The economic aspect of batik stamp made of can waste

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Abstract. The traditional batik stamp (canting cap) is relatively expensive tool, made of copper. The lack and high price of copper made it difficult for batik stamp crafter to market their products, and made alternative materials from wood and paper/cardboard. The weakness of wood and paper stamp is that the resulting rough motifs and not long lasting. The use of used can is environmentally friendly, assure sustainability by recycling waste of cans which causes environmental problems. This study departs from research on the innovation of Cantik batik stamp made of biscuit can waste, focusing on the economic aspect of the innovations. This analysis was important to see the advantages and or weaknesses of the can stamp, as a basis for applying the research product in the batik stamp rafter community. Descriptive research was conducted for cost calculation, analysis of selling power, and service life. The cost of can batik stamp found cheaper than copper stamp, since the materials is low cost, though 21% copper content was still needed for isen-isen, ganjelan, and bajelan part. However the labor processing cost was equal. The processing time efficiency was lower, while level of difficulty in processing was higher, because cans are harder and more difficult to shape and cut compare with copper. The durability of the can batik stamp was lower than copper, because can is easily oxidized and corrosive, so it will be more difficult to maintain. The risk of rust can be reduced by processing the final stamp in hot gondorukem (resina colophonium). For long lasting product, the can stamp has to storage in a dry and low humidity place, in hung position.

1. Introduction
Batik is one of the world cultural heritages of Indonesia recognized by UNESCO in 2009. Define as traditional resist dyeing process to produce distinctive motifs; the use of canting tulis (batik pen) and batik stamp to paste specific wax on fabric surface become an inseparable part of the batik itself. Batik stamps a tool used for pasting wax to fabric surface directly with motifs [1]. The history of batik starts with hand drawn canting in about 9th century in East and Central Java. The use of batik stamp has started since the mid of 19th century, noted by Thomas Stamford Raffles when he was the governor general of England in Java in 1811-1816. At that time, what was used was a wooden stamp. In the next century, the main material of batik stamp is copper, because copper is easier to shape and processed, having high durability, and give more fine motif patterns.

Nowadays, the copper becomes rare, while the price of copper sheets is relatively expensive and continue to rise until it reaches the price of IDR 120,000/kg. Besides, there is always a problem of shortages stock of copper [2]. There are some effort to replace copper with other materials, like wood, carton paper, and aluminum. An innovation research has been conducted to make batik stamp from used biscuit can as main material.
2. Theoretical Background

2.1. The Waste and Waste Management
Waste is the excess of product from production activity that is no longer used [3]. Waste classified into organic, inorganic and toxic hazardous waste. From the form, wastes are classified into solid, liquid and gas form. Can waste are included in the solid inorganic group.

Waste needs to be managed correctly. Waste management is a conservation effort that contains the 5R concept; those are Reduce, Reuse, Recycle, Replace, Replant [4, 15]. Meanwhile, Abella [5] add another three to become 8R, consist of Reduce, Replace, Reuse, Recycle, Recover, Refuse, Rejeck, and Rethink. The use of used trash can waste is the effort of reuse and recycle, and rethink to change the items that are no longer useful into something more useful. Household waste management is regulated in Article 1 Number 1 Government Republic of Indonesia, Regulation Number 81 year 2012 concerning Management of Household Waste and Waste Similar to Household Waste. Household waste is garbage originating from daily activities in the household that does not include feces. Household waste that is generated every day if it is not properly managed and not environmentally sound, over time it will result in the accumulation of garbage in the final disposal site (TPA). The accumulation of household waste that is not properly managed in an environmentally friendly manner will cause various impacts, both for the environment and for public health, as mandated by article 28 paragraph (1) 1945 Constitution of the Republic of Indonesia. Therefore steps are needed to overcome the generation of waste so that every citizen has a good and healthy living environment. One of the ways is by reducing and handling used trash can. Cans are as storage places or containers used to package food, drinks or other products. Cans are steel sheets wrapped in can (Sn) or in the form of a container made of steel and coated with thin white tin, like aluminium and alloy with a content of not more than 1.00-1.25% of the weight of the can itself [6].

Currently, the use of aluminum is increasing. One of the uses of aluminum in the soft drink industry is where aluminum is used as packaging for soft drinks (soft drinks). Ordinary aluminum is mixed to increase mechanical properties and strength, such as aluminum foil and beverage cans containing about 92-99% aluminum, the remaining copper, zinc, magnesium, manganese, silica, and other metals with a small percentage level [6]. Wahyuni et al. [7] studied about the metal content of some softdrink can, and found the same metal content in different composition.

| Metal Content (%) | Drink Can   |
|-------------------|-------------|
|                   | Pocari sweat| Cap kaki tiga | Greensands | Coca-cola |
| Aluminum          | 96.38       | 89.74        | 90.87      | 93.28     |
| Magnesium         | 1.14        | 3.28         | 2.25       | 1.17      |
| Manganese         | 0.75        | 1.93         | 1.21       | 1.04      |
| Iron              | 0.51        | 1.79         | 1.52       | 1.72      |
| Silicon           | 0.19        | 0.88         | 1.33       | 0.68      |
| Copper            | 0.19        | 2.36         | 1.93       | 1.26      |

2.2. How to Produce Batik Stamp out of Used Can
Canting cap or batik stamp is a tool for pasting malam with repeated pattern on the fabric surface by stamping. Mashadi and Gardjito [8] stated that there are four types of batik stamp based on its functions, those are: (1) Canting Cap Klowong, used to stamp batik ornament motif; (2) Canting Cap Tembokan, used to cover desired wide base color or the part that will remain white; (3) Canting Cap Biron, serves to cover the blue color based; and (4) Canting Cap Riningan, used to make dots to fill in klowongan motif part. Batik stamp consists of: gagang (handle), rangka (frame) ancak (base), siliwer (pattern motif part), and bajelan (stabilizer) [8].
The equipments and tools used for making batik copper stamp, are: (a) metal scissors or cutter used to cut cans or copper; (b) pliers taper as a clamp; (c) small clamp for arranging siliver parts, (d) mortar which was a container for smoothing stained powder, (k) hacksaw used to cut the metal parts of the stamp frame and the handle, (l) iron clamp was used to straighten ancak parts, (m) cupid yuyu a clamp to hold the part of bajelan/siliver, (n) sandpaper to flatten and sharpen the surface of the batik stamp, (o) fan for combustion of fire, (p) knife to cut hard and non-hard material, (q) a scissor to cut metal plate material, (r) bowl for melting gondorukem.

The process is as follows: (a) sorting out biscuit cans; (b) cutting cans into ribbon plate of 2 cm width, before burned for 30 minutes; (c) preparing design; (d) making a frame and silusi distance, with 0.5 cm width can plate and assembly; (e) put klowongan on the frame (f) assembling detail of motif (isen-isen); (9) assembling siliver or frame, (9) attaching the stamp handle on the back and cut the ends to be slipped to siliver, (10) brazing and sharpening batik stamps for smoothing the stamp surface is smooth and smooth.

The material used to make a batik stamp in mass depending on the motif and size of the stamp batik. Table 2 is a list of materials and materials used to manufacture one stamp batik from 3 types of batik motifs.

**Table 2. Material of Batik Stamps [9]**

| No | Material                        | Mass of Kawung Stamp | Mass of Gedhang Stamp | Mass of Tugu Stamp |
|----|--------------------------------|----------------------|-----------------------|-------------------|
| 1  | Copper Plate                   | 1.5 kg               | 0.6 kg                | 0.75 kg           |
| 2  | Janur Iron plate               | 0.5 kg               | 0.3 kg                | 0.5 kg            |
| 3  | Janur Iron plate (Handle)      | 0.108 kg             | 0.108 kg              | 0.108 kg          |
| 4  | Stained Powder                 | 0.2 kg               | 0.08 kg               | 0.1 kg            |
| 5  | Pijer Stone                    | 0.16 kg              | 0.05 kg               | 0.07 kg           |
| 6  | Firewood                       | 6 kg                 | 6 kg                  | 6 kg              |
| 7  | Gondo Candles                  | 3.85 kg              | 1.7 kg                | 1.9 kg            |
| 8  | Kerosene                       | 0.308 kg             | 0.308 kg              | 0.308 kg          |
| 9  | Water                          | 4.5 liter            | 4.5 liter             | 4.5 liter         |

Based on Indonesian National Work Competency Standards (SKKNI) Number 104 year 2018, regarding the process or steps in making stampbatik batik, as follows: (a) Preparation process, by identifying the function and size of the batik stamp, preparing the tools, material, design, and drawing the frame design; (b) Make the Stamp by: make ancak (batik stamp frame, assemble of klowongan based on pattern design, complete the isen-isen, lock all parts of motifs with ganjelan (metal locking plate), attach the frame part and handle part, attach the frame, motif components, and ancak, attach the frame to the back of the ancak and locked, attache frame, ancak, and the garan accordingly, install siliver as frame protector outside the frame and ancak; (c) improving the quality of batik stamp by: the component of motif ditoto (neat in position), stamp digolo according to the procedure, ensure the flatness of the surface, processing with hot gondorukem, make sure the batik stamp surface cleaned.

2.3. Maintenance of Batik Stamp

Batik stamp need some treatment for maintenance, for extend the service life, including: (a) Storage, where to store batik stamp, it has to placed sideways on the stamp rack or hung, avoid the occurrence of pressure/load/friction on the stamp surface so as to result in a change in the image of the stamp or the uneven surface, the storage place should be free from dirt, dust, substances chemical substances to prevent corrosion, and the possibility of being easily exposed to hard objects that can cause damage to the motif; (b) Waxing Treatment, placing the batik stamp surface on melted gondorukem is melted in a baking sheet with a size that can soak the part of the stamp that forms the motif, after that the batik
stamp is boiled in the gondorukem liquid so that the dirt dissolves, then the canting is shaken off, then the rest of the gondorukem that is still attached to the stamp is glued using newsprint, the method of packing. just stick it and then lift it, don't rub it because it can change the stamp motif; (c) Repairing, some part of klowongan and isen could damage in use or in storage, and need a small or big repair. Small repair just like arrange the part as before use the tweezers or small tools. The repairmen need if the stamp need to replace the copper plate due to corrosive condition or broken parts.

2.4. Relevant Research
Some relevant research has been conducted by Suharto et al. [16] innovated Canting Batik Cap (CBC) using CNC Router Milling Machine based on Mastercam Software, found that the CBC has feasibility value in technology as well as economic aspect. CNC Router Milling process was more efficient, and the aluminum material, caused lower price.

Hamidi, Wibisono, and Dharma [10] develop batik stampusing plastic materials with Additive Manufacturing Technology, resulting flexibility and shorter time production. The purpose of developing a plastic batik stamp is to find the right machining set-up in making designs and to assess the effectiveness of using plastic as a material in making stamp motifs. It was found that batik stamp made of plastic give lower cost the production was faster than batik stamp made of aluminum. The Hamidi et al. (2017) research was also a response to the huge inorganic waste, a way is needed to reduce waste by utilizing inorganic waste either cans or plastics to be recycled into a product that is useful in society and has sale value. In a creative way in processing inorganic waste into items that have useful values.

Busyaieri et al., conducted research about the use of aluminum from used trash can waste as a coagulant raw material for acid mine water treatment as an alternative for inorganic waste management. Coagulants were used for processing acid mine with TSS, Fe, Mn content, and pH parameters. One of the objectives of the utilization of used trash can wastes is to determine the optimum dose and efficiency of the KAI (SO4)2 I2 H2O coagulant in acid mine drainage treatment with parameters TSS, Fe, Mn and pH. The similarity of this research is both are reducing and recycling used trash cans. Recycling that develops creativity by utilizing used trash cans of waste into items that are attractive and valueable [11].

Sinaga [12] used the aluminum waste can for crafts, found that aluminum is easy to process, and become a product with higher selling value and using value [12]. Cahyani et al. [13] developed a simple batik stamp called KERTANEL of inorganic waste from used trash can and bottles directly, explained that was a new breakthrough in handling inorganic waste. The new batik stamp innovations reduced the use of canned waste by the community, and attracting the attention of stamped batik craftsmen in using this research product, canting batik cap from canned waste as a substitute for copper canting cap [13].

3. Research Methods
Experiment research was done following Purwanto [14]. In order to analyze the economic aspects of batik stamp with the used trash biscuit can material a survey method was conducted to explore the cost of: (1) cost calculation especially for manufacturing costs compared to Copper Canting Cap; (2) The acceptance of batik stamp among craftsmen, includes easiness of use, smoothness of the results of the stamp, and maintenance; and (3) durability of use.

The data obtained by instruments in the form of questionnaires and interviews, both interviews for product validation by batik stamp craft experts and questionnaires for eligibility tests by respondents.

Data analysis of respondents' responses to the creation of batik stamp using secondhand cans, panelists were asked for their personal opinion about the feasibility of creating batik stamp from canned materials. Each panelist was given an assessment sheet of the product and had the freedom to judge the product. The assessment sheet given to the respondents used scores. Scores obtained from all
assessed aspects changed in the form of a percentage. The score was converted into a percentage by dividing the score by the total and multiplying 100% [14].

Preparation of tools and materials used in the process of making used trash cans batik stamp materials, such as: (a) stationery namely pencils, markers, rulers, erasers, sharpener, hvs paper used to make sketch designs, (b) used trash cans were the main materials used in making canting cap, (c) copper was an additional material used as a grip, (d) stained material used to strengthen the circuit with a framework, (e) copper scissors used to cut cans or copper, (f) pliers taper as a clamp, (g) small clamp tool to arrange silier parts, (h) cutting pliers to cut hard character objects, (i) zinc scissors to cut zinc, aluminum or thin cans, (j) mortar which was a container for smoothing stained powder, (k) hacksaw used to cut the zinc parts of the framework and the handle, (l) iron clamp was used to straighten zinc of ancak parts, (m) cupid yuyu as a clamp to hold the part of bajelan silieri, (n) a file / pastor to flatten the surface of the canting cap, (o) a large fan to raise the temperature of fire in the canting combustion process, (p) a knife to cut non-hard material, (q) a scissor plate to cut plate material, (r) bowl, which was a container for melting stained material to be used.

The steps for making canting batik cap from used trash cans were not much different from copper canting cap, the manufacturing process was: (1) sorting out biscuit cans that were not rusty and clean, (2) cutting cans with a width of 2 cm and cans being burned first about 30 minutes, (3) creating design with 18 x 18 cms standard size; (4) Cutting can / zinc sheet using zinc scissors Cut 2 cm of zinc for klowongan and 0.5 cm for ancak or canting framework cutting of 0.5 cm can zinc frame given silusi in accordance with the zinc plate assembly, (5) The process of burning zinc or a can that has been cut for 30 minutes, the purpose of this zinc burning is to soften the zinc when forming according to the motif making klowongan motifs, namely the Unnes logo ornament and cacalincean weeds, (6) installing as much detail as possible on each motif, (7) making and arranging isen-isen according to designs such as ceceg isen-isen, beras kecer/spilled rice, tumbar bolong or moto deruk, ceceg pitu etc., (8) installing silieri or canting frame, (9) attach the canting handle on the back and cut the ends to be slipped to silieri, (10) brazing and sharpening batik stamps the batik stamp surface is smooth and smooth.

Attaching the tack on the back of the shelf, which aims to tighten or strengthen the zinc when brazed Installation of a frame or plate that is adjusted to the size of the batik stamp Installation of the handle / grip on the batik stamp a brazing process that aims to strengthen zinc with copper Drying directly under the sun for 1 hour, wait until the solder dries and turns white The process of burning canting that has been brazed. The process of dyeing the gondorukem (resina colophonium) the result of distillation of tapped pine sap. The process of boiling canting to eliminate malam or gondorukem for 20-30 minutes Arrangement of motifs in accordance with the design either klowongan or isen-isen.

4. Results and Findings

4.1. The Quality of Motifs

The performance (visual shape) of product was similar to copper stamp, and it gave high quality of motifs, finer lines of klowongan compared to copper, wooden, and paper stamp (70% strongly agree, 20% agree, 10% quite agree). The batik result indicate that the can stamp succeeded in producing fine, clear and clean lines of batik pattern (klowongan), even better than copper stamp. But the isen-isen (fill in motifs) had the same quality compare with copper stamp. This happens because the isen-isen part of the motifs were still made of copper content, due to difficulties of crafter to shape fine motifs out of can can. Besides, can can found difficult to be fastened to the frame without the help of copper. So, the isen-isen and ganjelan part of this can stamp was still made of copper with around 21% content.
4.2. Marketability
The can stamp was considered marketable since the appearance and performance was very similar to copper stamp. The acceptability of batik cap crafter was very high to the can stamp and the innovation becomes the real solution of the scarcity and the expensive price of copper. Around 55% respondent strongly agree and 45% agree that batik stamp from used trash cans was relatively cheap. Cost of materials differ only in copper content, where copper stamp consists of 28% iron plate for frame, ancak, siliwer, and handle, while 72% consist of copper plate for klowongan, isen-isen, banjelan, and ganjelan. Average of copper weight needed are 0.5 to 0.80 kgs, and with the price of copper plate 120.000 rupiah/kg, it is usually cost IDR 82.000 – 85.000,-, along with iron part and other materials (patri, gondorukem, fuel) it cost 115.000 rupiahs for material. While the can stamp material cost consist of iron part 28%, copper part 21%, and can of used trash can 51% (no cost and low cost material), the cost of material totally IDR 43.000,-. Processing cost was similar for both copper and tin, where can needs additional cost around 5.000 rupiahs per stamp, because cutting difficulties due to hardness of material. Average processing cost was 75.000 rupiahs for copper and 80,000 rupiahs for can stamp. Price of copper stamp in market place with standard size 18 x 18 cm² are 300.000 - 350.000 rupiahs including profit and marketing cost (57.29%). For can stamp with the same profit percentage the price could be 68.800 rupiahs per stamp including profit and marketing cost 60% from the price. With the same quality even finer, the can batik stamp has a good bargaining position.

4.3. Usability
From the aspect of usage, can stamp was lighter than copper stamp. Actually the quality of stamping, determined by the weight of stamp which give pressure to fabric surface, or the pressure of the crafter hand. However, female crafters prefer lighter stamp more, for easiness to lift up and move. The weight of standard size copper canting stamps ranges from 1.00 - 1.20 kgs, while can stamps weighs only 0.5 - 0.80 kgs in standard sizes.

4.4. Durability
Can is corrosive to acid and alkaline, and rust easily in the open air, while copper has high resistant to rust. However, the last process of stamp production was boiling the stamp surface in gondorukem, natural wax which is hydrophobic. Gondorukem will protect the stamps from corrosive materials and rusting due to air oxidation. Gondorukem processing is also done on a copper stamp. Storing stamps on dry room in hanging position was normal to all batik stamp especially the one made of metal.
5. Conclusions and Suggestions

It can be concluded that the innovation of batik stamp made of can cans has high feasibility to replace the excellence of copper stamp, for cheaper price, easiness to use, and the quality of motifs. It was costly 77.33% cheaper than the copper stamp, where the average price for copper 300.000 - 350.000 rupiahs, while can stamp price ranges between 68.000 - 75.000 rupiahs. The can stamp was more lightly compared to copper stamp, so it will be advantage to the crafter.

The production process was very similar to copper stamp, the difference was in copper content, where can stamp still need 21% copper for klowongan, insen-isen, banjelan dan ganjelan.

The durability of the can batik stamp was lower than copper, because can is easily oxidized and corrosive, so it will be more difficult to maintain. The risk of rust can be reduced by processing the final stamp in hot gondorukem (resina colophonium). For long lasting product, the can stamp has to storage in a dry and low humidity place, in hung position.

It is suggested to train some crafter for producing the can biscuit stamp, as the solution of scarcity of the excellency of copper stamp, for cheaper price, easiness to use, and the quality of motifs. It was costly 77.33% cheaper than the copper stamp, where the average price for copper 300.000 - 350.000 rupiahs. The can stamp was more lightly compared to copper stamp, so it will be advantage to the crafter.

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