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# Strategies of eco-friendly stimulant use policy in Perum Perhutani, Indonesia

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**Abstract:** The use of strong acid H<sub>2</sub>SO<sub>4</sub> stimulant (AN-ORGANIC) in effort to improve resin results in Perum Perhutani area is proved not safe for workers and the environment. On the other hand, eco-friendly stimulants such as ETRAT has been used in most areas of Perhutani and wood vinegar were developed. This research is aimed to identify strategies of eco-friendly stimulant use policies in tapping pine. Data collection was conducted through in-depth interviews to several informants consisting of tapper community, foreman, Ranger, Head of RPh, Head of KPH, Deputy head of KPH, NTFPs section chief, Head and deputy chief Production Unit. Selection of informants is carried out purposively that is derived from pine resin producing areas 3 largest in Perum Perhutani (KPH Banyumas West, KPH Kediri and KPH Sukabumi). The results showed that the strategy of eco-friendly stimulant use policies could be adopted by Perhutani with four strategies: 1) Increase the use of eco-friendly stimulant by utilizing eco-friendly wood vinegar-based stimulant produced by Perhutani; 2) Implement eco-friendly wood vinegar-based stimulant produced by Perhutani to press the price of an expensive eco-friendly stimulant; 3) Increase the use of eco-friendly and safer stimulant innovation to convince Perhutani so that eco-friendly stimulant can be accepted and used extensively; and 4) Press eco-friendly stimulant prices through innovations that could be accepted usage in Perhutani thoroughly.

**Keywords:** Stimulant, Eco-Friendly, Tapping, Pine, Policy Strategy

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## 1. Introduction

Pine resin trade Indonesia in the International ranks third after China [5]. Perhutani as one of the producers of pine resin in Indonesia is capable of exporting 80% of its production to foreign countries, namely Europe, India, South Korea, Japan and United States [13]. Increased effort resin results continue to be conducted by Perhutani in line with consumer demand for pine resin. One method to increase the production of pine resin by administering stimulant or aphrodisiac in pine trees tapping, ie a particular liquids are given in the wound of tapping pine useful to further smoothen out the resin from the stem of pine. The liquid used as a stimulant usually made from acid. Almost the entire area of Perhutani uses AN-ORGANIC (made from strong acids H<sub>2</sub>SO<sub>4</sub>) as a stimulant in tapping pine with composition grant of stimulant which varies depending on the altitude of the place.

The use of AN-ORGANIC is considered unsafe for both the health of the pines tapped as well as the tappers as well

as the environment. Therefore, it is developed organic-based stimulant products namely ETRAT safer and eco-friendly. In addition, it gives a positive effect on the resin production, which can increase the production of resin. However, the community does not use immediately the stimulant in the field. This is related to Perhutani policy that does not provide instructions on the use of ETRAT in tapping pine for the whole area of pine forest.

Other organic stimulant made from wood vinegar has good prospects in increased production of pine resin. Wood vinegar is a liquid smoke formed through the combustion process that condensed on the cold temperatures. Wood vinegar stimulant can be made from the trunks of wood waste or other materials that have lignoselulosa and can actually be self-produced by the Perhutani because it is easy and cheap. Based on the research results of field trials showed that stimulant made from wood vinegar is able to increase the production of pine resin on average by 17.8%

comparison with does not use stimulant.

Perhutani as pine forest managers have great power in the procurement of stimulant for resin tappers. For Perhutani, the increase in resin production through the introduction of stimulant required to meet the production targets that have been set. Therefore procurement stimulant used and its responsibility to its use in the field. Tapper communities have already using the stimulant that has been provided. Pine tappers have been aware of the negative impacts of the use of AN-ORGANIC stimulant prefer leaving it and replace it with a stimulant that is safe and eco-friendly.

This study is aimed to identify strategies eco-friendly stimulant use policies in tapping pine. Policy strategy is needed to accommodate the interests acquired in tapping pine Perhutani without compromising people's desire tapper.

## 2. Research Method

The data collection was conducted in September-November 2014 in the area of Perum Perhutani (Unit I Central Java, East Java Unit II and Unit III West Java-Banten). This is a qualitative research and data collection was conducted through in-depth interviews of some informants consisting of people who work in the area of tappers Perum Perhutani (89 people), foreman (5 persons), Ranger (1 person), Head of RPh (4 people), Head of KPH (2), Deputy Chief of KPH (2), Section Head of NTFPs (3 people), Head of Production (3) and Unit Deputy Chief (1 person). Selection of informants is carried out purposively that is derived from pine resin producing areas 3 largest in Perum Perhutani (KPH Banyumas West, KPH Kediri and KPH Sukabumi

SWOT analysis is used to achieve the research objectives. According to [3, 13, 14] SWOT analysis is identification of the various factors systematically to formulate corporate strategy by maximizing strengths and opportunities, but at the same time can minimize the weaknesses and threats. SWOT Analysis carried out by:

- A. Identify the internal factors of strengths and weaknesses as well as opportunities and threats that can influence the adoption of eco-friendly use of stimulant in tapping pine in Perum Perhutani.
- B. Determining Key Success Factors (KSFs) and Map of Strength Position, namely:
  - 1 Determining Key Success Factors
  - 2 From 6 (six) and the main internal factors and 6 (six) main external factors, then selected key success factors (KSFs). To select and set KSF, evaluation of internal and external factors that have been identified previously. Factors that give urgency, support and high exposure to the success for the present and the future, defined as KSF, with each aspects factor assessed are:
    - 3 Urgency factor to the achievement of the targets, including the value of urgency (NF) and weighting

factor (BF). NF assessment in achievement is done by changing the value of qualitative into quantitative values with a scale of 1 to 5, with details as following Table 1.

*Table 1. Urgency Assessment Scale (NF)*

No	Value Scale	Description
1	5	Very large/high
2	4	Large/High
3	3	Medium/Enough
4	2	Low/Small
5	1	Very low/Small

BF value is the ratio between NF and the number/total of NF (for each internal and external factors), which are expressed in percent. The formula for calculating BF [12, 4] is:

$$BF = (NF \times 100) / \Sigma NF$$

- a Support to the achievement of objectives factors, including support values (ND) and weight support values (NBD). Support values (ND) each factor is determined on the basis of the amount of support the achievement of the target with a scale of 1 to 5. Scale details ND value equal to the value of NF-scale details. NBD value of each factor is calculated by the formula:

$$NBD = ND \times BF$$

- b Linkages between factors to the achievement of targets, including the value of the relationship (NK), the average of relationship value (NRK) and weight relevance value (NBK). Internal factors and external inter-related or related in the achievement of targets. With the linkage will create synergy in supporting the objectives achievement. Linkage values of these factors are as follows:
  - The linkages value (NK) each factor to another factor determined on a scale of 0 to 5. Scale of 5 shows a very close relationship between the factors in support of the target achievement; scale value of 1 is very weak, while the scale value of 0 indicates absence of linkage relationships.
  - The average value of the relationship (NRK) each factor is divided by the number of NK-related factors (n-1) or the formula  $NRK = \Sigma NK / (\Sigma n - 1)$
  - The NBK value is calculated by the formula  $NBK = NRK \times BF$
- c The total value of the weight (TNB) is the sum value of NBD and NBK or the formula  $TNB = NBD + NBK$

Key success factors (KSFs) is determined based on factors that have the highest value of TNB [9, 10]. Then

selected four (4) KSF consisting of one factor with the highest value of TNB from each factor, strengths, weaknesses, opportunities and threats.

### 3. Results and Discussion

Analysis of internal factors (strengths and weaknesses) and external factors (opportunities and threats), which can influence the adoption of eco-friendly use of stimulants in tapping pine in Perhutani can be seen in Table 2.

*Table 2. Identification of Internal and External Factors*

Internal Factors	
Strengths	Weaknesses
1. Use of eco-friendly safer stimulant	1. Productivity of resin is lower
2. Pine forest sustainability is guaranteed	2. There has been no price difference resin resulting from the use of eco-friendly stimulant and AN-ORGANIC
3. Availability of eco-friendly stimulant	3. The Price of eco-friendly stimulant is expensive
External Factors	
Opportunities	Threats
1. Stimulant made from eco-friendly wood vinegar may be produced by Perhutani	1. Use of stimulant made from a strong acid (AN-ORGANIC) is a fixed price for pine resin activities in Perhutani
2. Pine resin tapper desperately need a safe and eco-friendly stimulant	2. Innovations stimulant that is safe and eco-friendly cannot be accepted for use in Perhutani as a whole
3. Innovation of eco-friendly stimulant used to increase the production of pine resin has been developed	3. Difficulty of changing the usage habits of AN-ORGANIC-based stimulant that has been done for generations

#### 3.1. Strength Factors

##### 1. Use of eco-friendly safer stimulant

Until now this stimulant used in tapping pine in Perhutani in the area mostly using stimulant-based inorganic strong acid is H<sub>2</sub>SO<sub>4</sub> or also known as AN-ORGANIC or trademarks SOCEPAS (consisting of sulfuric acid and Chloroastyl Phosponil Acid). The use of stimulant made from a strong acid such as complained by tapper has negative health effects such as hands become itchy and rough, stinging when in contact with the eyes and cause coughing. Further in [11, 15] states that when the short-term effects of inhaling vapors of sulfuric acid can cause irritation of the nose and throat and irritate the lungs. The acid can damage the skin and cause injury very hurt. It can cause blindness if splashed in eyes. Inhalation of vapors acid levels in the long run result in minor irritation of the nose, throat and lungs. For the pine tree itself, the use of strong acids may cause discoloration of the former leads rods, which appear red to black (scorched) and in continuous use in the long time period to cause decay tracheas walls in large quantities so that the trees become fragile. This condition will contribute negatively to the fall of the trees more so because of injury leads that are too deep and the wind reaches it. Even suspected chemical

ingredients in the resin of the results leads derived from an organic stimulant that is used so as to interfere with the use or further processing of the resin. Based on some literature also mentions that the use of strong acid stimulant such as H<sub>2</sub>SO<sub>4</sub> also cause soil and water pollution. The use of eco-friendly stimulant here is intended as a natural stimulant (biological, from plants). In Perhutani itself has been taking stimulant ETRAT in tapping pine although still used partially (not thorough) in certain circumstances (leads open and on location with altitude below 500 msl / low). ETRAT stimulant derived from ethylene substances that are useful in the resin formation in the plant. Tappers who use ETRAT stimulant do not feel the complaints as if they were using AN-ORGANIC. Perhutani itself already know that the use of ETRAT safer for the health of the tree tappers and tapped. However, due consideration of the ETRAT purchase price is more expensive than the AN-ORGANIC so that the use of ETRAT is limited. Other organic stimulant made from wood vinegar also had been tested in this study and may increase the production of pine resin. Excess wood vinegar is a stimulant can be produced easily and inexpensively as well as raw materials derived from waste wood or tree or any material containing lignocellulose. The use of wood vinegar stimulant in the field also is not complained by tappers either their health or tree tapped. Actually for Perhutani has realized that the use of safer and eco-friendly stimulant both to the tappers' health and tree tapped.

##### 2. Pine forest sustainability is guaranteed

The use of eco-friendly stimulant, as already described in point 1 gave a positive impact on the sustainability of the pine forest management. Sustainability here includes sustainability of pine stands are supported by adequate tree health and also the tapper as workers. The health of trees here relate to the excessive exploitation of harvesting resin because only about economic oriented so that the trees are "forced" to produce more resin to achieve the target, one of them by using strong acid-based stimulant. For the tappers who work as freelancer in Perum Perhutani, actually also have a choice to work other than as farmer as factory workers or worked in plantation sector or mining. When the income of tappers pine uncompetitive plus the health hazard that continues to overshadow, cannot be denied if one day the tappers will turn to other work other than as a tapper as mentioned above. These conditions will make it difficult for Perhutani to obtain employment forest communities, so that if a shortage of tappers will lower latex production results. Thus the sustainability of forest management as a producer of pine resin would be threatened halfway [1, 6].

##### 3. Availability of eco-friendly stimulant

Eco-friendly stimulant like ETRAT has already available in the market and produced by CV Permata Hijau in Bogor (West Java). Meanwhile considering the ease in manufacturing wood vinegar-based stimulant, it can be produced by Perhutani even by the people of tappers. Just stay committed to apply it in the field.

### 3.2. Weaknesses Factors

#### 1. Productivity resin lower

The use of eco-friendly organic-based stimulant and used in tapping pine resin can improve and extend the time flow of the resin so that resin obtained per harvest. However, the use of organic stimulant produces resin that is lower in comparison with the AN-ORGANIC. At low altitude (<500 msl), pine resin yield improvement using AN-ORGANIC stimulant, ETRAT and wood vinegar respectively of 49.15%; 33.57% and 15.5%. Similarly, at altitude > 500 msl, the increase pine resin results due to the use of AN-ORGANIC, wood vinegar and ETRAT respectively 51.7%; 28.1% and 17.8%.

#### 2. There has been no price difference resin resulting from the use of eco-friendly stimulant and AN-ORGANIC

Wage system is applied in Perhutani based on achievement, that tappers receive wages depend on the achievements that have been made within the time provided. Thus wages are received each month will vary depending tappers' willingness and ability in intercepting pine. Wage rates (known as the carry rate) established Perhutani based on the distance from the location of the leads (subplot) to place Resin Gathering (TPG). The wage rates are also distinguished by the quality of the resin, the quality of A and B where quality A higher rates of wage than quality B at the same distance. The quality here is based on the cleanliness of resin from impurities that goes in like the rest of the resin mixed leaves, twigs, dirt, and other impurities. On the other, as the development time and human awareness of the importance of health, all products which are directly related to humans should be safe for human health. No exception for pine resin products are processed into various products such as Gum Rosin and its derivatives, turpentine, alphapinene, bethapinene, and so forth. For the market share of these products is divided into 2 foodgrade products (which means the product is safe for human health) and non-foodgrade (these products contain substances that are not safe / harmful to human health). Gum rosin derivative products which include foodgrade categories used as tooth clamp bandages, food preservatives, a mixture of soap, cosmetics, and others. Non-foodgrade products found as paper sizing material, a mixture of turpentine, ink, and so forth. Regardless of sorting the two products should indeed all the products meet safety standards for human health. Therefore, one of the requirements is a safe product that is free from B3 (Hazardous Material), including strong acidic chemicals used in tapping pine. Considering the corrosive nature of the danger and possessed of a strong acid, then pine resin resulted is thought to contain harmful substances to human health. While the price of pine resin products in the world market does not see it and do not differentiate pricing based stimulant used. Yet look at the result of negative effects should no price difference between the resin produced by using inorganic and organic stimulant. There's

no denying that the Indonesian position though as the third of the largest manufacturers of pine resin but does not act as a "price taker" or determinants of price. This position is difficult and adverse pine resin manufacturers. However along the changing times, everything can change all the time and the market share will definitely look into that direction and will price discriminate based on the type of latex used stimulant.

#### 3. The prices of eco-friendly stimulant is expensive

During this stimulant used in tapping pine in Perum Perhutani area is held by way of buying into the company providing stimulant. AN-ORGANIC stimulant purchased from CV pine in Jember (East Java) was purchased from ETRAT stimulant CV Permata Hijau sustainable in Bogor (West Java). Based on interviews with Perhutani, procurement stimulant given to each unit (I, II and III), and each unit has the authority under the provision that the policies adopted by each unit may vary. AN-ORGANIC stimulant price range between IDR 6000-11.000/litre depends on the distance from the place of production whereas ETRAT stimulant ranged between IDR 10.000-12.000/liter (based on interviews with Perhutani in 2013). Based on price per liter, the price of ETRAT stimulant or organic stimulant more expensive than AN-ORGANIC.

### 3.3. Opportunities Factor

#### 1. Eco-friendly wood vinegar stimulant can be produced by Perhutani

Wood vinegar-based stimulant can be produced by Perhutani in an easy way and inexpensive. How to make a wood vinegar can be done with furnace ground methods and drum method [8], in which the manufacture of wood vinegar can be done together with the manufacture of charcoal. The smoke of burning the charcoal-making process can be used as raw material for the manufacture of wood vinegar (wood vinegar). By using fresh bamboo as a condenser in the cooling process, it hollowed and cut attached to the top of the chimney in the process of making charcoal and then arranged so that most of the smoke coming through the bamboo in order to obtain the final results of the process of cooling the smoke

Burning wood in the form of wood vinegar. The materials used in the manufacture of wood vinegar is easy to find and cheap price. The raw materials consist of sewage trunk, branches twigs or other parts of the tree that are not used are prepared by means of shredding up into 5-10 cm diameter and 15-20 cm long. Furnace ground method made by digging up the soil and incorporates raw materials as mentioned above, burned in such a way so as to emit smoke. Meanwhile the drum method, raw materials are arranged inside the drum and burning is done that removing the acid. This acid is captured and condensed with bamboo rod-shape liquid so called liquid acid. This liquid contains many acidic vinegar / acetic acid (CH<sub>3</sub>COOH) that is known as wood vinegar. In R & D Perhutani in Cepu, Central Java has also been building a vinegar tool maker with wood dome method and has even

been tested for produce wood vinegar, only now being stopped producing.

2. Pine resin tapper desperately need a safe and eco-friendly stimulant

Based on the facts on the ground, the use of strong acid (H<sub>2</sub>SO<sub>4</sub>) stimulant or AN-ORGANIC complained of by the tappers because negative health effects such as hands become itchy and rough, stinging when in contact with the eyes and cause coughing. For the tappers that actually do not want the stimulant that has bad effect. It's just because of the resulting latex production is not as high as when using stimulant AN-ORGANIC; they survive using AN-ORGANIC with such risks. But if there is another stimulant that are safer and can improve the production of latex, they prefer to use it. In addition the use of AN-ORGANIC also stimulant also less good effect against pine stands. If the situation is allowed to continue, it is possible for the tappers will turn to work in another place that is seemed safe for them.

Innovation of eco-friendly stimulant used to increase the production of pine resin has been developed

3. Innovation of eco-friendly stimulant used to increase the production of pine resin has been developed

Stimulant that is safe and does not create a significant environmental disturbance or eco-friendly has been developed and tested in Perum Perhutani area. Based on the interviews, in addition to ETRAT, stimulant that is introduced and tested in Perum Perhutani is SUPERFARM, GREEN ONE (GO) 1, 3 GO, GO 5 and BIOCAS. BIOCAS is a new product was introduced in 2014 in the area of East Java Perhutani Unit III and produced by the same factory as the AN-ORGANIC. Stimulants were tested in the Perhutani, claimed by the producers as organic and eco-friendly stimulant. However, with certain considerations, eco-friendly stimulant used in Perhutani area although not all areas of pine stands, chosen ETRAT stimulant. By looking at the number of stimulants offered in Perhutani office shows that up to now, the use of eco-friendly stimulant has become a necessity in tapping pine. All society life have been more aware of the importance of using eco-friendly stimulant.

### 3.4. Threats Factors

1. The use of strong acid stimulant (AN-ORGANIC) is a fixed price for pine resin activities in Perhutani

So far, most of the widened Perhutani area uses AN-ORGANIC in tapping pine. Based on the interviews, comparison of the use of ETRAT stimulant and AN-ORGANIC respectively 80% and 20%. It is the consideration of the stimulant purchase price where AN-ORGANIC is cheaper than ETRAT and also because of the habit of tapper people who already "addicted" must use a stimulant in any tapping activity especially stimulant that can produce more resin (AN-ORGANIC). Based on the use of AN-ORGANIC stimulants Director's Decree No. 527/045.1/PROD/Dir September 5<sup>th</sup> 2007 on the

recommended use of AN-ORGANIC, while the basic use of ETRAT contained on Directors Decree 220/045.9/PROSAR/DIR April 25<sup>th</sup> 2011 regarding the use of ETRAT stimulant in tapping pine.

2. Innovations stimulant that is safe and eco-friendly cannot be accepted for use in Perhutani extensively

Innovation stimulants continue to be developed adapted to present demands that are safe and eco-friendly. For Perhutani, it has an open attitude towards all innovations related to tapping pine. Only certain requirements Perhutani filed against the adoption of stimulant innovation, the conditions of production and price. Production terms associated with stimulant' ability to produce pine resin, which should be able to increase the yield of pine resin at least equal to if using AN-ORGANIC. Rate terms associated with stimulant price cheaper or at least equal to the price per liter of AN-ORGANIC [7]. On the other hand Perhutani also aware of the importance of the use of safe and eco-friendly stimulants. Moreover, later all the products produced from the resin of pine required to be safe for human health. With these considerations, Perhutani take steps using eco-friendly stimulant innovation in tapping pine although not yet used throughout Perhutani area.

3. Difficulty of changing the usage habits of AN-ORGANIC-based stimulant that has been done for generations

The use of stimulants in pine resin has been conducted since 1933 in Germany and Russia and America followed in 1936. The use of stimulants and is being adopted in Indonesia, although it has not yet simultaneous use and the legal basis for its use until the adoption decree on the Board of Directors recommended the use of AN-ORGANIC stimulant (No. 527/045.1/PROD/Dir) in 2007. Use of AN-ORGANIC was originally just a suggestion because tapping pine conditions at that time are still many who do not want to or use stimulant. This is related to the main orientation of the pine forest at the time taken shall not resin. Especially if it is connected with the main focus of Perhutani, which is focused more wooden results mainly teak. But with over time, non-timber forest products that are pine resin began to recognize because the outlook is promising. Moreover, the more years the number of request of the resin increased, thus encourage the use of stimulant to improve outcomes resin. For tapping, the more resin obtained will be more and more revenue as well. From the beginning as far as they are only suitable AN-ORGANIC stimulant used to increase production. Knowledge of AN-ORGANIC is what they are bringing to the posterity and siblings. Therefore if there is a new stimulant innovation, they feel free to try it out. They worry that the results of resin they obtain not as much when using AN-ORGANIC. Comparison of the factors internal and external to determine the value of NF and BF is presented in Table 3 below.

FKK evaluation results are presented in Table 4. Based on Table 4 it can be seen that internal factors such as

strengths and weaknesses that have the highest relevance value of each stimulant is the use of safer and eco-friendly stimulant and the Price of eco-friendly stimulant is expensive, the weight value respectively of 2.67 and 1.58. External factors such as opportunities and threats that have the highest relevance value of each is the eco-friendly

wood vinegar-based may be produced by Perhutani and the innovation of safe and eco-friendly stimulant cannot be accepted for use in a whole Perhutani, with respective weights of 2.64 and 2.01. Based on Table 4 were then created Success Key Factors Table shown in Table 5.

**Table 3.** Urgency Comparison Matrix between Internal and External Factors

No	Internal And External Factors	More Urgent Factors						Total NF	Bf
		a	b	c	d	e	f		
I	INTERNAL								
A	Strengths(S)								
a	The use of safer and eco-friendly stimulant		a	a	a	a	a	5	33
b	Pine forest sustainability is guaranteed	a		c	b	b	f	2	13
c	Availability of eco-friendly stimulant	a	c		c	c	f	3	20
B	Weaknesses (W)								
d	Resin productivity is lower	a	b	c		d	f	1	7
e	There has been no price difference resin resulting from the use of eco-friendly stimulant and AN-ORGANIC	a	b	c	d		e	1	7
f	The price of eco-friendly stimulant is expensive	a	f	f	f	e		3	20
	Total							15	100
II	EKSTERNAL								
A	Opportunities (O)								
a	The eco-friendly wood vinegar-based may be produced by Perhutani		a	a	a	a	a	5	33
b	The pine resin tapper desperately need safe and eco-friendly stimulant	a		c	b	e	f	1	7
c	The innovation of eco-friendly stimulant used to increase pine resin production has been developed	a	c		c	e	f	2	13
B	Threats (T)								
d	The use of strong acid stimulant (AN-ORGANIC) is fixed price for pine resin activities in Perhutani	a	b	c		e	d	1	7
e	The innovation of safe and eco-friendly stimulant cannot be accepted for use in Perhutani extensively	a	e	e	e		e	4	27
f	Difficulty of changing the usage habit of AN-ORGANIC-based stimulant that has been done for generations	a	f	f	d	e		2	13
	Total							15	100

**Table 4.** Evaluation of Internal and External factors

No.	Internal & Eksternal Factors	BF (%)	ND	NBD	Relevance Value												NRK	NBK	TNB	RANK
					1	2	3	4	5	6	7	8	9	10	11	12				
A.	Internal																			
I	Strengths (S)																	4,63		
1	The use of safer and eco-friendly stimulant	33	5	1,65	2	4	4	3	3	4	2	2	3	4	3	3,09	1,02	2,67	I	
2	Pine forest sustainability is guaranteed	13	3	0,39	2	3	2	1	1	4	2	2	3	2	3	2,27	0,30	0,69	III	
3	Availability of eco-friendly stimulant	20	4	0,80	4	3	3	4	1	4	1	1	1	2	2	2,36	0,47	1,27	II	
II	Weaknesses (W)																	2,43		
4	Resin productivity is lower	7	4	0,28	4	2	3	2	3	3	2	2	2	2	4	2,64	0,18	0,46	II	
5	There has been no price difference resin resulting from the use of eco-friendly stimulant and AN-ORGANIC	7	3	0,21	3	1	4	2	4	3	2	2	2	3	2	2,55	0,18	0,39	III	
6	The price of eco-friendly stimulant is expensive	20	5	1,00	3	1	1	3	4	4	4	4	2	4	2	2,91	0,58	1,58	I	
B.	Eksternal																			
III	Opportunities (O)																	3,74		
7	The eco-friendly wood vinegar-based may be produced by Perhutani	33	5	1,65	4	4	4	3	3	4	2	2	2	3	2	3,00	0,99	2,64	I	
8	The pine resin tapper desperately need safe and eco-friendly stimulant	7	3	0,21	2	2	1	2	2	4	2	2	2	1	1	1,91	0,13	0,34	III	

No.	Internal & Eksternal Factors	BF (%)	ND	NBD	Relevance Value												NRK	NBK	TNB	RANK
					1	2	3	4	5	6	7	8	9	10	11	12				
9	The innovation of eco-friendly stimulant used to increase pine resin production has been developed	13	4	0,52	2	2	1	2	2	4	2	2		1	1	1	1,82	0,24	0,76	II
IV	Threats (T)																		3,17	
10	The use of strong acid stimulant (AN-ORGANIC) is fixed price for pine resin activities in Perhutani	7	3	0,21	3	3	1	2	2	2	2	2	1		1	1	1,82	0,13	0,34	III
11	The innovation of safe and eco-friendly stimulant cannot be accepted for use in a whole Perhutani	27	5	1,35	4	2	2	2	3	4	3	1	1	1		4	2,45	0,66	2,01	I
12	Difficulty of changing the usage habit of AN-ORGANIC-based stimulant that has been done for generations	13	4	0,52	3	3	2	4	2	2	2	1	1	1	4		2,27	0,30	0,82	II

Before determining the strategy must first know the strength position map. Strength position map is determined by the total weight value (TNB) all strengths, weaknesses, opportunities and threats as in Fig 1.

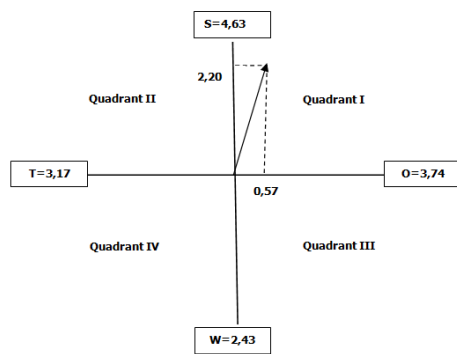


Figure 1. Strength Position Map

Fig. 1 above shows the power position is in quadrant I. This shows that the use of eco-friendly stimulant have a competitive advantage, which means that the strength and opportunity factors play a major role in decision strategies. General strategies that can be taken are to use the strengths of (S) to take advantage of opportunities (O) there.

Table 5. Success Key Factors

Internal Factors	
<b>Strengths (S)</b>	<b>Weaknesses (W)</b>
The use of safer and eco-friendly stimulant (S1)	Price of eco-friendly stimulant is expensive (W3)
<b>Faktor Eksternal</b>	
<b>Opportunities (O)</b>	<b>Threats (T)</b>
The eco-friendly wood vinegar-based may be produced by Perhutani (O1)	The innovation of safe and eco-friendly stimulant cannot be accepted for use in a whole Perhutani (T2)

The strategy is a combination or interaction of the success key factors for achieving synergy achievement of goals and objectives. The strategy is a general approach that is done in solving a problem. In preparing the strategy should be considered the driving force and the power resistor. Appropriate strategy is a strategy that can increase strengths and minimize weaknesses.

By combining the four (4) key to success priorities selected, arranged formulation of strategies that can be used to solve the problem. Formulation of the strategy drawn up in order to achieve the goals that have been set by using the SWOT analysis matrix as Table 6 below.

Table 6. Formulation Strategies Using SWOT Analysis

Internal Fkk	Strength (S)	Weaknesses(W)
External Fkk	The use of eco-friendly safer stimulant	The price of eco-friendly stimulant is expensive
Opportunities(O)		
Eco-friendly wood vinegar-based stimulant may be produced by Perhutani	Increase the use of eco-friendly stimulant by using eco-friendly wood vinegar-based produced by Perhutani	Implement eco-friendly wood vinegar-based stimulant produced by Perhutani to press the price of an expensive eco-friendly stimulant
Threats (T)		
The innovation of safe and eco-friendly stimulant cannot be accepted for use in a whole Perhutani	Increase the use of eco-friendly and safer innovations stimulant to assure Perhutani so that eco-friendly stimulant can be accepted and used as a whole	Press the stimulant prices through eco-friendly innovations that can be accepted for use in Perhutani as a whole

Use eco-friendly stimulant policies can be achieved by using 4 (four) strategy, namely:

1. Increase the use of eco-friendly stimulant by using eco-friendly wood vinegar-based stimulant produced by Perhutani. This is an ideal strategy that takes advantage of opportunities that exist with the strength that held (Strategy S - O). Wood waste in the form of the branches and twigs of pine trees or others lignocelluloses material is relatively abundant and can be used by Perhutani to produce wood vinegar in the manufacture of eco-friendly stimulant. This is a great opportunity and potential for Perhutani to develop eco-friendly stimulant due to the production of wood vinegar as a base for eco-friendly stimulant is very easy to manufacture and can be done by Perhutani itself. With abundant production of wood vinegar produced by Perhutani, the use of stimulant is possible applied over the entire area with several advantages such as not to pollute the soil and surrounding environment, safe for farmers/tapper and tree are tapped and could depress the price of an expensive stimulant on the market. These opportunities should really be used by Perhutani to make pine resin policy all over the region in promoting eco-friendly era in the management of natural resources in the Perhutani sector.
2. Implement from eco-friendly wood vinegar-based stimulant produced by Perhutani to press the price of an expensive eco-friendly stimulant. This is a strategy of utilizing the existing opportunities to overcome weaknesses (Strategy OW). This is related to the first strategy above, that by producing wood vinegar itself from existing materials in its own territory, and implement in tapping activities, Perhutani will greatly benefit because it can press the price of an expensive stimulant on the market that had been purchased by Perhutani. By pressing this eco-friendly stimulant price the selling price of pine resin will be more competitive because production costs can be reduced and the results resin obtained from the use of stimulants leads that are eco-friendly. This strategy needs to be taken into consideration for Perhutani to adopt and implement policies eco-friendly stimulant use throughout their working area.
3. Increase the use of eco-friendly and safer stimulant innovations to assure Perhutani that eco-friendly stimulant can be accepted and used as a whole. This is a strategy of using or optimizing the strength to overcome the potential threats facing (Strategy S - T). Innovations for eco-friendly stimulant development need to be done to obtain an eco-friendly stimulant that could further improve the results of pine resin. To further assure Perhutani in any development activity of this innovation, Perhutani should be actively involved so that eco-friendly stimulant innovation totally acceptable and thoroughly implemented throughout the region of

Perhutani. It is very possible to do because Perhutani has research institution that is the Research and Development Center in Cepu that could be involved in the research development innovation of eco-friendly stimulant.

4. Press stimulant prices through eco-friendly innovations that can be accepted for use in Perhutani as a whole. This is a strategy of pressing weaknesses to overcome the potential threats facing (Strategy W - T). The price of eco-friendly stimulant is still expensive in the market so that Perhutani have not implemented the use of it's for overall because of price considerations. The expensive price of eco-friendly stimulant can actually be pressed because Perhutani has the potential and opportunity to be used as described in the strategies mentioned above. Prices will be more pressed again when the innovations of eco-friendly stimulant being developed that will be obtained stimulant that can increase resin productivity, produced by Perhutani, safe for farmers/tappers and eco-friendly. Thus Perhutani will be more confident and receiving the use of eco-friendly stimulant innovation in the entire region.

## 4. Conclusions and Recommendations

### 4.1. Conclusions

Strategies stimulant use eco-friendly policies could be adopted by Perhutani with 4 strategies as follows:

1. Increase the use of eco-friendly stimulant by using eco-friendly wood vinegar-based produced by Perhutani;
2. Implement eco-friendly wood vinegar stimulant produced by Perhutani to press the price of an expensive eco-friendly stimulant;
3. Increase the use of eco-friendly and safer stimulant innovations to assure Perhutani so that eco-friendly stimulant can be accepted and used as a whole;
4. Press eco-friendly stimulant prices through innovations that can be accepted for use in Perhutani as a whole.

### 4.2. Recommendations

Based on the above conclusions and the map position of power there, the Perhutani advised as follows:

1. For short term, Perhutani could adopt the use of eco-friendly stimulant innovation with strategies utilizing the existing opportunities with the strength that held(Strategy SO) is "Increase the use of eco-friendly stimulant by using eco-friendly wood vinegar-based that produced by Perhutani ";
2. For long term, Perhutani need to develop innovations to obtain eco-friendly stimulant that can increase pine resin productivity, and press expensive stimulant prices in the market.



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