

Utilization of Robusta Coffee (*Coffea Canephora*) Wood as Stylish Wooden Sunglasses for Young People

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Abstract: Nowadays wooden sunglasses are popular to bring quirky impression as it has eco-design value. Teak, sonokeling, or ebony are types of wood commonly used as wooden sunglasses. Meanwhile, there is a type of wood with abundant availability in East Java that is also potential to use: Robusta coffee (*Coffea Canephora*) wood, as this wood is hard enough and has sufficient elasticity. However, the economic value of this wood is currently low, as it is only used as firewood. This research aims to optimize the economic value of Robusta coffee wood by utilizing them as sunglasses. The first step was market analysis to decide who was the potential target of user/consumer/buyer. The next analysis was “persona” and artifact analysis. “Persona” method was used to illustrate the behavior and lifestyle of the user, while artifact analysis is to get a picture or the pattern of fashion-stuffs owned by the user. These methods resulted in three series of design concepts: “Diver”, “Sherlock”, and “Storyteller”. Furthermore, a mood board was made as a design guide, by collecting images, photos and material containing the related situation, theme or color. Mood board aims to determine the shape of wooden sunglasses to meet the design concept. Finally, experiments were conducted by the exploration of wood materials to meet the impression as determined by design concept, those are wood cutting processes with many patterns, finishing, layering, laser cutting, mix-material, wood bending, component mounting support, and the market test. The results of this study indicate that Robusta coffee wood has the potential to be developed into wooden sunglasses. The challenge lies in the process of cutting (mostly wood coffee has a lot of cracks), mixing wood with resin, the fit into anthropometry requirement, and bending wood. The quality control will guarantee precise and consistent quality to ensure the wooden sunglasses is comfortable to wear.

1 INTRODUCTION

Sunglasses with wooden frames are becoming a phenomenon of fashion trends. Wooden sunglasses are increasingly popular among young people and public figures as they can bring a quirky impression (Adventa, 2016).

As a tropical country, Indonesia's potential in producing timber is very large. That is why wood raw material is used for various purposes. Countless woodcraft products, ranging from furniture, cutlery, home decor, to accessories. Eco-design and the use of natural materials as raw materials are increasingly widespread. Market demand for environmentally friendly products is increasing (Arianto, 2017).

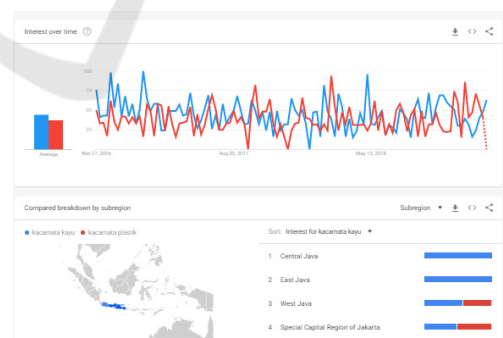


Figure 1: Comparison of Interest Pictures Over time on wooden sunglasses and plastic sunglasses (Google Trend, 2018)

The above is a graph of the comparison of eyeglass trends over the past 2 years between wooden sunglasses and plastic sunglasses in Indonesia. It can be seen that the interest over time of wood sunglasses is higher than plastic sunglasses. The distribution of

interest is also more evenly distributed than plastic sunglasses.

Types of wood usually used for wooden sunglasses are teak, rosewood, and ebony. It is because those woods are hard but still have sufficient elasticity for bending feature needed for sunglasses. There is another type of wood that is hard and elastic enough which is coffee wood.

It is noted that Indonesia is the fourth largest coffee producer in the world after Brazil, Vietnam, and Colombia. According to statistics from the Directorate General of Plantation of Indonesia (2017), in 2017 Indonesia was able to produce 637,539 tons of coffee beans at 1,227,787 hectares of land. The land area increases when compared to the previous year which was 1,228,512 Ha. This proves that Indonesia has very large coffee land and continues to increase every year. [2] According to the Plantation Office of East Java Province (2017), most of the coffee production in East Java is Robusta coffee. The area of robusta coffee fields in East Java in 2017 is 85,075 hectares with a production of 51,107 tons. The calculation is far more than Arabica coffee which in 2017 in East Java there was only 21,380 Ha of coffee land with a production of 16,507 tons.

East Java has a coffee plantation area of 85,075 ha in 2017 (Statistics of Agriculture Office of Indonesia, 2017). One hectare on average consists of 1,200 coffee trees, so in East Java, there are at least 102 million coffee trees. From the above calculations, it can be concluded that the availability of wood coffee in East Java is very abundant at 102 million coffee trees

East Java is noted to have extensive coffee plantation land owned both government and private (Arianto, 2017). The abundance of this coffee plantation is not yet optimally utilized, especially the wood. So far, the utilization of coffee wood is only for drum sticks, ashtrays, prayer beads, machetes, and furniture. These products use sapwood, while coffee wood that has been cut down for a long time and already being old and dry, tends not to be utilized. Therefore, this old and dry coffee wood has only been used as firewood.

The small size of coffee wood and its irregular stems make coffee wood less attractive to the people of East Java. Wood coffee is mostly just a substitute for coffee bean production. That is coffee wood in East Java is only used as firewood that has lack of economic value.

2 LITERATURE REVIEW

2.1 Classification of Robusta Coffee (Coffea Canephora)

Robusta coffee plants have better adaptations compared to arabica type coffee. The area of robusta coffee plantations in Indonesia is relatively extensive. Because the type of Robusta coffee can grow at a lower altitude than the location of Arabica plantations. The original Robusta coffee is almost gone. Currently, several types of Robusta have been mixed into clones or hybrids, such as BP 39, BP 42, SA 13, SA 34, and SA 56 clones. Robusta coffee production, in general, can reach 800-2,000 kg/hectare/ year (Directorate General Plantation of Indonesia, 2002).

Based on taxonomy, the scientific classification of the robusta coffee plant (*Coffea canephora*) is included in:

Kingdom	: Plantae
Division	: Magnoliophyta
Sub Kingdom	: Tracheobionta
Superdivision	: Spermatophyta
Class	: Magnoliopsida
Subclass	: Asteridae
Orde	: Rubiales
Family	: Rubiaceae
Genus	: Coffea
Species	: Coffea Robusta

2.2 Productive and Moisture Content of Robusta Coffee

The sapwood of coffee wood has a high water content so the coffee wood must be dried first to reach the desired moisture content. Or we can also use hardwood, the old and dry one. Coffee wood water content can be known as (Risky, 2015).

Table 1. Productive Age Tables and Robusta Coffee Water Content

Sapwood	Hardwood
<ul style="list-style-type: none"> • Teenage years • Unproductive • The Moisture > 20% 	<ul style="list-style-type: none"> • 50 years old • Rejuvenation results • The moisture content of 12%

2.3 Productive and Moisture Content of Robusta Coffee

Wooden sunglasses have been made and are on the market. So far there are several wooden sunglasses

brands on the market. Some use wood as raw material but use more metal than wood. There are also those who use wood materials, but the products are 100% customized design. There are also those who market their products with a predetermined form from the beginning but duplicate the design of non-wood material glasses. So that no one has specifically explored the uniqueness of wood coffee

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3 METHODS

The first step was market analysis to decide who was the potential target of user/consumer/buyer. The next analysis was “persona” and artifact analysis. “Persona” method was used to illustrate the behavior and lifestyle of the user, while artifact analysis is to get a picture or the pattern of fashion-stuffs owned by the user. These methods resulted in three series of design concepts: “Diver”, “Sherlock”, and “Storyteller”. Furthermore, a mood board was made as a design guide, by collecting images, photos and material containing the related situation, theme or color. Mood board aims to determine the shape of wooden sunglasses to meet the design concept. Finally, experiments were conducted by the exploration of wood materials to meet the impression as determined by design concept.

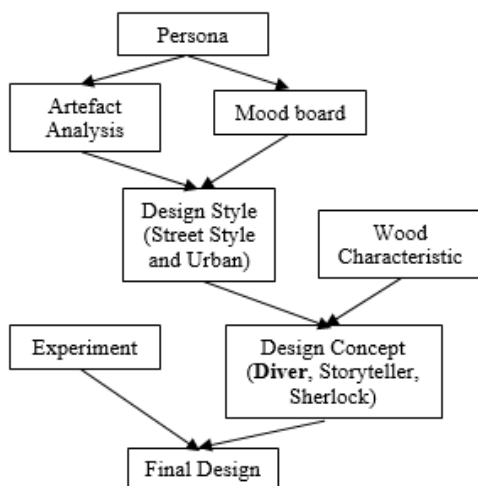


Figure 2: Design Framework

4 RESULT AND DISCUSSION

4.1 Persona

This persona is obtained from observations of potential target markets, with the following description:

Name : Katie
 Age : 25 years old
 Hobbies : Water Activities (Swimming, Diving, Cruising)

Katie is a singer and actress. Katie is an Instagram user with a large follower of 136.4 million followers. Katie likes to spend time watching horror movies while having free time. But when viewed from the vacation pattern, Katie always spends his time close to water, ranging from just swimming, beach tanning, cruising to scuba diving. Katie is a public figure who represents the millennials and is seen often wearing glasses, especially sunglasses.

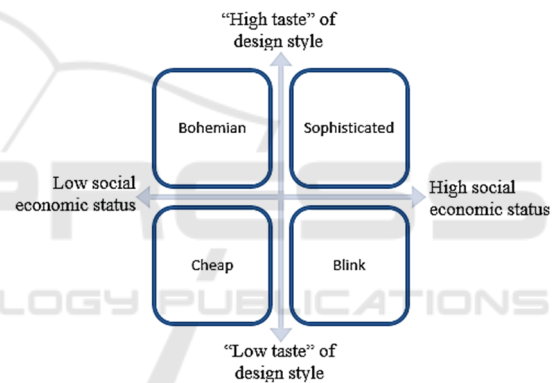


Figure 3: Design Framework

From the classification of prospective customers according to their attention style and social class, it is classified as sophisticated because prospective customers have high economic status and are followed by culture or the desire to buy a product is also high. The characteristics of sophisticated users:

1. Good treatment: A sophisticated person has a high sense of responsibility for every work done. They are more mature and wise in determining a decision. Caring with the issues around and they became an inspirational figure for people around.
2. Having high knowledge: Having knowledge that is relatively good, intelligent, and hard-working, so from the point of socializing they are very great and can balance their interlocutors.
3. Fashionable: Have a taste in fashion. Beautiful appearance looks neat, the tendency to appear naturally, not excessive.

4. Good relationship: Having a close relationship both in relatives and family. So that it can build trust for those around them.

4.2 Artefact Analysis

Katie looks like she often wears glasses that tend to be rounded, circle, and big rims. For the style of her own glasses, Katie likes classic-style glasses. It can be seen from the shape of the glasses she wears that are tend to be rounded and sometimes she is also seen wearing sunglasses with top bars and original aviators. Katie likes to wear glasses with a mild impression. For the type of glasses based on the lens, Katie is more often seen wearing sunglasses. Not only black lenses but she also seen several times using colored lenses, both mirror lenses, and polarised lenses.

4.3 Moodboard

Moodboards are carried out in parallel with artifact analysis by identifying themes and colors. Based on the product used by the person, the person tends to like to wear comfortable clothing, for example, sweaters, jumpsuit, plain t-shirts. Persona also likes clothing with a classic style and not an era like turtlenecks and denim. Persona sometimes uses a dress, but the dress used tends to be nuanced summer dress and still very comfortable to use. for footwear, people prefer to use sneakers. Persona only uses high heels when attending large and formal events. The conclusion is found that street style and urban style are in demand by persona.

4.4 Experiment

Experiments in this research consist of: wood cutting processes with many patterns, finishing, layering, laser cutting, mixing material, wood bending and market test.

4.4.1 Wood Cutting Process

This wood cutting process experiment is needed considering the wood character of Robusta coffee which has many cracks and tends to be small in diameter

Because of the analysis of the type of cut pattern found that the most suitable cut pattern is vertical, it is necessary to analyze the number of wooden boards that can be produced from one robusta coffee stick. Based on the types of cut patterns based on fiber in the cross-sectional pattern in Figure 2.2, the most

suitable coffee wood is cut based on the radial board pattern because its diameter is relatively small which is the lowest average of 48 mm Whereas the thickness of the wooden board chased is 10 mm. This is to pursue the production process of sunglasses that are really thin layered.

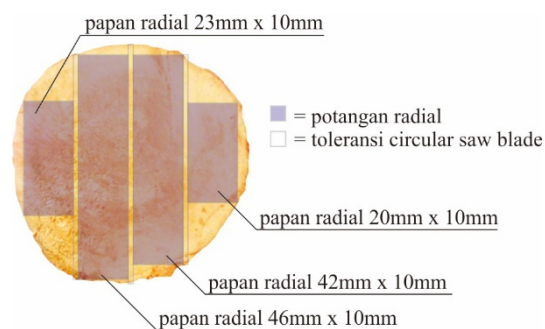


Figure 4: Minimal Radial Cut Pattern

Analyzed on the minimum cross-section of the coffee log, the coffee wood is 48 mm in diameter, it was found that one log of wood produced 4 wooden boards. Variants of wooden board sizes are 46mm, 42mm, 23mm, and 20mm. Everything is 10mm thick.

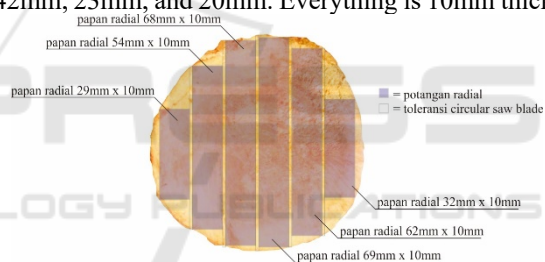


Figure 5: Maximum Radial Cut Patterns

Analyzed on the maximum average cross-section of the coffee wood trunk, namely coffee wood 72 mm in diameter, it was found that one log of coffee produced 6 wooden boards. The wooden board variants are 69mm, 68mm, 62mm, 54mm, 32mm, and 29mm. Everything is 10mm thick.

Based on the above analysis, it can be concluded that the rims are most suitable for using large diameter logs because the average rims of the sunglasses are 55mm. As for the part of the paste or stalk sunglasses can use large or small rods.

4.4.2 Finishing Analysis

Woodstain: If the surface of the wood is still rough it must be done more than twice the brush to achieve a pretty good finishing. The typical color of coffee will disappear. The wood texture of the coffee looks clearer. In the end result, the coffee wood surface will look slightly shiny.



Figure 6: Final results of wood stain finishing

Fine Sandpaper: If there is a small crack on the coffee surface of the coffee wood, then during this sanding process it is smoothed easily.



Figure 7: Final Results of Fine Sandpaper

Polyurethane: This finishing was carried out with the help of craftsmen from Sahawood eyeglasses. The end result is relatively slightly shiny, does not remove the texture of coffee wood fiber, and is waterproof.

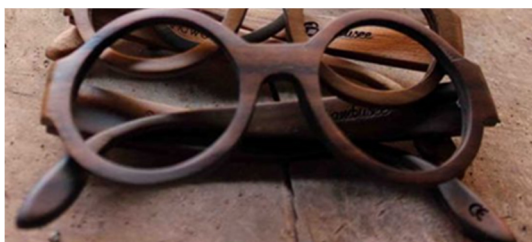


Figure 8: Example of the results of finishing using polyurethane

Based on the end result, Polyurethane Finishing is the most efficient finishing because of its character which does not remove wood fiber and wood color. As well as its waterproof character does not inhibit its users to use their sunglasses while in humid areas or do water activities.

4.5 Trend Analysis

Trend analysis is done to select the final design concept that will be used from alternative design concepts. Of the three alternative concepts, keywords were taken to define trends during the last 12 months in Indonesia.

For the concept of diver, keywords diving is taken to represent the activities of divers or divers. For Sherlock, Sherlock's own keywords are taken, because Sherlock is a fictional character who can represent himself. Whereas for the storyteller concept Robusta keywords are taken as a phenomenon raised in the concept.

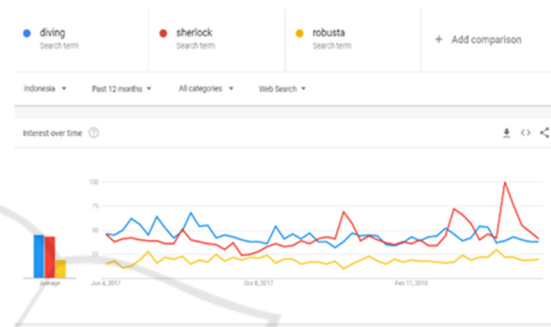


Figure 9: Interest Over Time from the Third Keyword Alternative Concept (Google Trend, 2018)

Judging from the Interest Over Time chart over the past 12 months, it has been seen that keywords diving and Sherlock top the level of interest in Indonesian society compared to Robusta. Both have competitive and balanced graphics. But diving charts tend to be stable at an average of around 60%. From the graph above it can be concluded that the diver concept represented by diving keywords has the greatest potential to be lifted.

Coffee Wood x Metal

In the mix-material experiment was carried out to find out the possible compatibility of coffee wood combined with other materials. The following are the results of a wood mix-material experiment. Given metal is a material that is always in demand in eyewear products.



Figure 10: Coffee Wood x Metal Experiment

The experiment was carried out by combining robusta coffee wood material with stainless steel in the bridge and top bar sections. Judging from the experiments above, metal and coffee wood have a match, because it turns out that the combination of wood and metal brings synergy and balances the impression of wood that is too dense and impresses stocky. But in the manufacturing process requires more precision. This is because there are more connection details between wood and metal that must be made, including plumbing for screw mounting and base rims.

Coffee Wood x Ebony Wood:



Figure 11: Experiments on Mix Materials between Coffee Wood and Wood Timber

In this experiment, the two types of wood, namely coffee robusta and ebony wood were cut according to the profile of the sunglasses using laser cutting. Then put together with white glue. The combination of both gives an impression like browline sunglasses. This is because the color of ebony is much darker, namely dark brown.

Coffee Wood x Polyester Resin: From the experimental Mix Material between Coffee Wood Skin and Polyester Resin, it was found that the resin end result was bubbling. In addition, the final results of dry resin are evenly distributed but not at the same level of flexibility. Found in some parts dry but slightly flexible like rubber.



Figure 12: Experiments on Mixing Materials between Coffee Wood Skin and Polyester Resin

Coffee Wood x Epoxy Resin: The experiments were first carried out in 3 types of experiments with different pigment consistencies. This is to find out the best consistency for the product applied to small products such as sunglasses, and the end result.



Figure 13: Mix-material experiments (epoxy coffee wood)
1

In Experiment 1, 2 times resin pouring was carried out. The first resin pour is navy blue with some white pigment. Failure was found that it turned out that the pigment precipitated and damaged the reaction between the catalyst and resin so that it did not dry completely. Subsequent pouring is a resin with sufficient pigment to produce an almost clear navy. In this process, it is found that the dry resin is perfect. The pigments do not settle and interfere with the drying process. The total drying time is 49 hours.

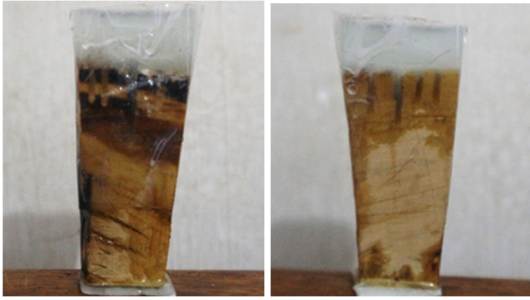


Figure 14: Mix-material experiments (epoxy coffee wood)
2

In experiment 2 only uses one type of resin. Clear resins are mixed with very little blue pigment. In this experiment the dry resin is perfect, and the pigment does not interfere with the drying process. Total drying time is 24 hours.



Figure 15: Mix-material experiments (epoxy coffee wood)
3

In experiment 3, pouring the first resin with concentrations of sea blue pigments is quite a lot like experiment 1 and produces a similar result which is not perfectly dry, even the resin is not sticky to wood and can be separated from wood. Then the second experiment was carried out by pouring a resin with a low pigment concentration such as experiment 2 between the non-dry resin and coffee wood. It is produced that the pouring of the second resin is completely dry and adhesives to the over pigmented wood and resin surfaces. The drying time is 56 hours.

The combination of resin and wood coffee has a unique blend in visual terms because it produces the impression of underwater and sky. However, in the manufacturing process, it was found that the over pigmented resin would not be completely dry and sticky, this is because the drying process of the pigment tends to settle and disrupt the catalyst concentration to the resin. So using resin with low pigment levels is the best choice.

After knowing the best levels of pigments for epoxy resin, another experiment was conducted with the best levels of pigments, namely very low pigments.



Figure 16: Mix-material experiments (epoxy coffee wood)
4

From the above experiment, a new board was formed in the form of a mixture of resin material and robusta coffee wood. From the board above it can be used to form eyewear profiles. **Coffee Wood Skin x Epoxy Resin:**



Figure 17: MIX-material experiments (epoxy coffee wood)
5

In the experiment above it was found that bark retains its exotic color, which is a darker color than wood.

5 WOOD BENDING EXPERIMENT

Sunglasses have a slight curvature in the temples. Then a wood bending experiment was carried out using a steel profile tool. The experiment was carried out directly on coffee wood. Wood is pressed from both directions to have the desired stickiness. In this experiment, there were no problems. Perfect curved wood with a high curvature can reach 30 mm.



Figure 18: Bending experiments of coffee wood

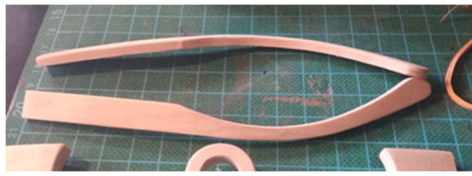


Figure 19: Final result of coffee wood bending experiments.

6 ANTHROPOMETRY ANALYSIS

Based on the Ergonomics Journal of Reading Glasses (Faisal, 2016), the size of the lens is very diverse, but the minimum horizontal width of one lens is 55-60 mm. While the universal bridge width is 10 mm.

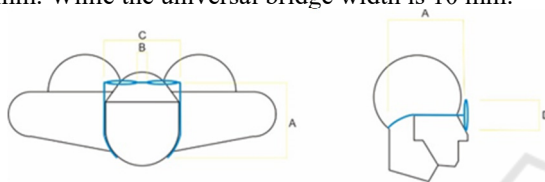


Figure 20: Dimensions of general eyeglasses (visible image)

- A = 130 mm – 140mm
- B = 10 mm – 15 mm
- C = 132 mm – 140 mm
- D = 52 mm – 60 mm

Whereas to measure the length of the rims, measurements of eyewear rims were carried out in a sample of 10 people. This affects the horizontal viewing range and comfort. Where in this case the length of the rims refers to rarely between the base of the temple.

Table 1: Survey tables for eyeglasses rims length (Source: Dorojati, 2017):

Sample	Length (mm)
1	131 mm
2	130 mm
3	134 mm
4	140 mm
5	138 mm
6	140 mm
7	139 mm
8	137 mm
9	140 mm
10	132 mm

From the table above, it was found that the length of rims ranged from 130 mm - 140 mm. In addition to the length of the rims, other parts of the sunglasses that come in direct contact with the user are nosepad. Its function is to support the sunglasses on the user's nose.

Table 2: Nasal anthropometric survey tables.

No.	Age	M/F	NW	NH	BW
1	18	F	40	20	12
2	19	M	40	25	15
3	19	F	30	15	15
4	20	F	25	20	20
5	20	M	30	25	20
6	21	F	30	20	18
7	21	M	40	30	20
8	23	F	30	25	18
9	23	F	35	30	19
10	24	M	40	30	20
11	24	M	43	27	20
12	24	F	37	20	18
13	30	M	47	25	20
14	32	F	35	20	17

- NW (nose width) = width of nose lobe
- NH (Nose Height) = Height of nose from tip lobe until the nose tip
- BW (Bridge Width) = The width of the nose Bridge

7 CONCEPT

The concept of form is taken from the overall product concept, namely the diver. From these concepts, some extreme are obtained which can be form content, among others, sea atolls, sea troughs, sea corals, an underwater cave, wave quality, scuba equipment, and local beach conditions. So finally the diver is divided into 5 form variants namely Karimun Jawa, Wakatobi, Alor, Derawan and Raja Ampat. The five are some of the best diving locations in Indonesia with their respective characters.

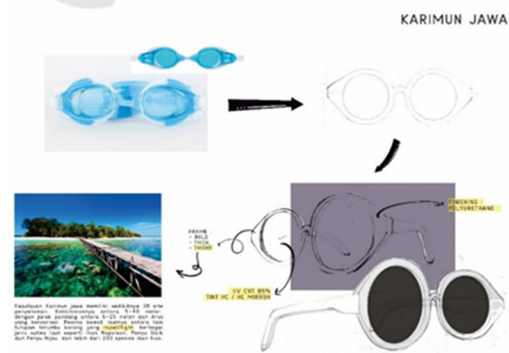


Figure 21: Karimun Jawa concept scheme

Based on the scheme above, the idea starts with the form of swimming goggles. The sunglasses are the basic form of swimming goggles and then adapted

to form wooden sunglasses. Because the shape is like enveloping the lens and seems tight and tight, the name of the variant of the wooden eyeglasses is named Karimun Jawa Because Karimun Jawa has coral reefs that are known to be very tight and intense.

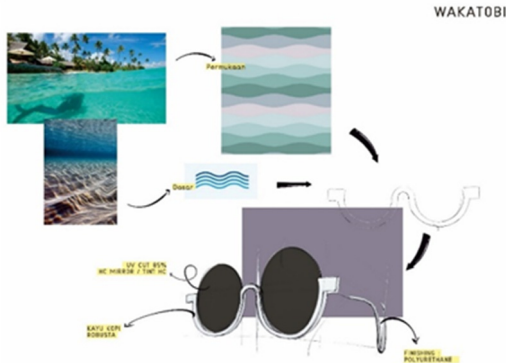


Figure 22: Wakatobi concept scheme

The Wakatobi variant of ideation begins with observing the beach in the Wakatobi area and it is found that both the surface and the seafloor form calm and shallow waves. This was later adapted into the shape of a wooden eyeglass frame that resembled shallow waves.



Figure 23: Alor concept scheme

In the same variant the idea has similarities to the Wakatobi variant, ie the idea is waves. However, considering the alor has a higher wave flow and tends to be very sharp, the waves in the Wakatobi variants in the extension become higher and resemble dramatic waves.



Figure 24: Derawan concept scheme

In the derivative variant, the idea starts from the characteristic of Derawan beach, which has a lot of atolls. Atoll is a collection of coral reefs that form circular or almost circular like a ring that surrounds the lagoon in it. The circular shape of the atoll is due to the development process of atolls that grow around volcanic islands, where over time the volcano loses its magma activity (inactivity) and then its peak erodes leaving ring-shaped coral reefs called atolls. The contrast between the beach of seawater and atoll is then adapted to be the contrast that occurs between coffee wood and blue resin.

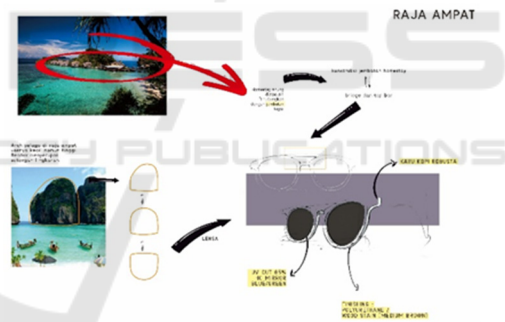


Figure 8. 5 Raja Ampat concept scheme

The Raja Ampat variant begins with observing the situation in a location where many homestays are found. Each homestay is connected with wooden bridges. This philosophy was later adapted into the formation of the top bar and the bridge. In addition, the basic shape of the archipelago in Raja Ampat is quite typical, its shape is high and its edges are curved like a half circle. This was later adapted into the shape of eyeglass frames.

8 CONCLUSIONS

Coffee Wood among the fashion industry. Because of its large availability, there are at least 102 million

coffee trees spread in East Java. Coffee wood has good characteristics to produce wood sunglasses. Coffee wood includes hardwood class II wood and has sufficient elasticity for bending and pressing. Plus, the utilization of coffee wood can increase and become more optimal. Considering that coffee wood is considered to be firewood or coffee powder and coffee bean waste. So, in line with that can increase the value and income per capita of East Java province.

(Sussex Publishers) Retrieved from Psychology Today: <https://www.psychologytoday.com/intl/blog/fulfillment-any-age/201602/6-messages-your-glasses-may-be-sending-people>.

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