PROJECT PROPOSAL

NESTLE CREATING SHARED VALUE PRIZE

Cleaner Production: A Solutive Concept of Sustainable Development Goals in Green Production of Essential Oils in Gunung Condong

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EXECUTIVE SUMMARY

1. What problem is this initiative trying to address?

The problem from essential oils production in Gunung Condong is the lack of integration between the science of technology, environment and organizational structure of essential oils production which makes the economic improvement of the community difficult to achieve. Essential oils sold in the market had a purity level about 70% for a long time. While the quality of essential oils is good if the purity level reaches 87%. However, the essential oils products in Gunung Condong has a purity level under the market standard, that is 60%. Production wastes are also not optimally managed yet, either solid waste or liquid waste. In addition, the production of essential oils in Gunung Condong is only done at the time of product demand. It makes the demand cannot be properly continued.

Based on the existing problems, it is necessary to evaluate the essential oils production from SDG (Sustainable Development Goals) program based on Cleaner Production. Therefore, further efforts is needed to improve the quality of essential oils products and to evaluate its system in Gunung Condong by considering the environmental aspect. The efforts that can be made to overcome these problems are the integration of technology and social approaches that can be applied to essential oils. Based on some research, clove fermentation can improve the purity of essential oils.

Therefore, the present project is hoped to be not focused on the improvement of the purity of oils, but also to evaluate waste management caused by essential oils production through waste and water management. Also, the program will evaluate the structure of oils production and product sales to create system sustainability.

2. Solution summary:

What is proposed solution?

The form of implementation of SDG's program which will be applied in this project is aimed at the production of essential oils as the original product of Gunung Condong, Purworejo, Central Java through the concept of "Cleaner Production". The selection of clean production concept is based on the existing condition of essential oils production process in Gunung Condong in which there are many deficiencies and problems that disturb the quality, quantity, and sustainability of essential oils products.

What do you see its must promising aspect for creating shared value?

The Cleaner Production concept in this case will involve 4 elements of approach:

1. Technology: as an effort to improve the quality and quantity of essential oils products and to manage the generated waste.
2. Social as an effort to increase community participation in the production of essential oils. The basic concept on offer is from, by and for the community.
3. Economy, as an effort to increase the selling values and market opportunities of essential oils. Thus, the benefits will be more felt by the surrounding community, even it can further help to increase the original revenue of Purworejo, Central Java.
4. Environment: as an effort to formulate waste management system in accordance with the characteristics of generated waste. This aspect will be collaborated with the aspects of the technology as previously described.

The stages of project implementation will refer to the basic concept of "Cleaner Production" as the following figure. The basic concept stages will be then implemented in accordance with each element (4 elements) as previously mentioned. The key to the implementation of the Cleaner Production stage is a continuous cycle.

3. Impact:

What is the impact of the work to date? specify both the social n the environmental impact of your work!

1. Implementing of SDG's program in the production of essential oils in Gunung Condong through technological, social, economical and environmental approach using cleaner production concept.
2. Increasing the quality (level) of essential oil products as a typical product of Gunung Condong in a sustainable manner, from under 70% to 87% (SNI, 2016).
3. Increasing the quantity of essential oil production from 20 kg/ton cloves 60 kg/ton cloves
4. The enhancement both quality and quantity of cloves essential oil can increase the selling value of the product, so that the welfare of the community will increase
5. Increasing the welfare of local communities through the development of indigenous products by involving the participation of the community in the implementation of planning, assessment, evaluation and implementation of the program in a sustainable manner.

4. Financial sustainability plan: how is this initiative financially supported? How will you ensure its financial sustainability long term?

The competitor of the company's plan is a large-scale producer who has a definite market share, however the market opportunity for essential oil is very large, both small and large scale, this can be seen from the relatively stable price of clove leaf oil at 2002 and 2003. In early 2002 the price of clove leaf oil reached Rp 29,500, - and in 2003 fluctuated between Rp 23,000 to Rp 25,000 per kilogram. The prices also tend to be stable until entering 2004. Fluctuations in clove leaf oil prices are also influenced by fluctuations in the rupiah against the US dollar. At the time of crisis of 1997, clove leaf oil price could reach Rp 57.000, - per kilogram (primary data). Based on primary field data obtained, clove leaf oil producers estimate the price for breakeven point (BEP) or break even is around Rp 20.000, - per kilogram. By looking at the price difference on the BEP condition with the selling price in the market, then this business is quite promising.

Essential oil products 95% using domestic products because the cloves used are natural resources in the village of Gunung Condong. Growing media or additional fertilizer are all made from local raw materials.

One of the rural community institutions has applied the principles of social and economic institutional development of the community with the aim of making rural communities, especially farmers to be robust, dynamic and independent in order to realize a prosperous society is the Institute for Prosperous People's Economy that developed in Southeast Sulawesi Province. *Lembaga Ekonomi Masyarakat Sejahtera* (Prosperous Economic Society, abbreviated as *LEM-Sejahtera*, means to be a glue of unity for all villagers from various backgrounds (livelihood, group, ethnic, religion, and political views) and program synergies from all institutions conducting development activities in village level. The *LEM-Sejahtera* farmer institution is a village economic institution formed from, by, and for rural communities with a local wisdom approach, with all villagers in collecting self-help power to utilize the available resources available to improve the welfare of all their members.

5. Unique value proporsition:
what makes your initiative innovative? How does your project differ from other organization working in the same field?

Green engineering concept with cleaner production approach is a concept made for :

1. Minimize the emission from the resources
2. Human health protection
3. Environment sustainability protection

This concept become unique because it planned, built, and implemented by involving local society in Gunung Condong. By using this concept hopefully can give some effective and efficient improvement since it project planned and developed then. This project emphasize the concept of “from the village, by the village, to the village”

CHAPTER I

A. Introduction

Gunung Condong, a small village in Purworejo Regency, Central Java has a high biodiversity potential. Various plants are able to grow quite well, such as food crops, horticulture, plantation, and forest products. Based on data from Bappeda Purworejo 2005-2009, the plantation in Purworejo Regency consists of clove plantation, coffee, sugar palm, Java cotton, cardamom, *kemukus*, Javanese ginger (*Curcuma zanthorrhiza*), aromatic ginger, turmeric, elephant ginger, tobacco, patchouli, *mlinjo* and vanilla. In addition, the plantation processing industry in Purworejo Regency is also very potential to develop one of the essential oils distillations.

Clove is a potential commodity of the region *(Citation)*. Essential oils is one of the processed ingredients of plants that have important values for human life. Essential oils derivation is widely used as raw materials in various industries such as the perfume industry, cosmetics, essence, pharmaceutical industry and flavoring agent. Essential oils plays an important role as an odor binder in perfume products, such as patchouli oils, vetiver oils and sandalwood oils. Essential oils derived from herbs is commonly used as flavorings in food and drink, such as pepper oils, cinnamon oils, nutmeg oils, clove oils, coriander oils and ginger oils.

Since 2000 Gunung Condong has started producing essential oils. Based on the information from surrounding residents, the types of essential oils that have been produced include: cloves and patchouli. Essential oils can be produced by plants in a variety of quantities and can easily be extracted through a simple distillation process. Gunung Condong is one that implements a simple distillation process in producing essential oils.

The problem from essential oils production in Gunung Condong is the lack of integration between the science of technology, environment and organizational structure of essential oils production which makes the economic improvement of the community difficult to achieve. Essential oils sold in the market had a purity level about 70% for a long time. While the quality of essential oils is good if the purity level reaches 87%. However, the essential oils products in Gunung Condong has a purity level under the market standard, that is 60%. Production wastes are also not optimally managed yet, either solid waste or liquid waste. In addition, the production of essential oils in Gunung Condong is only done at the time of product demand. It makes the demand cannot be properly continued.

Based on the existing problems, it is necessary to evaluate the essential oils production from SDG (Sustainable Development Goals) program based on Cleaner Production. Therefore, further efforts is needed to improve the quality of essential oils products and to evaluate its system in Gunung Condong by considering the environmental aspect. The efforts that can be made to overcome these problems are the integration of technology and social approaches that can be applied to essential oils. Based on some research, clove fermentation can improve the purity of essential oils.

Therefore, the present project is hoped to be not focused on the improvement of the purity of oils, but also to evaluate waste management caused by essential oils production through waste and water management. Also, the program will evaluate the structure of oils production and product sales to create system sustainability.

B. Purpose

1. To mplement SDG's program in essential oils production in Gunung Condong through technological, social, economical and environmental approach using cleaner production concept.
2. To improve the quality and quantity of essential oils products as a typical product of Gunung Condong in a sustainable manner.
3. To improve the welfare of local communities through the development of indigenous products by involving the participation of the community in the implementation of planning, assessment, evaluation and implementation of the program in a sustainable manner.

C. BENEFITS

1. Implementing of SDG's program in the production of essential oils in Gunung Condong through technological, social, economical and environmental approach using cleaner production concept.
2. Increasing the quality and quantity of essential oils products as a typical product of Gunung Condong in a sustainable manner.
3. Increasing the welfare of local communities through the development of indigenous products by involving the participation of the community in the implementation of planning, assessment, evaluation and implementation of the program in a sustainable manner.

CHAPTER II. SUSTAINABLE PRODUCTION DEVELOPMENT

The concept of Sustainable Development Goals (SDG's) refers to the universal purpose in maintaining the balance of the three dimensions of sustainable development: environmental, social, and technology. Based on the results of the Conference on Sustainable Development undertaken by the United Nations in Rio de Jainero 2012, the main foundations for the implementation of SDG's are human, planet, welfare, peace and partnership. The main purpose of SDG's implementation of the program are: ending poverty, achieving equality and tackling climate change. The efforts to achieve these objectives are implemented through 17 global objectives according to the following figure.

Fig 1. Seventeen Goals in Sustainable Development Goals.

The form of implementation of SDG's program which will be applied in this project is aimed at the production of essential oils as the original product of Gunung Condong, Purworejo, Central Java through the concept of "Cleaner Production". The selection of clean production concept is based on the existing condition of essential oils production process in Gunung Condong in which there are many deficiencies and problems that disturb the quality, quantity, and sustainability of essential oils products. The problems that interfere the production process of essential oils in Gunung Condong are:

1. The availability of raw materials essential oils that still have not met the production target. The type of raw material needed is: cloves and patchouli.
2. The quality of essential oils production still does not meet the essential oils quality standards in general. The content of eugenol is still <87%.

3. The unavailability of structured management in managing waste generated during essential oils production process, so it is considered to disturb the environment and health of the people of Gunung Condong in the future. The waste is generated in the form of solid waste and liquid waste.
4. The target of the essential oils market of Gunung Condong is still unclear, so it still involves the 3rd party in the market. As a result, the selling price of essential oils is lower than the market standard.
5. The economic benefits of local specialty products are still not widely felt by the public

The existing condition of the essential oils production process in Gunung Condong is further described in Chapter I. The Cleaner Production concept in this case will involve 4 elements of approach:

1. Technology: as an effort to improve the quality and quantity of essential oils products and to manage the generated waste.
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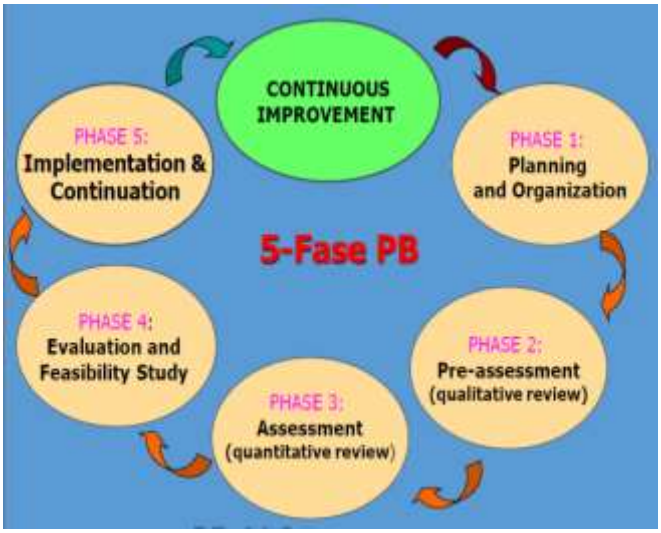


Fig 2. Basic Concept of Cleaner Production.

The CP technique employed by organization differs, however, the basic CP processes are:

1. Planning and organization - CP process, stakeholder input sort, formed CP team, reviewed or written environmental policy, budgets and program.
2. Assessment - identified and assessed material inputs and outputs, assessed current processes and costs, reviewed environmental and health impacts, identified CP options.
3. Feasibility analysis - each CP option is assessed for its environmental impact and its technological and economical viability, selected final CP option.
4. Implementation - selected CP option is implemented and the monitoring and evaluation program is established.
5. Continuation - regular audits is conducted and findings feed back into the decision making process, stakeholders informed of progress and gains.

PHASE 1: Planning and Organization

Gunung Condong is a village located in the highlands of Bruno District, Purworejo, Indonesia. There are five hamlets namely Brembet, Kemplung, Karangsari, Kepudang and Krajan. About 1,500 people live in Gunung Condong. The majority of these people work in agriculture with a composition of 500 people working in the forestry sector, 300 in horticulture, 250 farms, 350 plantations and others 100 inhabitants. Based on this condition, there is no doubt that people are well acquainted with the management and utilization of cloves, one of the agricultural commodities, as essential oils. However, based on field studies, people are less aware of the importance of waste management production.

Cleaner production (CP) is a preventative approach to managing the environmental impacts of business processes and products. CP uses changes in technology, processes, resouces or practices to reduce waste, environmental and health risks; minimise environmental damage; use energy and resources more efficiently; increase business profitability and competitiveness; and increase the efficiency of production processes. Cleaner production is applicable to all businesses, regardless of size or type. Based on CP's phases mentioned above, planning and organisation is the first step to built up an organization or group.

Environmentally conscious for rural development program in Gunung Condong is suitable to be applied. it is supported by the existence of organizational structure.kepala desa bersama dengan berbagai head affairs adalah aparatur negara yang bertanggung jawab dalam pembangunan desa. Integrated system from government, development, financial and general affairs could help community in establishing essential oil industry which is environmentally conscious.The head of government affairs together with the head of development affairs can assist the village head in the formulation of management policies to create a zero essential oil production environment. The village financial system is well managed by the competent authority, Suyono. While the management of village wealth inventory has been managed by the head of general affairs. If the essential oil development program is typical of Mount Condong can be realized, it will create zero waste environment, increase in income, and increase the welfare of the community. Scheme bellow is village board members in Mountain Condong:

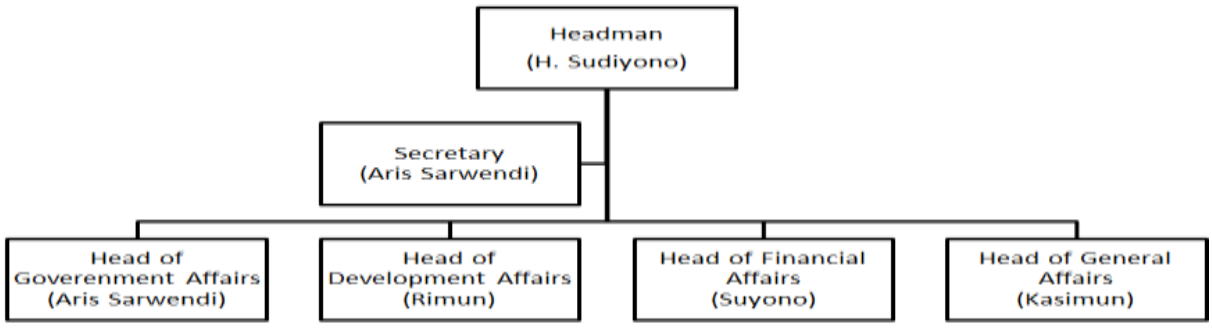


Fig 3. Village Board Members

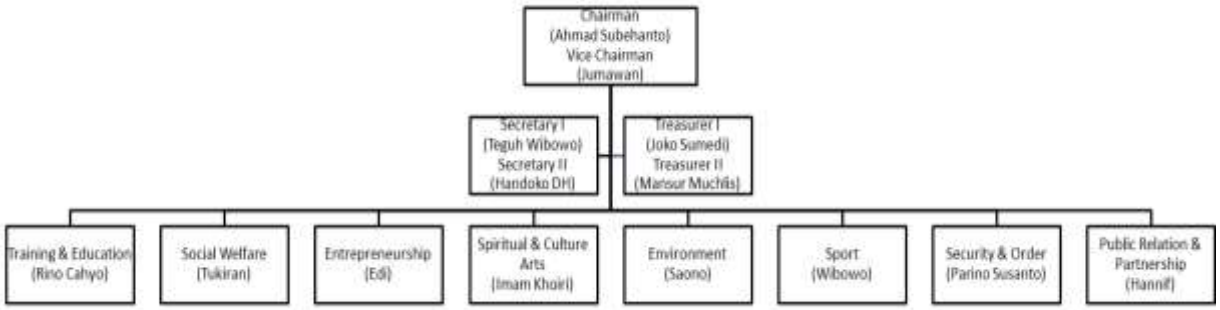


Fig 4. Youth Organization

One of the rural community institutions has applied the principles of social and economic institutional development of the community with the aim of making rural communities, especially farmers to be robust, dynamic and independent in order to realize a prosperous society is the Institute for Prosperous People's Economy that developed in Southeast Sulawesi Province. *Lembaga Ekonomi Masyarakat Sejahtera* (Prosperous Economic Society, abbreviated as *LEM-Sejahtera*, means to be a glue of unity for all villagers from various backgrounds (livelihood, group, ethnic, religion, and political views) and program synergies from all institutions conducting development activities in village level. The *LEM-Sejahtera* farmer institution is a village economic institution formed from, by, and for rural communities with a local wisdom approach, with all villagers in collecting self-help power to utilize the available resources available to improve the welfare of all their members.

The village-level *LEM-Sejahtera* Board consists of chairmen, secretaries and treasurers assisted by stewardship of hamlet levels with neighborhood approaches to organize citizens at hamlet level, while for the control and guidance of institutions at the village level a supervisory board and supervisor is established. As a legalisation of business activities for all *LEM-Sejahtera* farmers institutions in all districts established cooperative *LEM-Sejahtera*. For the construction of LEM-Sejahtera, an unfavorable institution is built which also serves as a forum for facilitators, controllers and advocates of sub-district, district and municipal institutions, with a governance structure consisting of government officials, private sector, banking, farmers associations and non-governmental organizations.

The existence of *LEM-Sejahtera* demonstrates the success of an integration model that combines the social and economic interests of citizens. The existence *of LEM-Sejahtera* will be sustainable if able to accommodate social interests (Homo socially) and economic interests (Homo Economicus) which is embodied in the integrated concept of socio-economic interests of society (Homo socio-economicus).

Business development can be done with two approaches: (1) regional-based business development and (2) commodity-based business development. In agriculture very close to the countryside, the development of regional-based enterprises is very much in line with zoning agricultural commodities. With a region-based, the existence of an agricultural product or other type of business will cluster in a region, so that will meet the scale of business economics. With the base area then the volume of production and quality more easily controlled.

The development of commodity-based enterprises focuses attention on special results with quality awake. The development of commodity-based enterprises provides an ease in coordination system, but gives a relatively high risk because it has no other product alternative. The basis for business development needs to be discussed in member meetings, but as an illustration the merging of the two approaches becomes the best alternative. When using a combined model then the first consideration is the territory, then the commodity or the type of business. With the region becoming the first criterion, the economics of the type of business will be more easily assessed feasibility.

PHASE 2: Pre-Assessment

The current processing of essential oils found in Desa Desa Condong generally still uses conventional equipment and stages. The distillation process currently used by the hill-bent community itself is by the method of distillation with water and steam. However, in fact in the oil essential oil, there are three kinds of distillation methods, namely:

1. Water distillation
2. Water steam distillation
3. Steam distillation

Fig 5. The existing essential oil processing factory

Distillation is the process of separating the components of a mixture of two or more types of liquids based on their vapor point difference and this process is carried out on essential oils that are not water soluble. According to (Guenther, 1987) the distillation is performed to purify and separate volatile oil by means of evaporation, and the evaporation process is also intended to extract essential oil from essential oil-producing plants with the help of water vapor. In the distillation system with water and steam the oil decomposition process is smaller (hydrolysis, ester, polymerization, resinification and others).The method of distillation with water and steam is more efficient than the method of distillation with water because the amount of fuel needed is smaller and the yield of oil is greater (Ketaren, 1985). The following are the steps in the essential oil distillation with water and steam:

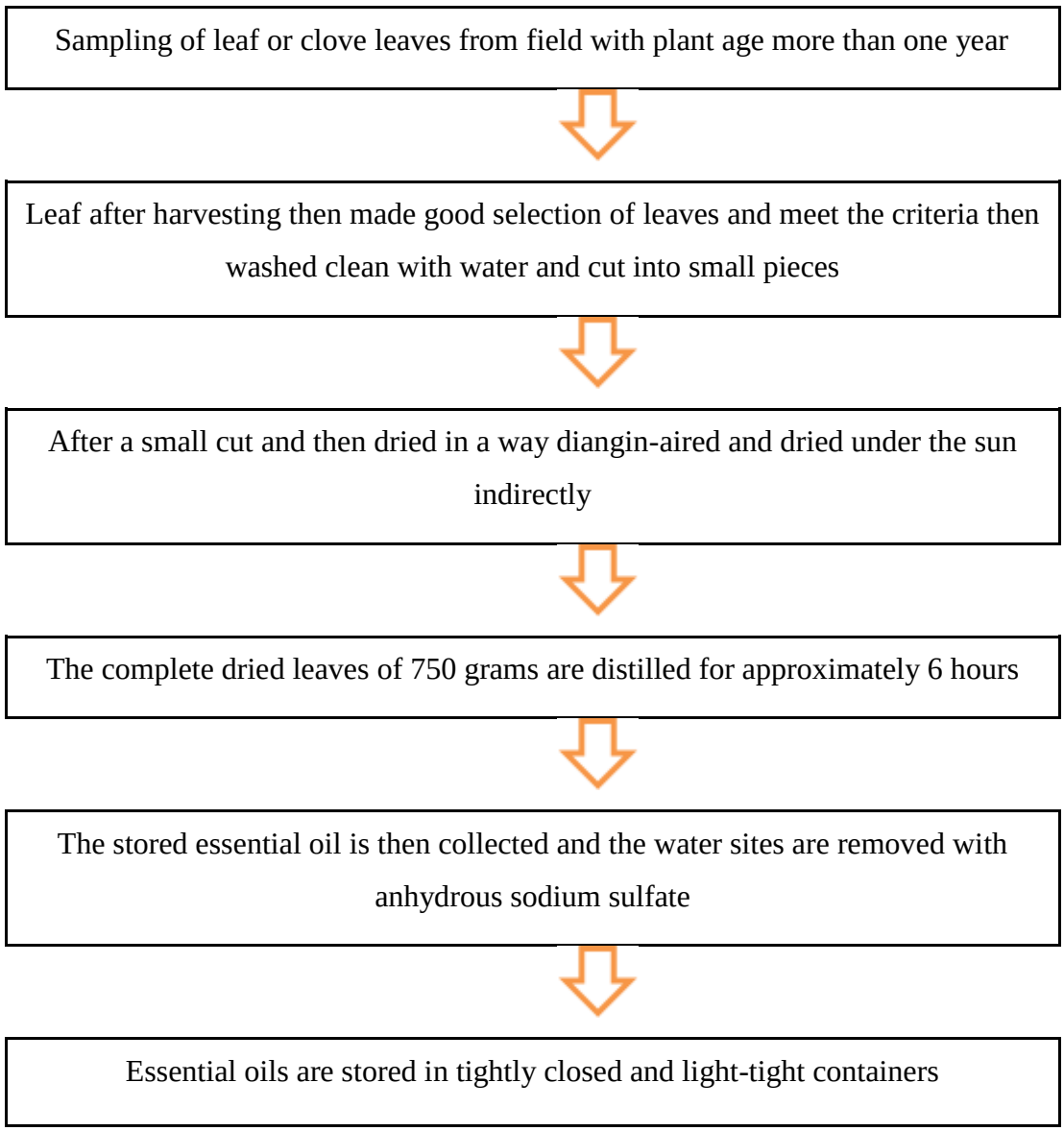


Fig 6. Process production

PHASE 3: Assessment

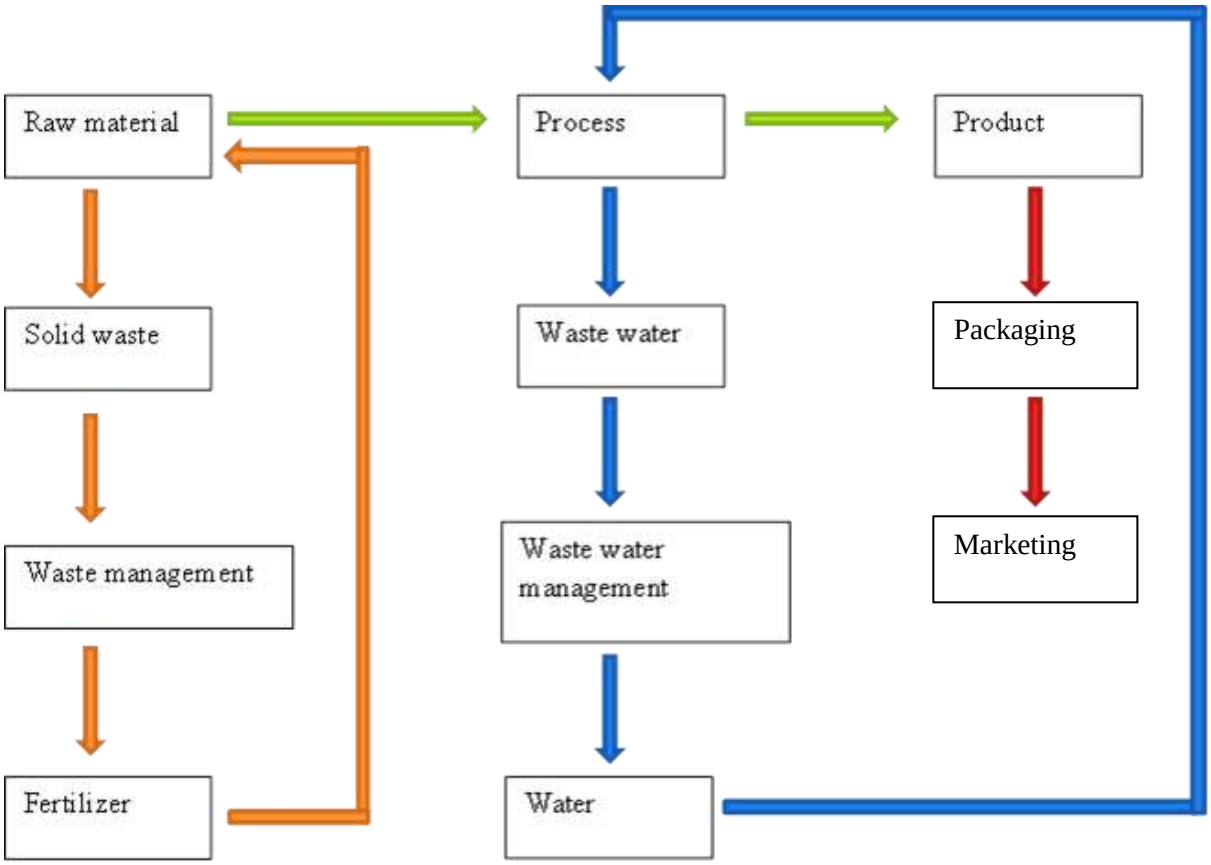


Fig 7. Process of Cleaner Production in Pre-Production, Production, and Post-Production

Making essential oil with fermentation technology innovation

1. Material preparation of clove essential oils

   Parts of clove plants such as twigs and clove leaves are dried in a shady spot and not exposed to direct sunlight

2. Fermentation

   The sterile clove leaves (200 grams) were sprayed with 100 mL of stater solution (nutrient solution + Trichoderma harzianum 6%) evenly (Nasruddin et al., 2009). The clove leaves are put into a jar and fermented for 8 days in aerobic fermentation at room temperature for 5 days followed by anaerobic fermentation at room temperature for 3 days (Pujioktari, 2013).

   T. harzianum is a microbial fungus capable to degrade cell walls of plant parts that are fermented due to the activity of cellulose enzymes. Successful fermentation will produce a distinctive acidic odor with the formation of lactic acid and citric acid. According to a study by Wijaya et al. (2015), the results indicate that the fermentation

method is the best method applied in the production of essential oils. The essential oil fermentation method has fulfilled the standard set by SNI 06-2387-2006.

3. Analysis of clove essential oil content

The absence of standardization of essential oil products in Gunung Condong is one of the obstacles in product marketing. These factors lead to public distrust of the essential oil products of Gunung Condong. Gas Chromatography (GC) analysis can be used to determine the level one of essential oil content, i.e., eugenol.

The research conducted by Wijaya et al. (2015) proved that the yield of fermented essential oils showed leaf texture changed to be more fragile. This is because cellulose contained in the leaf cell wall can be degraded by cellulase enzyme produced by T.harzianum during fermentation. The smell of fermented leaves is also changed, that is a distinctive aroma of fermentation that smells rather stinging. The typical aroma of fermentation is thought to be derived from citric acid. According to Agnihotri (1970), *Trichoderma harzianum* is able to produce citric acid and *Trichoderma viride* is able to produce oxalic acid. The production of organic acids will affect the pH of the media. According to Ensminger (1990) in Pujioktari (2013), good fermentation characteristics include acidic pH as well as the smell of acids or a mixture of lactic acid and citric acid.

From the process of distillation of clove leaves of this fermentation yield of essential oil yielded equal to 2,6567%; refractive index 1.5190; solubility in ethanol 70% 1: 1,5; weight of type 20℃ / 20℃ 1,030; and the peculiar smell of clove oil with the color of clear yellowish oil. Based on the physical properties of essential oils obtained, it can be concluded that the essential oil of clove leaves fermentation results in accordance with the range specified in SNI 06-2387- 2006.

Solid Waste Management to be A Fertilizer

Clove processing into essential oil becomes a selected agribusiness in Gunung Condong. It will produce various wastes, ranging from raw material processing, processing, and even packaging along with the essential oil industry. Zero waste is a key to reaching the destination of SDGs. Practically, at the initial step, raw material of cloves produce solid waste. Solid waste means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or water pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and estates, and disposable materials in the US. The USC 1342, as amended (86 Statement 880), or source, special nuclear or by-product material as defined by

the Atomic Energy Act of 1954, as amended (68 Stat. 923) except as may be provided by existing agreements between the State of New York and the government of the United States (DEC New York, 2017). Solid waste generated by raw material is old age clove flower and plant organ pollution that cannot be used as raw material for making essential oil.

SDGs has one of the goals of sustainable industrialization and foster innovation (UN, 2017). Innovation offered in achieving sustainable industrialization in this activity is the manufacture of fertilizer made from non-proceed raw material. There are flowers through the age of harvest and the foliage that fell in the area of cultivation. Procurement of compost fertilizer from clove solid waste can affect the environment, economy, and community resources itself. Based on the environmental aspect, compost fertilizer is an eco-friendly fertilizer, so its application gives a positive effect on the environment, such as the ecosystem is maintained due to the absence of pollution. Based on the financial aspect, fertilizer is essential input in clove planting. The success of the community of Gunung Condong in the manufacture of fertilizer that can reduce the price of goods production. Judging from the existing impacts, compost fertilizer is correlated with increasing human resource capacity and community welfare of Desa Gunung Condong. Increasing human resource capacity in terms of the training of compost manure from clove waste can improve the soft skill of the community in agriculture. In addition, the welfare of the community is seen from the improvement of living standard as marked by the increase of income due to the reduction of production cost. The following illustration shows the process of fertilizer making:

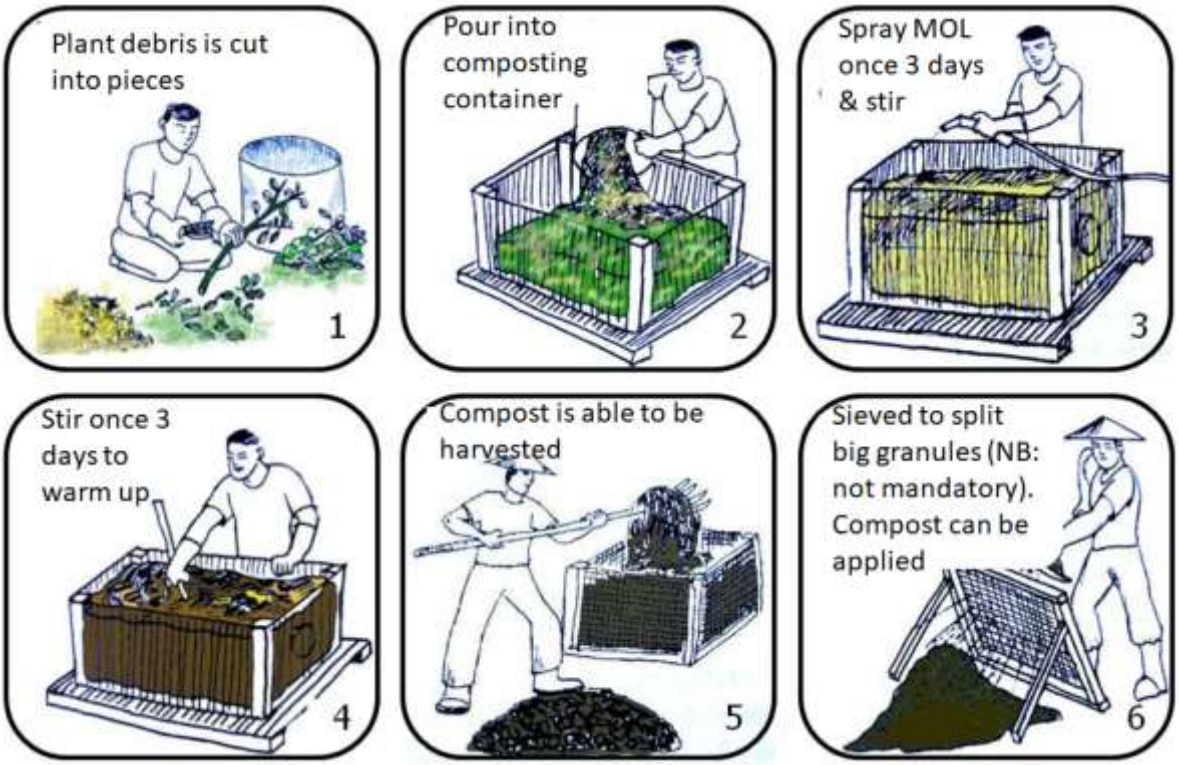


Fig 8. Solid waste processing into fertilizer

Management of solid waste to be a fertilizer is not successfully done without MOL. MOL is local microorganism used as a starter in the manufacture of solid organic fertilizer and liquid fertilizer. Its main ingredient consists of several components, i.e., carbohydrates, glucose, and a source of microorganisms. The base material for fermentation MOL solution may come from agriculture, plantation, as well as household waste organic. Carbohydrates as a source of nutrients for the microorganisms can be obtained from organic waste such as rice water, cassava, wheat, grass, and leaves of Gliricidia. Source of glucose derived from liquid brown sugar, granulated sugar, and coconut water, as well as the source of microorganisms derived from the bark of rotten fruit, shrimp, conch, rice casserole, and cow urine (Adianto, 1993). It can be purchased at agricultural production of facility stores. MOL, already present in the packaging, is usually labelled EM4 (Effective Microorganism 4) which means that there are 4 types of soil microbes profitable in the packaging. Here is the process of making MOL:

1. Prepare enough stale rice to be formed into spheres as big as a baby fist.
2. Place the rice sphere in a sealed container.
3. Put the container in place of direct sun, and silence ± 3 days.

4. Observe whether the fungi have grown or not after 3 days. Fungi are usually yellow, orange and gray.
5. Insert the fungi overlaid rice ball into the container.
6. Make a mixture of water and sugar with a ratio of 1 l water with 4 tablespoons of sugar.
7. Pouring the water solution that has been mixed with sugar into the container containing the fungus rice and closed tightly.
8. Silence/incubate the mixture of rice and sugar solution for 4-6 days. If it is successful, the mixture of rice and sugar water will smell like sour tape.
9. MOL can be used as a starter to make compost using water mixed with MOL ratio 1: 5.

Waste Water Treatment Plant

Fig 9. The exixting waste water from essential oil production

The waste water from byproducts of essential oil distillation process is still not processed in Gunungcondon village. Generally waste water is only accommodated or discharged into the environment without any processing. According to Peraturan Menteri Lingkungan Hidup 2014 about Baku Mutu Air Limbah, waste water is a water produced from a business and / or activity in the form of liquid.Unprocessed wastewater and discharged into the environment can cause deterioration of environmental quality and become a source of disease. Parameters used to determine the level of water pollution include color, pH, TSS, phenol, BOD and COD (Sugiarto, 2008). Waste water quality standard according to the general characteristics of waste water in the production of essential oils in general are as follows.

Table 1. General Characteristics of Waste Water of Essential Oils

Parameter	Content	Unit
pH	6-9	-
TSS	100	mg/l
BOD	75	mg/l
COD	150	mg/l

Source: Peraturan Menteri Lingkungan Hidup RI, 2014

Waste Water Production

The estimated wastewater generated during the process of making 25 kg of essential oil from cloves is about 2665.7 liters. Illustration of wastewater production from essential oils according to the following figure.

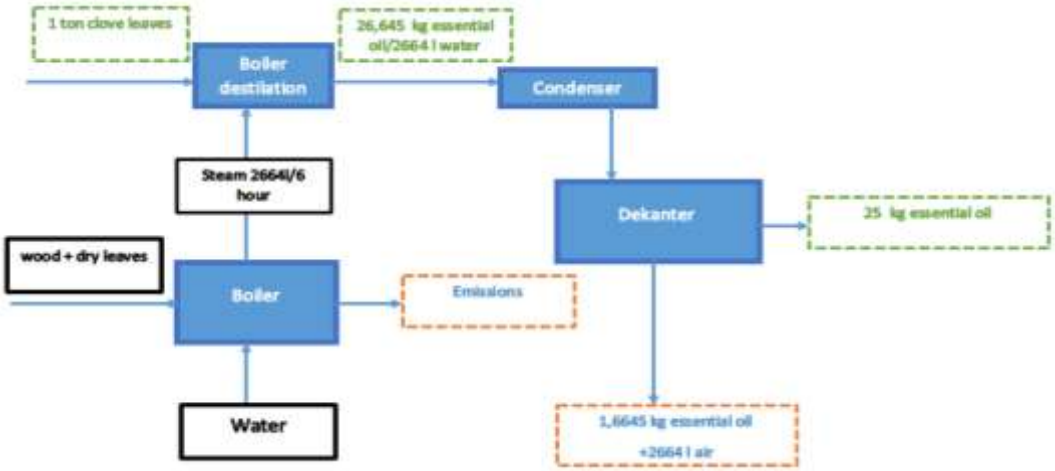


Fig 10. Waste water production from essential oil

The design of wastewater treatment systems

The design of waste water treatment system in this project is Anaerob-Aerob Biofilter Plant (Fig. 11). Waste water treatment with Anaerob-Aerob Biofilter process is a waste water treatment process by combining anaerobic biofilter process and anaerobic biofilter process. By using an anaerobic biofilter process, the organic pollutants present in the waste water will break down into carbon dioxide and methan gas without using energy (air blowers), but ammonia and hydrogen sulphide (H2S) gas are not lost. Therefore if only using anaerobic biofilter process alone can only decrease organic pollutants (BOD, COD) and suspended

solids (TSS). In order for the processed water to meet the quality standard, the processed water from the anaerobic biofilter process is further processed using an aerobic biofilter. With the aerobic biofilter process the remaining organic pollutants will break down into carbon dioxide (CO2) and water (H2O) gases, the ammonia will oxidize to nitrite then become nitrate, while H2S gas will be converted to sulfate. By using anaerob-aerob biofilter process will be able to produce processed water with good quality by using lower energy consumption.

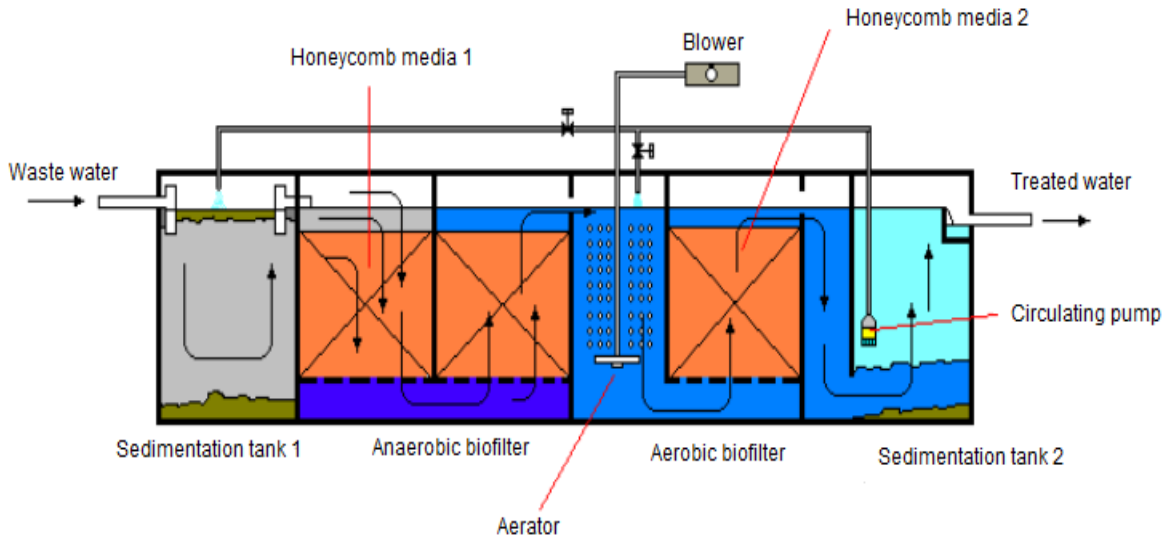


Fig. 11 Waste water treatment plant

Some advantages of wastewater treatment process with anaerobic-aerobic biofilter between
others ie:

1. Management is very easy.
2. There is no need for large areas.
3. Low operating costs.
4. Compared with the active sludge process, the resulting Mud is relatively small.
5. Can eliminate nitrogen and phosphorus that can cause eutrophication.
6. Air supply for aeration is relatively small.
7. Can be used for wastewater with a considerable BOD load.
8. Can remove suspended solids (SS) well.

PHASE 4: Evaluation and Feasibility Study

In order to produce durable products for a long time, several things to note in the packaging

1. clean before stored → serves to reduce the impurities on essential oils
2. store in a crate → serves to reduce photodegradation due to exposure to light
3. store at low temperature → stabilize function of compounds contained in essential oils
4. container storage → each container has its own influence for the quality of essential oils, an alternative option is to use a plastic container by doing the above steps, then the chance of essential oils can be durable products for a long time.

The use of essential oil is very much, depending on the type of plant taken from the flute. This essential oil is used as raw material for perfume, comestics and medicines. Essential oils are also used as an ingredient in flavor and fragrance (flavor and fragrance ingredients). The commodity and perfume industry uses essential oils for making soap, toothpaste, samphoo, lotion and perfume. Food industry using essential oil as flavoring or flavor enhancer. The pharmaceutical industry uses it as an anti-pain, anti-infective, bacterial killer. The function of essential oils as perfumes is also used to mask the odor of other ingredients such as insecticides needed by the preservative industry and insecticide materials.

Clove leaf oil refining business is also a commodity that can be seeded in the international market although its contribution is relatively low compared to other commodities, but at least the export of clove leaf oil has given foreign exchange earnings above one million dollars per year since 1988. The low value of this export due to the low production output that is heavily influenced by the season. From the demand side, the demand for clove leaf oil is still high so that the opportunity to develop and open a clove leaf oil business in other regions in Indonesia still has wide market potential. From the employment aspect, the clove leaf oil distillation business does not absorb a large amount of labor, but has backward effect at least on equipment manufacturing and clove farmers who become raw material suppliers. This business also has a high added value.

The absorption of manpower from these efforts can be felt by the surrounding communities in rural areas that are generally farmers and have a direct impact on their income and economic improvement. With reduced unemployment will directly affect the social conditions of society such as reducing the level of crime.

Clove leaf oil processing business produces waste that is not harmful and environmentally tolerable. The liquid waste is distilled water. If the process of separation of water and clove leaf oil takes place perfectly, then the remaining water has no adverse impact

on the environment. Another solid waste is dried ash of burning leaves that can be used as fertilizer. In general, this clove leaf oil refinery business is environmentally friendly.

The competitor of the company's plan is a large-scale producer who has a definite market share, however the market opportunity for essential oil is very large, both small and large scale, this can be seen from the relatively stable price of clove leaf oil at 2002 and 2003. In early 2002 the price of clove leaf oil reached Rp 29,500, - and in 2003 fluctuated between Rp 23,000 to Rp 25,000 per kilogram. The prices also tend to be stable until entering 2004. Fluctuations in clove leaf oil prices are also influenced by fluctuations in the rupiah against the US dollar. At the time of crisis of 1997, clove leaf oil price could reach Rp 57.000, - per kilogram (primary data). Based on primary field data obtained, clove leaf oil producers estimate the price for breakeven point (BEP) or break even is around Rp 20.000, - per kilogram. By looking at the price difference on the BEP condition with the selling price in the market, then this business is quite promising.

Essential oil products 95% using domestic products because the cloves used are natural resources in the village of Mount Condong. Growing media or additional fertilizer are all made from local raw materials.

PHASE 5: Implementation and Continuation

A. Introduction of Agroforestry Practice

The term of Agroforestry itself is an system of land management which combining forestry and agriculture as well as farm production in the same land. Agroforestry was applied to obtain maximum result from forest management (Gold et al., 2000). Actually, Agroforestry practice has been implemented and has obtained attention for a long time as an alternative within land use practices which the natural resources are efficient and more eco friendly. These practice more directed to the function of soil and water conservation. In the larger scope so that agroforestry consist of practice which the range include establishment and management of trees. in and inside of agriculture land. grassland and sherpherding with the purpose to controlling soil erosion, developing sustainable agriculture system, improving wildlife habitat and rural landscape, mitigating environmental pollution and increasing agriculture economic through harvesting based on product which authenthic.

Currently, agroforestry trend has obtain attention and introduction very large as a solution to solve environmental, social and economic problems. According to Garrity (2004) agroforestry technology is a holistic approach and optional which innovatif to utilizing benefit within mitigation both of poverty and climate change. In the past, adoption from

agroforestry was considered as an optional to conserve soil and water as well as increasing land aesthetic or diversity from agriculture commodities. Currently, adoption from this system are necessary to assist especially decreasing of poverty, mitigating environmental pollution and atmosphere. Although, there are many benefits will but adoption from agroforestry currently in all of world must still limited.

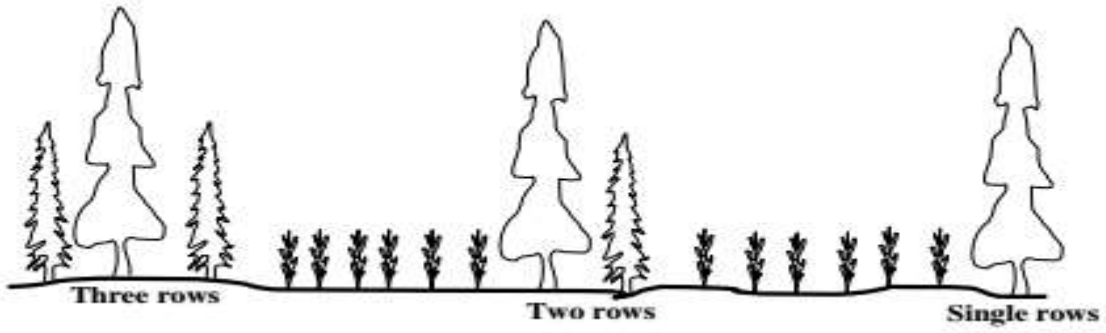
B. Crop Criteria for Agroforestry

A number of tree species and or shrubs can be used as one of the commodities in agroforestry practices. According to Garrity and Mercado (1994) the selection of tree species for agroforestry is critical for successful determination and production on different systems. Some of the factors that influence from the selection itself include:

1. Average growth: Trees should grow rapidly for maximum and strengthen soil erosion control as well as production benefits.
2. Potential to regrow: The ability of trees to survive frequent cuts and rapid regeneration is important especially in planting blocks.
3. Canopy and Leaf Characteristics: Leaf orientation and density plays an important role in the interception of falling rain, limiting light or controlling the shadows for proper crop development. Leaf decomposition rate is another factor for nutrient and supply cycles against planting blocks, forestry agriculture and silvopastur.
4. Determination: Rapid determination of seeds or weeding and resistance to weeds as well as the ability to adapt to pests, floods, stagnant water and temperate fluctuations following essential quality determinations.
5. Rooting System: Root distribution is important for stabilizing soils, recycling nutrients and minimizing chemical leaching. In some ecosystems, trees with shallow root systems will be able to reduce leaching.
6. Usage: The most important criteria for tree selection are shown for use of plantations including timber, fruit, feed crops, green manures and fuel production,

The design of planting blocks using intercropping plants can affect the flow of water, air and heat energy within themselves as well as the overall intercropping of agricultural crops. The view of the plant block system is important to reduce competition among plant species, production and land optimization. Interrupted plants may consist of one or a mixture of plant species that have been embedded in multiple or single rows. The following is a scheme of intercropping arrangements in a planting block:

Some points should be considered when designing a planting block among others, namely:



1. Lines of trees and or shrubs should be spaced to accommodate the light, biological, temperature and nutrient requirements of agricultural crops. Some competitions for water and nutrients reduce agricultural production and / or tree growth in the early stages of development.
2. The exact selection of trees and agricultural crops, planting block arrangements, pruning and timing of planting and harvesting can reduce competition.
3. Mulch and use of the cover crop should be a component in the system.
4. Corn, soybeans, wheat and potatoes require abundant light and should not be planted too close to the hedgerow.
5. Tolerant species grow below or near trees.
6. Setting the distance from the fence plant should be to increase the potential as a control for runoff and soil erosion.
7. The distance arrangement between the hedgerows ranges from 10 to 25 m depending on local and regional scales and objectivity.
8. A distance of 25 m between the hedgerows is likely to avoid overlapping shade for up to 20 years.
9. A longer period of agricultural crop production requires a wider distance between the hedgerows.
10. The fence plants should be set evenly for the wind direction to the west and east to provide sufficient light while reducing wind erosion.
11. The tree line should be oriented to the east-west direction to maximize the use of sunlight.

C. Challenges in Agroforestry Systems

Benefit of soil and water conservation of agroforestry practices are well recognized but these systems are yet to be widely adopted. Adoption of agroforestry pracitces has been

slow. Agroforestry systems must be made profitable. Examples of crop production increases, commercialization of tree-derived products, and provision of financial incentives might heighten farmer's interests in agroforestry practices. Agroforestry systems have potential to address the subsistence needs of rural communities, but a large scale adoption is needed to restore the vast marginal and degraded lands so as to effectively ensure food security, alleviate poverty and sustain the environment. Development of regional and local programs that provide financial incentives to farmers who engage in agroforestry practices is a priority for a large scale adoption of these system to combat poverty.

Consideration in relation to social (e.g. demographic factors, land ownership, availability of markets, infrastructure), economic (e.g. financial incentives, economic benefits) and environmental (e.g. soil erosion, water quality, global climate change) constraints are essential to the success of agroforestry programs. Some of the technical obstacles that limit the rapid expansion of agroforestry for soil and water conservation are the lack of (Nathan et al., 2005).

1. Knowledge concerning the design and management techniques.
2. Selection and domestication of potential tree species.
3. Supply or seeds of vegetative materials.
4. Large scale demonstration and commercialization of agroforestry tree products and
5. Country or region specific programs for selection of species, management guidelines and marketing.

There are also constraints in regards to:

1. **Competition for water, light and nutrients**. Trees and shrubs (e.g., alley cropping) can compete with the companion crops for water and nutrients, resulting in reduced crop yields. Tree roots that penetrate deep into the soil profile increase nutrient cycling and reduce competition for water in surface layers. Increases in soil fertility, C inputs, water use, uptake of leachable nutrients and soil biomass by egroforestry practices over annual cropping systems may not always increase crop yield due to competition (Sudmeyer and Flugge, 2005).
2. **Weed invasion**. Weed invasion and tree shading reduce yields of sensitive crops.
3. **Leaching of chemicals**. Site specific consideration to leaching of nutrients through tree rows is important. In some regions, deep rooted trees cause significant leaching of nutrients.
4. **Soil compaction**. Frequent traffic for harvesting and cultural practices in intensively managed forest systems compact soil. Traffic-induced compaction during harvesting and

site preparation affects growth of trees, offsetting any potential benefits on soil properties.

5. **Soil properties**. Impacts of different tree plantations on soil erosion and soil properties differ among tree specis because of differences in biomass or litter input.
6. **Crop yields**. A balance between benefits to soil erosion control and crop production must be estabiliched to develop sound agroforestry ecosystem. Aside from the benefits for soil and water conservation as well as wildlife habitat improvement, agroforestry implications for maximizing tree, crop and pasture yields are unclear. Components benefiting the optimum production of trees, crop, forage and livestock may adversely affect soil erosion control, wildlife habitat and C sequestration.

D. Steps for Developing an Agroforestry Plan

D. 1. Initial Objectives and Priorities

Agroforestry Planner exploring multiple uses for their property face many preliminary decisions. Not least, if you have a number of different objectives for an ares some may seem to be in conflict. Our land management objectives and priorities will be specific depend on our circumstances and the area we wan to develop for agroforestry. For example there are several goals related to agroforestry plannner within develop their land i.e.

1. Develop a new source of income from unproductive land (diversification).
2. Reduce costs of an existing farm or forest operation.
3. Develop a source of long term income.
4. Develop a source of short term income while awaiting long term income from timber.
5. Reduce property taxes.
6. Protect or improve environmental conditions.
7. Increase grazing opportunities.

D. 2. Evaluate Personal Resource

In addition of our agroforestry practices will require the input of other personal resources. An evaluation of the resources available will help determine which agroforestry options are best suited to our practices. An evaluation should including:

1. Management and labor availability
2. Equipment and buildings: Building and equipment including machines and hand tools that can be used for this development.
3. Livestock: In and around land may already have cattle, sheep or other animals.

4. Plant material: Our sources such as seed, seedlings, cuttings and larger trees.
5. Other materials: Resource such as sawdust or shavings, manure and straw for mulch

D. 3. Identify Current Land Uses

Probably, our land currently are not a land which able to utilized fully for our agroforestry practices so that there are several types of land uses i.e.:

1. Residential.
2. Recreational.
3. Farming (which crops).
4. Grazing (type of livestock).
5. Timber production.
6. Non-timber production.
7. Environmental uses.

D. 4. Map Area(s) for Agroforestry Development

An agroforestry development may include all of our land or only specific areas such as existing woodlands, open field, logged over area or riparian zone. In either case, identifying objectives and making decisions will be much easier if we break our land into seperate development areas with similar current uses and site conditions (such as soil, moisture and existing plants. For each agroforestry development area, we should:

1. Draw a sketch map of the area we are targeting for agroforestry development. Using the legend which provided in our workbook, indicate boundary lines, main geographic features, houses other building and roads.
2. Identify and measure the area approximately, marking these measurements on the sketch. This will help determine planting requirements and potential crop production.

D. 5. Soil Assessment

The soils are grouped according to their limitations for field crops, the risk of damage if they are used for corps and the way they respond to management. There are two principal categories within classification system i.e. The Capability Class and Capability Subclass. The Land Capability Classification identifies the potential of local areas for agricultural production. To categorize the classification of our soil able to refer to County Soil Surveys due to contain The Land Capability Classification for all soils in our country.

The classes are ranked from 1 (highest) to VIII (lowest) but the capability subclasses refer to soil groups within a class. Classes I-IV are considered capable of the sustained production of common field crops. Crop species become limiting as the land capability declines from Class I to Class IV. Class V lands are only capable of producing perennial forage crops or specially adapted crops. Class VI lands are capable of providing sustained pasture. Class VII land are incapable of either arable culture or grazing.

D. 5. 1. Soil Texture and Composition

Mineral soils are particles of rock or minerals produced from rock by weathering and other geological processes. Sands and gravel are the largest particles, while clay and silt soils contain the smallest particles. The finer textures soils hold more water and dry out more slowly. Organic soil layers or horizons are derived from decaying vegetation usually in a thin layer above mineral soils. Where found in a sizable layer, they tend to retain both water and nutrients.

D. 5. 2. Soil Depth

Soil depth determines the rooting capability of the plants you may wish to grow. In particular, forest soils can be quite shallow, requiring extra care in management. You will notice distinct layers as we dig down and we may come across restricting layers such as:

1. Stones and rock outcrops that can interfere with digging and cultivation and can reduce the nutrient and water-holding capacity of the soil. Rock outcroppings are areas with very little soil.
2. Hardpan, a hardened layer below the surface of the soil that can prevent penetration of water and roots. Additional soil features that may be problematic include

D. 5. 3. Soil Mosture

Soil moisture, which is key to the establishment and growth of plants is closely linked to soil texture. The spaces (pores) betweem soil particles hold water and air needed by plants for good growth. Generally, coarser soils are well-drained and are often dry for longer periods while soils with finer textures hold more water and are likely to remain moist longer. Other factors, such as ground water level or the presence of an impermeable layer that restrict drainage also determine soil moisture.

D. 5. 4. High Water Table, Standing Water or Flooding

Regarding the characteristic of area such as wetlands and parts of riparian zones which remain fully saturated for extended periods of time area of special concern. These area are sensitive to access development and machine use and are important for wildlife habitat and other environmental values. We will need to identify these areas of our land and plan to use especially careful management. Access may be limited for all or part of the year.

D. 5. 5. Nutrients

The availability of nutrients in the soil affects the quantity and quality of products produced. We can undertake a soil test to determine the soil pH (acid/alkaline balance), specific nutrient levels and recommendations for various crops. Tissue analysis is also an effective way (preferred in forest soils) to determine nutritional status of existing trees and plants. Although there are soil sampling field kits, soil and tissue samples are usually sent to a laboratory for analysis and interpretation. South and southwest-facing slopes are usually warmer and drier than those facing north, and naturally support different plant communities. Terrain relief refers to whether the site is steep, flat, sloped, rolling, gullied or broken

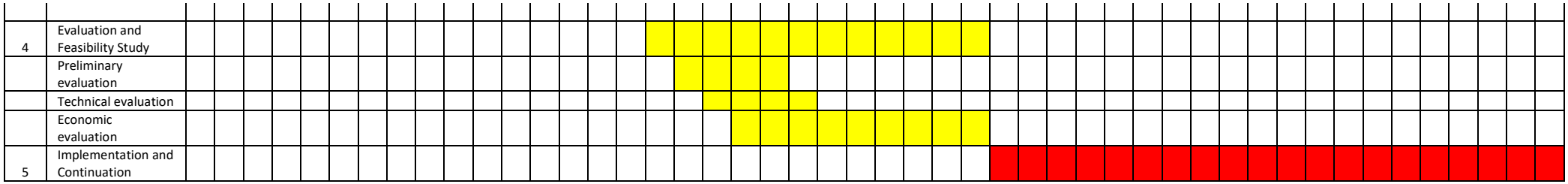
D. 6. Physical Features (Terrain)

There are several physical features that can influence our capability to produce particular crops on a site. Aspect refers to the direction toward which the site slopes (if any). South and southwest facing slopes are usually warmer and drier than those facing north and naturally support different plant communities. Terrain reliefs refers to whether the site is steep, flat, sloped, rolling, gullied or broken (steep slopes betweeen benches). This will influence access and machine capability, water management, cold air drainage, and other microclimate factors. Frost pockets are one additional features to consider Cold air flows downhill and pools in low areas. The resulting localized frosts can damage delicate flowers and shoots that start to grow early in the spring. Even crop plants correctly chosen for our hardiness zone can be affected. Assess low areas on our land for potential frost pockets - the absence of native berry plant can be a good indicator. Avoid theses areas for frost sensitive plants. Sloped or bench land that has good air drainage is a better choice.

CHAPTER III. SCHEDULE

The project will be implemented for 1 year (12 months) with details as follows:

No.	Description of activities	Implementation time																																											
		Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9				Month 10				Month 11				Month 12			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Planning and Organization																																															
	Site survey																																															
	Set up project team																																														
	Forming of LEM-Sejahatera																																														
	FGD Team of Event Organizers with LEM Sejahtera																																														
	Sosialization of Cleaner Production																																														
2	Pre-Assessment																																														
	Site inspection																																														
	Identification of matters																																														
3	Assessment																																														
	Collecting data																																														
	Identifying Cleaner Production Options																																														
	Training of clove cultivation integrated with agroforestry																																														
	Training of harvesting																																														
	Training of Essential oil production with innovation of fermentation technology																																														
	Training of Solid waste management to fertilizer																																														
	Training of Waste water treatment																																														
	Training of Packaging																																														
	Training of Marketing																																														


4 Evaluation and Feasibility Study
Preliminary evaluation
Technical evaluation
Economic evaluation
5 Implementation and Continuation

CHAPTER IV. BUDGET USE PLAN

For 1 Year

1 Year equals 12 Months

CODE	ACTIVITY TOTAL BUDGET	BUDGETING IN 2017			
		QUANTITY	UNIT	PRICE	TOTAL COST
A	**Honor and Wage**				
	Team Honor	4	OB	147 CHF	7,063 CHF
	Production Technical (25 days)	2	OB	136 CHF	272 CHF
	Administration (every tenant)	5	month	55 CHF	276 CHF
	Data processor development	1	unit	147 CHF	147 CHF
	Team Salary (52 days, 100.000 each day)	20	individu	383 CHF	7,652 CHF
B	**Supplies**				
	Cengkeh Seed	70	kg	2 CHF	165 CHF
	Fertilizer (Tablet Gramalet)	100	Zak	18 CHF	1,839 CHF
	EM4	10	L	2 CHF	19 CHF
	Trichoderma	10	kg	8 CHF	81 CHF
	Water Tandon (500 liter)	12	unit	74 CHF	883 CHF
	Paper Purchase A4	8	rim	4 CHF	29 CHF
	Refill Printer	3	cycle	7 CHF	22 CHF
	Stopmap Purchase	30	item	0 CHF	2 CHF
	Envelope Purchase	10	unit	0 CHF	2 CHF
C	**Equipment and Facilities**				
	Oil Control Testing	2	test	221 CHF	441 CHF
	Termohigrometer	3	unit	11 CHF	33 CHF
	pH meter	3	unit	11 CHF	33 CHF
	Water Hose	100	m	7 CHF	662 CHF
	Shovel	2	item	7 CHF	15 CHF
	Sprayer	1	unit	22 CHF	22 CHF
	Product Wrap	25	unit	1 CHF	15 CHF
	Bucket	25	item	4 CHF	88 CHF
	Sampling	20	unit	7 CHF	147 CHF
	Sampling Tools	1	unit	110 CHF	110 CHF
	Construction Ingredient	1	set	7,357 CHF	7,357 CHF
	Other Equipment (honeycomb, blomer, etc)	1	set	736 CHF	736 CHF
D	**Services**				
	Website Design and Bandwith Purchase	1	unit	368 CHF	368 CHF
	Interviewees	2	hours	221 CHF	441 CHF
	Interviewees on Field	7	activity	147 CHF	1,030 CHF
	Training in Gunung Kidul	2	package	221 CHF	441 CHF

	Maintenace Cengkeh Farm (6 people)	144	times	7 CHF	1,059 CHF
	Implementer Team (9 people)	216	times	11 CHF	2,384 CHF
	Laboratorium Analyst	20	times	37 CHF	736 CHF
	Focus Group Discussion	20	times	74 CHF	1,471 CHF
	O & M	1	set	2,472 CHF	2,472 CHF
E	**Transportation**				
	for exhibition, empowering, training, marketing, promotion dan socialization	2	times	736 CHF	1,471 CHF
	Transport for Local Production	24	times	37 CHF	883 CHF
	Transport Local Marketing	24	times	37 CHF	883 CHF
	Transport Survey/Control	24	times	7 CHF	177 CHF
	Lumpsum	6	days	26 CHF	155 CHF
	Hotel	6	days	37 CHF	221 CHF
F	**Non Operational Expenditure**				
	Exhibition Operational Expense	1	package	736 CHF	736 CHF
	Utilization Expense	12	month	18 CHF	221 CHF
	Fotocopy Expense	6	activity	15 CHF	88 CHF
	Bindery Expense	120	activity	1 CHF	88 CHF
	Consumption Expense	14	activity	15 CHF	206 CHF
	Other Expense	1	set	1,471 CHF	1,471 CHF
	TOTAL BUDGET				**43,646 CHF**

CHAPTER V. TEAM OF EVENT ORGANIZERS

Name	Institution	Department	Position & Duty
Ahmad Fadhil Nasir, S.T.	*Beasiswa Unggulan Mengabdi*, Ministry of Education and Culture - Indonesia	Industrial Engineering	Chief Executive
Dhika Sri Angggrahini, S.P.	*Beasiswa Unggulan Mengabdi*, Ministry of Education and Culture - Indonesia	Agriculture	Person in Charge of Raw Material
Reza Bayu Firmansyah, S.Si.	*Beasiswa Unggulan Mengabdi*, Ministry of Education and Culture - Indonesia	Forestry	Person in Charge of Processing
Titi Tiara Anastassia, S.T.	*Beasiswa Unggulan Mengabdi*, Ministry of Education and Culture - Indonesia	Environmental Engineering	Person in Charge of Waste Management
M. Khariurrijal Ibrahim, S.E.	*Beasiswa Unggulan Mengabdi*, Ministry of Education and Culture - Indonesia	Accounting	Person in Charge of Finance
Najmu Tsaqib Akhda, S.P., M.A.	*Beasiswa Unggulan Mengabdi*, Ministry of Education and Culture - Indonesia	Rural Development	Person in Charge of Rural Development
H. Sudiyono	Staff of Local Government of Gunung Condong		Head of Gunung Condong
M. Aris	Staff of Local Government of Gunung Condong		Secretary

Wagiran	Member of Farmers Association of Gunung Condong		Chairman of Farmers Association of Gunung Condong