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PERCEPTION OF THE USEFULNESS OF CONTAINER DEVICES BASED ON SIEVE VARIATIONS ON THE QUALITY OF PINE SAP HARVESTING

(*Persespi Kegunaan Alat Penampung Berbasis Variasi Saringan Terhadap Kualitas Pemanenan Getah Pinus*)

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ABSTRAK

Wadah getah pinus terbuka yang terbuat dari tempurung kelapa dan mangkuk plastik menyebabkan kualitas getah pinus menurun, dan sulit untuk mendapatkan kualitas premium, karena masuknya kotoran. Kotoran tersebut berupa ranting-ranting sisa, daun pinus kering, rumput, tanah, dan kerikil. Selain itu, ketika angin dengan mudah melepaskan tempurung kelapa karena ikatannya tidak cukup kuat dengan pohon pinus. Pori-pori tempurung akhirnya mudah tererosi oleh hujan karena proses pemotongan. Wadah terbuka (tanpa tutup) sangat rentan menghasilkan getah pinus yang kurang murni karena tercampur dengan kotoran yang jatuh ke dalam wadah. Kotoran yang kecil akan sulit terurai karena kotoran tersebut dapat dengan mudah melewati saringan. Penelitian ini bertujuan untuk mengetahui persepsi kegunaan alat wadah berbasis variasi saringan terhadap kualitas penyadapan getah pinus. Penelitian ini dilakukan dengan pendekatan deskriptif kuantitatif. Pengumpulan data dilakukan dengan teknik kuesioner yang diberikan kepada pengguna, yaitu petani pinus. Analisis data dilakukan dengan statistik deskriptif, yaitu menghitung rata-rata dari hasil rekapitulasi kuesioner. Hasil penelitian menunjukkan bahwa masyarakat setuju bahwa petani dapat menggunakan inovasi wadah getah pinus berbasis saringan dalam penyadapan getah pinus. Alat ini memiliki daya tahan yang baik, mudah dalam perawatan, mudah digunakan, praktis, efektif, aman, mudah disimpan, tidak menghasilkan sampah, dan memiliki manfaat serta fungsi yang sangat baik. Dampak dari penggunaan alat ini adalah Perhutani tidak perlu lagi mencari alat, dan kualitas getah pinus yang disadap dengan wadah getah pinus berbasis saringan tidak diragukan lagi. Dengan kualitas getah pinus yang baik, pendapatan komunitas petani getah pinus meningkat.

Kata kunci: Getah pinus; alat pengumpul; kegunaan; produk hutan; variasi saringan.

ABSTRACT

Open pine resin containers in the form of coconut shells and plastic bowls cause the quality of pine sap to decrease, and it is difficult to obtain premium quality, because of the ingress of dirt. The impurities are in the form of leftover twigs, dry pine leaves, grass, soil, and gravel. In addition, when the wind easily releases the coconut shell because the binding is not strong enough with the pine tree. The shell's pores are finally easily eroded by rain due to the sawing process. Open containers (without covers) are very susceptible to producing less pure pine sap because they are mixed with impurities that fall into the container. They will be difficult to decompose if the dirt is small because the impurities can easily pass through the filter. This study aims to determine the perception of the usefulness of a container tool based on filter variations on the quality of pine resin harvesting. The study was conducted with a quantitative descriptive approach. Data collection was carried out using a questionnaire technique that was given to users, namely pine farmers. Data analysis was carried out using descriptive statistics, namely calculating the average of the results of

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the questionnaire recapitulation. The study results showed that the community agreed that the farmers can use the innovation of a pine sap container based on a sieve in harvesting pine sap. The tool has good durability, is easy to maintain, is easy to use, practical, effective use, ; is safe, is easy to store, does not produce waste, and has excellent benefits and functions. The impact of using this tool is that Perhutani no longer needs to look for tools, and the quality of the pine sap harvested with this sieve-based pine sap container is no longer in doubt. With good quality harvested pine sap, the income of the pine sap farmer community has increased.

Keywords: Pine resin; collection tool; usability; forest products; filter variations.

I. INTRODUCTION

Wonosobo Regency, Central Java, is included in the working area of Perum Perhutani Forest Management Unit (KPH) North Kedu, which has an area of 9,928.46 Ha with a forest area based on the administrative area of 8,476.53 Ha (19.0%) (Perhutani, 2021). The main commodity of this forest is pine trees that produce sap. Sap is one of the non-timber forest products (NTFPs). In general, the Non-Timber Forest Products (NTFPs) industry is a labor-intensive industry and does not require sophisticated technology but can produce a product that is of high value and environmentally friendly (Waluyo et al., 2012). Therefore, Pine is one of the NTFPs that really needs to be developed at this time because pine sap has commercial value and quite good potential (Lempang, M., 2017). Specifically in 2021, gondorukem and terpentine, which are derivative products of pine resin with a total production capacity of 92,550 tons spread across Central Java, East Java, and West Java, through contributions from eight Gondorukem and Terpentine Factories (PGT), namely Sukun (18,000 tons), Garahan (16,000 tons), Cimanggu (13,500 tons), Rejo Winangun (12,000 tons), Sindangwangi (10,500 tons), Winduaji (9,000 tons), Paninggaran (6,750 tons) and Sapuran (6,300 tons) (Perhutani, 2021). These results show that PGT in Sapuran, Wonosobo Regency, still ranks lowest in its pine resin production. PGT Sapuran is usually supplied by 10 Perum Perhutani BKPH, one of which is BKPH Kebumen, which is located in Ngadisono, Kaliwiro.

Approximately 107 species of pine are spread across Europe, America, Africa, and Asia. Approximately 28 species of pine are found in Asia, with 3-7 species in Southeast Asia, including *Pinus merkusii*, *P. khaysia*, and *P. insularis* (Alrasjid et al., 1983). *Pinus merkusii* Jungh. et de Vriese is a type of two-jointed pine that grows naturally in Southeast Asia (Hood, S., & Sala, A., 2015). The *Pinus merkusii* Jungh. et de Vriese tree grows naturally from northeast India through Burma, Thailand, Laos, Cambodia, and Vietnam to a few degrees south of the equator on the islands of Sumatra, Luzon, and Mindoro in the Philippines at an altitude of 300-2,000 m above sea level (Tantra, 1983; Satjapradja, 1983). The species of pine merkusii is naturally found in Indonesia only in northern Sumatra (Alrasjid et al., 1983). There are three strains of merkusii pine in Sumatra, namely Tapanuli, Kerinci, and Aceh (Tantra, 1983). According to (Sastrapraja, 1980), pine trees are usually round and straight with brown to blackish bark and rough, deeply grooved, and scaly bark resembling long pieces. Pine trees can reach a height of up to 70 meters, with a trunk length without branches of about 70% of the total height (Lempang, M., 2018; Cunningham, A., 2012).

Pinus merkusii is a reforestation plant that can grow in various environments in Indonesia. *Pinus merkusii* is a prima donna species planted in forest, land, and water conservation programs, especially in reforestation and greening programs that have been implemented by the government through the Ministry of Forestry since the 60s (Rahmadani, R., 2021). *Pinus merkusii* has a straight, rounded trunk and is usually unbranched. The crown is cone-shaped, and the leaves are needle-shaped. The trunk of the pine sap merkusii is medium to large in size with a tree height of between 20 and 40 meters and a tree diameter of up to 100 cm. The outer bark is rough, does not peel, and the grooves are wide and deep. *Pinus merkusii* is a producer of NTFPs in the form of resin (Yeriana SP, et al., 2023). Natalia (2010) stated that *Pinus merkusii* can grow well in dry or wet places with hot or cold climates, such as Wonosobo. Mirawati (2017) stated that although many types of *Pinus merkusii* do not require suitable growing conditions, their growth is influenced by several factors, such as soil properties, climate, and altitude (Rahmadani, R., 2021).

Pine trees that dominate the forests in Wonosobo are producers of *pine sap* which is located and is a Non-Timber Forest Product (NTFP). NTFP is an asset that has very promising long-term results if empowered and managed optimally. Pine resin is one form of Non-Timber Forest Product (NTFP) that has great potential (Sukadaryati, 2014). Pine resin is a type of oleoresin, which is a mixture of complex resin compounds and turpentine found in a thick and sticky liquid, which can be in the form of seeds or opaque. Tapping of sap from pine forests can be

processed to produce gondorukem and turpentine which are raw materials for advanced industries. Gondorukem is used as raw material for the paper, ceramics, plastics, paint, batik, printing ink, polish, pharmaceutical, and cosmetic industries. While turpentine is used as a raw material for the cosmetics, paint oil, solvent mixtures, antiseptics, camphor, and pharmaceutical industries. (Merdeka, 2020). Pine wood products can be used as building materials, matches, mepel, chopsticks, and paper. Pine bark contains flavonoids and vitamin C which are useful for improving blood circulation, knee pain, menstrual cramps, and even medicine to improve memory in the elderly. Pine oil from the pine tree type pinaster can relieve muscle pain. Pine flowers are widely used for decoration, crafts, and frames.

Pine sap storage device innovation continues to be carried out because pine resin is one of the export commodities that has a significant impact on the community's economy. As one type of NTFP, pine resin has become part of the international trade system. According to (Bina, 2014), Perum Perhutani is ranked third in the trade of Indonesian pine resin in the international market, after China and India. Perum Perhutani is the third largest producer of gondorukem and turpentine derivatives in the world, ranking third after China (70%) and Brazil (11%). According to Bina (2012), Indonesia's pine resin production is around 900,000 tons per year. Its price on the international market ranges from 50,000 to 60,000 tons, while China is able to penetrate 800,000 tons per year. According to Perum Perhutani, in 2010, Indonesian pine resin products were exported to several countries, including the United States, South Korea, India, and Europe (Sukadaryati and Dulsalam, 2015). According to (Sukarno et al., 2015), Perum Perhutani has been actively tapping pine resin in recent years. The price of pine resin derivative products ranged from $2,000 to $4,000/ton in 2014, with some cases reaching $15,000/ton (Bina, 2014).

Perum Perhutani BKPH Kebumen in Ngadisono, Kaliwiro District, Wonosobo Regency, is experiencing a decline in the quality of pine tree tapping results which often occurs during the rainy season. This is because the containers used to collect the tapping results are still traditional, namely using coconut shells and plastic pots (Figure 1). The disadvantage of using coconut shells and plastic pots is that rainwater and sap become one because both containers are open. This will cause a decline in the quality of pine sap and it is difficult to obtain premium quality, because of the entry of dirt. The dirt found was in the form of leftover twigs, dry pine leaves, grass, soil and gravel. This occurs during the tapping renewal. Many leftover trunks or cracked skin fall into the sap collection area. In addition, when the coconut shell is easily blown away by the wind because its binding power is not strong enough with the pine tree. The pores of the shell are finally easily eroded by rainwater and due to the tapping process. Open containers (without a cover) are very susceptible to producing less pure sap because it is mixed with a lot of dirt that falls into the container and will be difficult to break down if the dirt is small because the dirt can easily pass through the filter.

Another use of containers is with plastic bags. Plastic bags can reduce dirt that enters the sap so that the sap produced is cleaner compared to coconut shells (Sukadaryati, S., 2014). In addition, the cost required to buy plastic is also relatively cheaper. However, the use of plastic is only used once and then thrown away so that it will produce a lot of plastic waste and pollute the environment because plastic is difficult to decompose. On the other hand, coconut shells can be used repeatedly and if they cannot be used again will not produce hazardous waste, because coconut shells or coconut shells are easily decomposed naturally. However, open sap storage containers will greatly affect the results of pine sap and have an impact on less than optimal farmer income and reduce the economic value of sap. Therefore, it is necessary to engineer a sap container that can accommodate sap in such a way that the level of dirt can be reduced.

Figure 1. Coconut Shell Container
Gambar 1. Wadah Tempurung Kelapa

Figure 2. Results of harvesting pine resin mixed with soil
Gambar 2. Hasil penyadapan getah pinus yang tercampur dengan tanah

One of the supporting media for the creation of the best quality sap production is in the sap collection tank, which is located right under the drops of sap flowing from the tapping site. The slope of the tapping channel affects the mass of pine sap obtained so that it falls right into the tank. Until now, the tapping channel still uses curved and open zinc so that during the rainy season, the sap is guaranteed not to fall right into the tank. The sap container plays an important role in increasing production results because it is the only container and storage of sap from the tree that was first found in the container; the container currently used at Perum Perhutani Ngadisono, Kaliwiro is a bowl with a diameter of 8-10 cm and a height of 5-7 cm made of plastic without a cover on top and coconut shell with an average diameter of 10 cm and a height of 6 cm so that rainwater or dirt will be very easy to enter, the sap that has been collected can also spill because the container is very light so the wind very easily blows it away.

Along with the increasing interest of farmers in cultivating pine plants, in addition to the problem of resin containers, farmers still experience many challenges. One of them is weather conditions that affect the harvest of pine resin with poor quality, Figure 2. Pine tapping can be done every day if the weather is sunny, but if the weather is bad, such as rain, pine tapping is disrupted or cannot be done. Bad weather, such as rain can cause the income of pine farmers to be unstable and possibly low. The purity of pine resin affects the price of pine resin, which can affect the income of pine farmers. Low purity of pine resin will affect their wages. Therefore, technology is needed that can handle the difficulties faced by pine farmers. Currently, technology is often used together with other sciences to develop or utilize solutions to problems that occur in society.

The benefits of pine trees are numerous, thus encouraging Perhutani to continue to improve the quality of pine sap harvested by farmers. This study contributes to helping improve the quality of pine sap harvested by farmers by creating an innovative filter-based pine sap collector. To see the effectiveness of this pine sap collector innovation, a field test was conducted by asking sap farmers to try the tool as a substitute for plastic bowls and coconut shells, which have the various weaknesses mentioned above. An important finding in this study is the better and cleaner sap quality when harvesting is done with a filter-based pine sap collector rather than using a plastic bowl or coconut shell. The efficiency of the tool was also collected by looking at the sap farmers' responses through a questionnaire on the use of the tool to determine the perception of the use of a collection tool based on various filters on the quality of pine sap harvesting.

II. MATERIALS AND METHODS

This study uses a quantitative approach, descriptive type (Creswell, 2015; Sugiyono, 2006; Zulfikar et al., 2024). The quantitative approach was chosen because the data taken were in the form of numbers from the recapitulation of the utility questionnaire. In this study, only descriptive statistics were used, describing of the questionnaire results on the data centralization measure, namely the mean and percentage. The description was chosen because this study will describe one variable, namely the use of pine resin storage tools in the community. The research sample was taken randomly as respondents from pine forest farmers from three areas in Wonosobo Regency, namely Kaliwiro, Wadaslintang, and Kalibawang Districts, with five respondents from each district. The questionnaire was given after respondents used the pine resin collection tool that the team had innovated.

The innovation of the pine sap container design developed in this study is a semicircular container made of aluminum with a lid with various types of filters inside and a closed tapping gutter made of iron plate that can increase the productivity of the required tool performance, Figure 3. The semicircular bowl-shaped container made of aluminum makes it easy to accommodate the pine sap produced. The cover protects the sap from dirt from the tree and outside. Various types

Figure 3. Innovation of Pine Sap Collecting Tool Based on Filter
Gambar 3. Inovasi Alat Penampung Getah Pinus Berbasis Saringan

of filters are used to filter the incoming sap, so that the resulting sap is really clean. The closed tapping gutter made of an iron plate aims to protect the sap from dirt falling from the tree, and the belt is used to install the pine sap container so as not to injure the pine tree.

This tool innovation is a development of Mody Lempang's research results that use a closed sap container and the use of a tapping channel as the sap entrance into the container will maximize the sap obtained, in addition the water content is less because turpentine will be more easily separated from water. Dirt will also be difficult to enter because the sap entrance is small and the sap container is very tight and closed. In contrast to the research conducted by Mody Lempang, Perhutani in Kaliwiro, West Java, completely uses only the koakan method to obtain sap. This method is used because the cost is relatively affordable and the time used is more efficient. This research provides an innovation in the development of tools made by Mody Lempang by adding various types of filters to the closed container in Figure 4.

The research was conducted by socializing the innovation tool to the community, and the community was allowed to try it; then, the farmers selected as samples were given a questionnaire. The questionnaire instrument was developed from indicators of community satisfaction in the use of the tool, namely: 1) tool durability; 2) ease of tool maintenance; 3) ease of use; 4) practicality of tool use; 5) tool effectiveness; 6) tool safety; 7) ease of tool storage; 8) waste produced; 9) tool usefulness; 10) tool functionality. Before being used, the questionnaire instrument was validated internally by three experts: a research expert, a physicist, and a forestry practitioner. Internal validation is to see the suitability of the question items with the instrument's research objectives, constructs, and readability (Jumini et al, 2024).

Data analysis was carried out using descriptive statistics, namely calculating the average results of the questionnaire recapitulation. The questionnaire score category was determined by classifying the community's response to the usefulness of pine resin containers. This instrument has 10 questions/statements with a minimum score of 1 and a maximum score of 5. So if the respondents' answers have a minimum value of 1x10=10, and a maximum value of 5x10=50, then the class interval distance is (50-10)/5=8 (Azwar, 2019; Jumini et al., 2021; Sudaryono et al., 2013). Thus, the community's response to the usefulness of pine resin containers can be categorized as in Table 1 below.

Figure 4. Two sieves with different diameters
Gambar 4. Dua saringan dengan diameter berbeda

Table 1. Categories of Community Response
Tabel 1. Kategori Tanggapan Masyarakat

Total Score	Average Score	Response classification (*Klasifikasi Tanggapan*)
43.0 – 50.0	4.3 – 5.0	Strongly agree (*Sangat setuju*)
35.0 – 42.0	3.5 – 4.2	Agree (*Setuju*)
27.0 – 34.0	2.7 – 3.4	Doubtful (*Ragu-ragu*)
19.0 – 26.0	1.9 – 2.6	Don't agree (*Tidak Setuju*)
English: 10.0 – 18.0	1.0 – 1.8	Strongly Disagree (*Sangat tidak setuju*)

III. RESULTS AND DISCUSSION

1. Respondent Characteristics

Respondents in this study came from pine resin farmers who are forestry workers. Pine resin farmers generally live around forest areas, especially in mountainous areas with abundant pine tree populations. They usually work independently or join forest farmer groups (KTH), coordinating with Perhutani or related institutions. Most pine resin farmers rely on hereditary skills in tapping resin, using traditional methods that have been used for years. This profession is often a side job for rural communities, although tapping pine resin is the main income source supporting daily life for some others..

In carrying out their work, pine resin farmers face various challenges, ranging from weather factors to the tools limitations. Rain and high humidity can hamper resin production, while the traditional containers used are often less efficient in accommodating the sap optimally. In addition, fluctuations in the price of pine resin in the market also affect their income, making this profession uncertain. However, the perseverance and experience of farmers in reading natural conditions and understanding good tapping techniques allow them to survive and optimize their harvest.

In addition to the technical aspects, the characteristics of pine resin farmers also reflect the spirit of mutual cooperation and togetherness in their community. Many farmers share knowledge and experience, both in tapping techniques and how to process resin to make it more valuable. They also have a close relationship with nature, understand the growth cycle of pine trees and maintain their sustainability so that they can continue to be used sustainably. With the innovation in pine resin collection tools based on various filters, it is hoped that their productivity will increase, and they can get better results from the hard work they do.

2. Pine Sap Production Results

Pine sap collection tools based on various filters are made in order to improve the quality of the pine resin produced, figure 5. The function of the filter is to filter dirt that enters the container. These two filters work in stages in the filtering process. Filter 1 is responsible for filtering large particles from the sap, while Filter 2, with a smaller density, filters finer particles so that the final result obtained is cleaner. After the sap passes through Filter 1, large particles will be filtered so that only small particles are captured by Filter 2. Thus, the sap that comes out of Filter 2 is cleaner and ready to be used or processed further. Filter 2 functions as the second stage in the filtering process, with the aim of capturing finer particles that are not captured by Filter 1. After the sap passes through Filter 1, which filters large particles, Filter 2, with a smaller density, filters finer particles. This ensures that the final result that passes through Filter 2 is cleaner. Filter 2 is very important to ensure that the sap produced meets the required cleanliness standards, so that it is ready to be used or processed further. Therefore, Filter 2 is very important in producing high-quality sap through a gradual filtering process.

3. Pine Sap Quality

The quality of pine resin is based on SNI 7837:2016, which is divided into 4 quality classes, namely (1) Super Premium with SP quality mark, white in color with impurities less than 5%; (2) Premium Quality with P quality mark, white in color and impurities content (5-10)%; (3) Quality I with I quality mark, white in color and impurities content (10-14)%; (4) Quality II with II quality mark, white to brownish cloudy in color and impurities content (14-18)% (Evayanti et al., 2017). Based on initial research conducted during the development of this tool, it was found that the sap produced was of good quality, Super Premium category with an impurity content of less than 5%. The purity of the sap produced is due to having gone through a two-stage filtration process, so the results are cleaner, not mixed with dirt. The sap produced is clear, there are no animals or other small forest animals. So that in laboratory research this tool has effectiveness and efficiency in producing sap with good quality. To find out the usefulness and benefits of this pine sap collector tool based on filter variations, a trial of the tool was conducted in the community. The results of the farmer community response questionnaire are summarized in Table 2.

Batok Tree Sap Results
Hasil Getah Pohon Batok

Tree 1 Result of 1 and 2
Hasil Pohon 1 Saringan 1 dan 2

Result Tree 2 sieves 1 and 2
Hasil Pohon 2 Saringan 1 dan 2

Tree Results 3 sieves 1 and 2
Hasil Pohon 3 Saringan 1 dan 2

Figure 5. Comparison of Pine Sap Harvest Results
Gambar 5. Perbandingan Hasil Penyadapan Getah Pinus

Table 2. Summary of Pine Farmer Community Questionnaire Results
Tabel 2. Ringkasan Hasil Kuesioner Komunitas Petani Getah Pinus

No.	Pertanyaan (Question)	Jumlah (Amount)	Rata-rata (Average)	Kategori (Category)
1.	Tool durability (*Ketahanan alat*)	19	3.8	Agree (s*etuju*)
2.	Ease of tool maintenance (*Kemudahan perawatan alat*)	18	3.6	Agree (S*etuju*)
3.	Easy to use (*Kemudahan penggunaan*)	14	2.8	Doubtful (R*agu-ragu*)
4.	The practicality of using this tool (*Kepraktisan alat*)	19	3.8	Agree (S*etuju*)
5.	Tool effectiveness (*Efektivitas alat*)	19	3.8	Agree (S*etuju*)
6.	Tool security (*Keamanan alat*)	20	4.0	Agree (S*etuju*)
7.	Ease of tool storage (*Kemudahan penyimpanan alat*)	15	3.0	Doubtful (R*agu-ragu*)
8.	Waste produced (*Getah yang dihasilkan*)	25	5.0	Strongly agree (*Sangat setuju*)
9.	The use of the tool (*Penggunaan alat*)	23	4.6	Strongly agree (*Sangat setuju*)
10.	Tool functionality (*Fungsionalitas alat*)	20	5.0	Strongly agree (*Sangat setuju*)

The response of the pine tree farmer community after using the pine sap container on average stated that they agreed with the durability of the tool, ease of maintenance, ease of use, practicality and effectiveness of the tool, and the safety of the tool. The durability of the tool can be relied on because it is made of aluminum metal, which is not easily damaged and does not rust easily. Aluminum is resistant to corrosion, light but strong, resistant to extreme weather, durable, and environmentally friendly. Simple maintenance, does not require special maintenance, easy to clean, because it is weather resistant so it does not need to be checked/replaced frequently. This tool is easy to use because it is light, quick to install, strong, and stable. The community agrees that this tool is practical to use because it is light, strong, and durable, relatively quick to install, and effective to use because it produces purer sap, efficient collection, and high durability. After all, the tool is made of aluminum, so it does not react to pine sap so that its purity is maintained. The community also considers this tool safe because the container is closed, firmly attached to the tree, weather resistant, durable, aluminum equipment is not at risk of contamination by chemicals that can damage the quality of the sap.

The community strongly agrees that this tool does not produce waste, can be recycled, and requires minimal maintenance. They strongly agree with the usefulness of the tool because it produces purer, more durable, and efficient sap, with better sap storage capacity, and consistent quality. The community also strongly agrees with the functionality of the tool because of the efficiency of sap storage, durability, closed design, stability and safety, and ease of use. It is very helpful in improving the quality of harvested sap. With the various advantages of this tool, the community still feels doubtful about the ease of use and storage,

because most people do not easily adapt to new tools. The community needs time to get to know the tool and get used to using it. The old tool is considered easier to use and store because they are used to it. With the new sap storage tool, the community needs to learn gradually. If coconut shells are stored, they are simply stacked in a corner of the forest, for this tool, a safe storage place needs to be considered. The community only needs to get used to it, and it takes time to accept something new. So in general, the innovation of pine sap collectors based on various filters is very possible and feasible for use by pine farmers.

Based on the survey results in three sub-districts, namely Kaliwiro, Wadaslintang, and Kalibawang Sub-districts, the results are as shown in Figure 6. In terms of tool durability, ease of tool maintenance, ease of use, practicality of tool use, tool effectiveness, tool safety, and ease of tool storage in the three sub-districts gave almost the same response, on average respondents agreed. In the category of waste produced, Kalibawang and Kaliwiro Sub-districts gave almost the same response. Both areas strongly agree that the pine sap collection tool based on a filter does not produce waste because the tool can be used repeatedly and is very easy to clean. In the category of tool usability and tool functionality, respondents in the three areas agreed that the innovation of the pine sap collection tool based on filter variations is very functional and very useful in helping pine sap farmers improve the quality of the harvested sap.

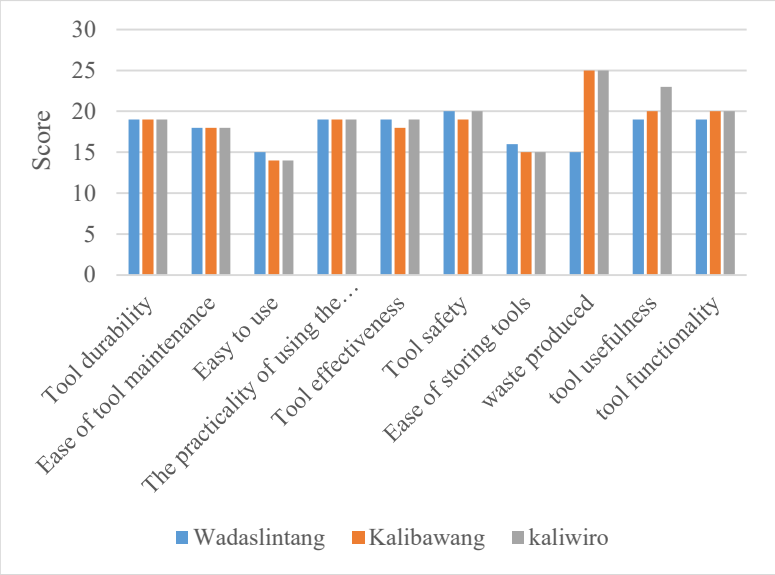

Figure 6. Survey Results on the Utilization of Pine Sap Containers
Gambar 6. Hasil Survei Pemanfaatan Wadah Getah Pinus

The results of this study provide an important contribution to increasing Indonesia's income through Non-Timber Forest Products (NTFPs), especially Perhutani BKPH in improving the quality of harvested pine resin. This is in line with Sumardayanti's research which improved the quality of pine resin by drilling (Sukadaryati, 2014). The design of the container in the form of a semicircular bowl makes it easy to dredge and there is a filter that can be lifted when taking sap. This tool also has limitations in its installation which is slightly longer than the old tool. For this reason, it is advisable to understand how to install the tool properly and correctly and ensure that the tool is installed correctly and not tilted.

IV. CONCLUSION

A. Conclusion

The results of the study showed that the community had a good perception and agreed that the innovation of a filter-based pine resin container could be used by farmers in harvesting pine resin. The tool has good durability, is easy to maintain, is easy to use, is practical and effective in its use, is safe, is easy to store, does not produce waste, and has excellent benefits and functions. The impact of using this tool, Perhutani no longer needs to look for tools, and the quality of the sap harvested with this sieve-based sap container is no longer in doubt. With good quality harvested sap, the income of the sap farming community has also increased.

B. Suggestions

Based on the findings, it is recommended to enhance the usability and accessibility of filter-based pine resin collection tools through: Community training on tool installation and maintenance, Collaboration with industry stakeholders to standardize the production and distribution of the tools, Further studies to explore the environmental and economic impacts of adopting the tool at a larger scale.

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