activity consist of some activities such as bulb cleaning, sorting and grading, drying, and storage. In general, it begins with cleaning the garlic by removing dirt attached to the garlic bulb without removing the roots and leaves of the stem. Sorting and Grading is the process of selecting and separating garlic bulbs based on the quality and size of the bulbs. Bulbs that are not suitable to be used as seeds can be sold wet to collectors or markets, while bulbs that are suitable to be used as seeds and seedlings are continued for the drying process. After the bulbs are clean, the garlic can be tied and then dried by hanging it on a drying rack (usually made of bamboo) under the sun. To be able to produce good seedlings or seeds, the drying period is required for 40-55 days after harvest or until the water content in the bulbs is reduced to around 85%.

Garlic storage for consumption is a maximum of 2 months and for seedlings a maximum of 8 months. We recommend that sun-dried garlic bulbs be filled in sacks @ 25 Kg and then arranged in a warehouse using a plank or bamboo base underneath. Spraying disinfectant, a day before storage to avoid pest attacks in the warehouse such as white butterflies.

Seed certification and labelling is a process of certifying a group of seeds through a series of examinations and/or tests, and meeting quality standards or minimum technical requirements (MOA, 2019). Meanwhile, a label is a written or printed

information about the quality of seeds that is affixed or installed clearly on a number of seeds or each package. Certification activities are carried out by going through several stages such as:

Preliminary inspection, Plant Inspection (40-50 days after planting and before harvest), post-harvest supervision, seed quality inspection in the Laboratory and in the warehouse, issuance of certification, and labeling. The distribution of garlic seeds is different for each actor, for example, farmers sell seeds to collectors and local stockmen, this is because the number of seeds owned is not much, which ranges from almost 5-10 tons. While collectors can sell their seeds to local stockmen from outside the region such as Bima, NTT, and some areas in East Java. Meanwhile, stockmen who are known as seed wholesalers can sell seeds to a wider market such as Sumatra, Malang, Irian Jaya, NTT, Temanggung, and several other areas. In addition, stockmen can also sell their seeds through the e-catalogue provided by the Ministry of Agriculture.

Transportation tools commonly used by seed sellers in Sembalun are through cargo (air) and trucks, ships (sea). The selection of this means of transportation can be determined between the seller and the buyer. Then proceed with determining the sharing point between sellers and buyers of garlic seeds.

Risk Identification of Garlic Seed Farming

Based on observations and interviews conducted regarding identification of risks of garlic seed production to farmers and stockmen in Sembalun District, several problems were found in producing garlic seeds both in the cultivation process and the post-harvest process until the production of certified garlic seeds. The problems were grouped into several sources of risk, it described in the form of a fishbone diagram as in Figure 1.

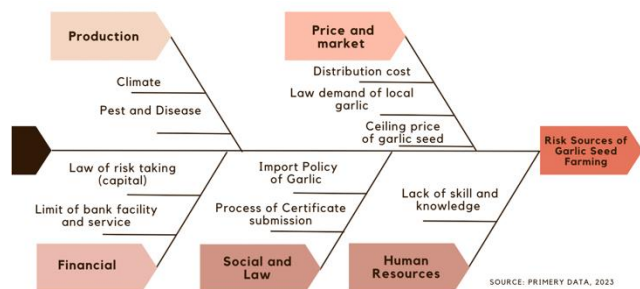


Figure 2. Diagram fishbone garlic seed production risks

In detail, the sources of risk in the production of garlic seeds in Sembalun District can be explained as follows:

Risk of production

High rainfall that comes earlier and longer was a factor that affect seed and garlic farming in Sembalun District. The garlic planting season usually start in February to June, if it passes, then farmers will face a lack of water availability which is useful in maintaining soil moisture and helping in the absorption of nutrients. As experienced in early 2022 and 2023, the rainy season lasted longer, hampering the garlic production process. In addition, due to the high rainfall with a long time, the drying process is hampered, which affects the quality of the seeds produced.

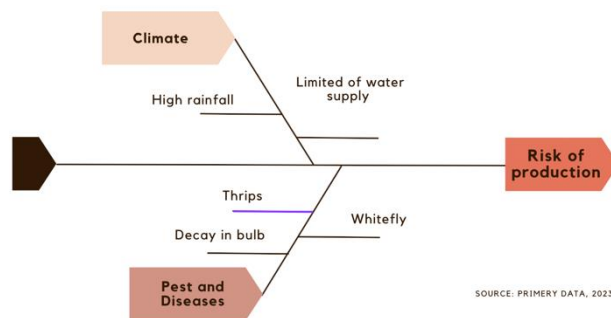


Figure 3. Fishbone Diagram of Garlic Seed Farming Production Risks

Similarly, pest and disease attacks are a problem for farmers in garlic cultivation, as stated by one of the garlic stockmen as well as the Head of UPTPP Sembalun District that disease attacks often cause rotting of garlic bulbs causing damage up to 80% and this disease attack has not been found how to handle it. While pest attacks by Thrips were also often found and cause leaves to wither and yellow, usually farmers apply insecticides to overcome this problem.

The pest attack in the form of white butterflies found during the seed storage process in the warehouse was also faced by garlic seed stockmen. This attack can cause the bulbs of garlic seeds to become hollow, especially if there was still moisture content in the bulbs and stored for a long time (>1 year).

Strategies for dealing with pests and diseases can be carried out at the pre-planting stage by clearing the land. At this stage, farmers should ensure that there are no weeds that will be a source of disease for the core crops later (East Lombok Regency Department of Agriculture, 2023). As for the white butterfly pest attack in the warehouse during the storage process, a preventive strategy can be carried out in the form of sterilizing the warehouse using insecticides. Farmers, especially stockmen who have storage warehouses, can spray with insecticides before the seeds were put in and stored in the warehouse.

Weather is one of the factors that cannot be avoided by farmers, therefore mitigation needs to be done in the

form of making drainage or deeper water channels so that plants on the bed are not flooded by water. If there is still a pest attack in the form of white butterflies during storage, the breeder or farmer can spray the same insecticide again at the beginning. In addition to providing treatment at the time of implementation, training and field schools are also one of the mitigation efforts in the sense of increasing the knowledge and skills of farmers and stockmen in increasing production and the quality of seeds that can be produced. The higher the knowledge and skills of farmers, the better the product is expected to be. Moreover Ai et al., (2023), said that yield was also important factor for the growth of garlic seedlings.

Risk of price and market

Based on the identification of the risk sources of garlic seed farming at the risk of price and market, several main causes were obtained as outlined in Figure 3. Price was strongly influenced by the demand for a good, the higher the demand, the lower the price of the goods (*ceteris paribus*). Similarly, in Sembalun District, the low demand for local garlic was due to the influx of imported garlic since 2019. This condition was faced with competition in price and quality of imported products with local products. As it is known that the price of imported garlic is cheaper with the quality in terms of larger clove and whiter compared to local garlic whose price is quite high and smaller clove (Kiloes & Hardiyanto, 2021). The impact of this condition was the decline in local garlic production and then also has an impact on the lack of availability of garlic seeds in Sembalun District. As a result of low demand, there was a decline in farmers' interest in farming.

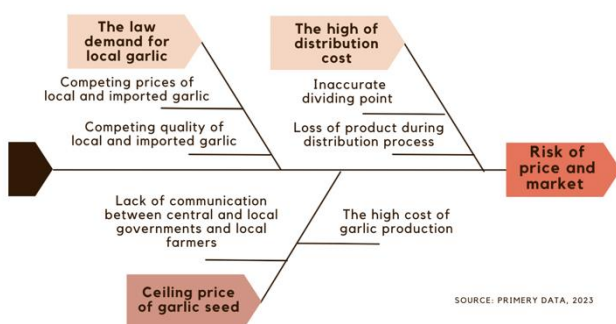


Figure 4. Fishbone Diagram of Price and Market Risk of Garlic Seed Farming

The fixed price of garlic seeds (ceiling price) was one of the factors that can cause a decrease in profits and even adverse the garlic seed stockmen in Sembalun District. The setting of the ceiling price does not seem to see the conditions that occur in the field where production costs continue to increase. In addition, the distribution costs incurred are one of the considerations

for stockmen. Until now, stockmen can use two types of transportation, namely cargo (airplanes) and trucks (ships).

The strategy that can be carried out by farmers and stockmen in dealing with price and market risk, namely the need for deliberation between the central ministry level with stockmen and garlic farmers throughout Indonesia in order to determine the purchase price of seeds and garlic. Therefore, it requires the active role of local governments in conveying actual information to the central government so that it can be mediated nationally. Furthermore, the problem of high distribution costs requires accuracy by the stockmen in reading the location of the dividing point, if the location set by the stockmen is not in accordance with the estimate, it can cause higher transportation costs. On the issue of import policy, the government has implemented a mandatory garlic planting policy in Indonesia. However, this policy needs to be followed up again because it does not solve the problem of falling national garlic demand.

Risk of financial

Financial risk in this study was not a big risk compared to the previous two risks, because in fact farmers and garlic seed stockmen in Sembalun District did not apply for capital much. A few of them, if they need capital, prefer to borrow money from family and relatives. In addition, one of the causes of the low level of capital borrowing can also be due to the lack of banking office facilities in the location. One strategy that can be done at this risk is to provide banking facilities around the location so that it can facilitate farmers and stockmen in obtaining capital for their farming activities.

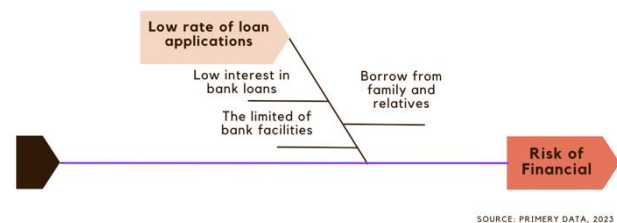


Figure 5. Fishbone Diagram of Financial Risk of Garlic Seed Farming

Kahsay (2019) and Fang et al. (2021), mentioned that some of the reasons farmers are less interested in using organic fertilizers and vegetable pesticides were due to lack of credit availability of farmers, high cost of fertilizer and lack of awareness on the use of organic fertilizer. Therefore, the law of the use of organic fertilizer and pesticide could increase risk in garlic seed's production. The more issues that farmer face, the more risks that they will get.

Risk of social and law

In general, social and legal risks can be institutional risks resulting from changes in policies and regulations set by the institution itself or the government. For example, the government's policy of opening import faucets to meet garlic consumption in Indonesia. The entry of imported products has an impact on the creation of price and quality competition between domestic and imported products. As it is known that imported products always win in price, the cheaper price of imported garlic will affect the low demand for domestic garlic. Moreover, based on its shape and color, imported products have better quality where imported garlic has a larger clove and pure color which is whiter than local garlic.

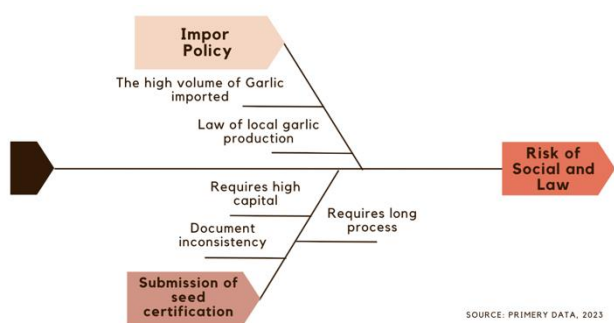


Figure 6. Fishbone Diagram of Social and Low Risk of Garlic Seed Farming

This problem is responded to by the limited availability of domestic garlic seeds which then has an impact on the lower availability of domestic garlic. As an effort to deal with this problem, policies need to evaluate policies that benefit and provide welfare for local farmers. The problem of applying for garlic seed certification is often found by garlic seed stockmen, where the documents they submit are different from the location of the activity. In addition, the process of applying for seed certification also requires a longer time by passing through several strict stages. Therefore, the government also issuing regulations regarding mandatory planting policies for garlic importers at 5% of total imports (Sayaka et al., 2021; Kiloes et al., 2021). This attempt is expected to increase garlic farming land in Indonesia, and also to increase garlic national production.

Risk of human resources

Human resources in this case are labor or farmers and stockmen involved in garlic seed production activities. Although not many recognize this aspect as a risk in producing garlic, it is a problem for some farmers and garlic seed stockmen. The problem is the lack of labor skills in determining the moisture content in garlic bulbs. Until now, the drying process has been done

manually with a benchmark day in determining the moisture content. Usually, to get optimal results or the water content is really reduced, it takes 40-55 days of drying without rain.

In addition, in the cultivation process, there is still a lack of farmer's ability to control pest and disease attacks in the form of Thrips and rot on garlic bulbs. At the seed storage stage, stockmen also often face pest attacks in the form of white butterflies in the warehouse, causing the seeds to not be good if stored for more than one year. Therefore, tools and facilities are needed to overcome this risk in the form of a drying location (drying floor) facilitated with a transparent roof, so that when rain comes farmers are not disadvantaged and a tool to measure the water content of the bulbs.

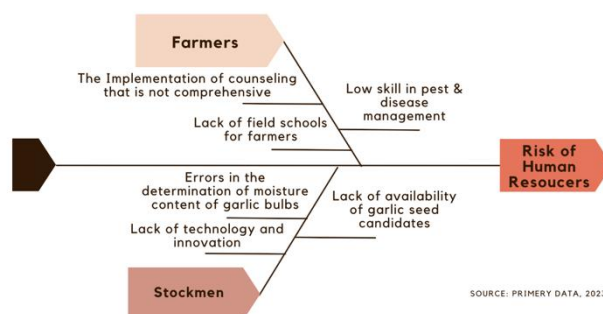


Figure 7. Fishbone Diagram of Human Resources Risk of Garlic Seed Farming

The strategy that can be applied to this risk is to organize regular and evenly distributed extension activities and field schools (Ferara et al., 2023) for garlic seed farming actors in Sembalun District. This is expected to increase farmers' knowledge and skills in garlic seed farming activities in Sembalun District (Salahudin et al., 2021; Maryati et al., 2023). In addition, the application of technology also needs to be done in the drying activities of garlic seed candidates, this is related to the measurement of the water content contained in garlic bulbs. The high-water content in garlic bulbs can cause failure in seed production due to bulb decay. In addition, it is also necessary to have a drying location (drying floor) facilitated with a transparent roof, so that when the rain comes farmers are not disadvantaged. As mentioned by Yaseen et al. (2018), Yasin et al. (2018), Mumuh et al. (2020), farmers participation in apprenticeship and training programme could be the main direct source of exploiting farming business opportunities.

Conclusion

Based on the research that has been done, it is known that several sources of risk that became a problem in the implementation of garlic seed farming in

Sembalun District consist of production, price and market, social and legal, financial, and human resource risks. In some sources of risk that have been identified, it is found that production risks and prices and markets are the biggest risks for garlic farmers and stockman in Sembalun District. The main risks found were: a) Production Risk: weather such as high rainfall and pest and disease attacks such as Thrips and Whitefly; b) Price and Market Risks such as import policies, seed ceiling prices, and distribution costs.

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Author Contributions

All writers have contributed in completion, sentence structure, and translation of this article. Danasari, I.F and Febrilian, B.R.A focused on concept, method of analysis, and interpretation. Sari, N.M.W., Maryati, S., and Supartiningsih, N.L.S. participated in interview process and data analysis.

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Conflicts of Interest

The authors declare no conflict of interest

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