E-waste for interior accessories: an exploration of material recycling

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Abstract. The development of an electronics-based industry that produces products with power sources as a supporting facility for daily life will not stop. Not only has the product shelf time, electronics are encouraging people to renew their old collection by the time they follow the latest one. This trend has continuously changing lifestyle into consumerism that leads the future of electronic waste. The older electronic products were quickly replaced with the emergence of new model with new design and more complete features. When the time comes, electronic products become obsolete and useless. These obsolete objects are included in the category of electronic waste. Electronic waste is a type of waste that cannot be decomposed by soil and is not renewable. E-waste is a type of recycled waste by reuse it in the form of smaller pieces to produce new product that are completely different from previous products. This research aims to analyse interior accessories design ideas related to local culture as a way to use electronic waste so that it can be used sustainably. Wickering (anyaman) technique is one of the process to recycle will be applied to e-waste by stringing parts of electronic waste materials into local Betawinese cultural inspiration as a comprehensive study. The idea is the exploration of electronic waste through the local wisdom of Betawinese pattern. This study uses the design thinking method and qualitative methodology on collecting data.

Keywords: E-Waste Recycle, Betawinese Pattern, Interior Accessories, Sustainability

1. Introduction

The Human civilization goes hand in hand with the development of technology created to facilitate, accelerate, summarize various activities completing daily work. A device created to help people use electronic devices as module. Nowadays, all of the human activities are familiar with electronic devices. Communication equipment such as television, computer, mobile phone, seems to be an integral part of everyday urban life. The fulfilment of people’s needs related to lighting, air conditioning, sound system, health, and other activities are close to electronic devices. Electronic devices produced today have limitation related to maintenance and service life.

The development of time that runs in a gas-fired way, making the trend of electronic equipment discovery also changes rapidly. Rapid changes in the features and capabilities of the equipment, making the benefit of electronic devices short-lived, thus creating a large flow of waste from outdated
electronic devices [1]. As a result, the replaced device becomes useless and transforms as garbage that is difficult for nature to decipher, hard to be decomposed by soil. In fact, new inventions related to electronic make the old device no longer usable. The tendency of people seeing first electronic device has a high value, but when there is a new discovery then the old device has almost no use. Electronic waste becomes a new pollution. Some countries have already implemented laws on electronic waste management [2]. Thus, the electronic waste is not a detrimental problem for the environment applying reduce, recycle, reuse, responsible. It is necessary to create a system in the effort to increase the value of waste from a device after use [3].

The recycling strategy is applied by making the system of using the components as a closed – loop cycle and using of the material continuously. In the side of production efficiency, the easiest way to recycle can be done by melting the basic material based on each type of material then be processed again into a new form. For example, a waste made of plastic is melted with high temperature and then reformed with moulding as needed. However, it can only be done using special equipment, quite complex, expensive and required a spacious place. The increase in the number of e-waste occurs especially in major cities that have a reliance on electronic devices for activity. In order to start the recycle movement can be done from home, we need an easy, efficient and effective way in a place that is not very spacious. Furthermore, in our hypothesis, people can recycle this material with the right design techniques easily.

The increase in the number of e-waste is increasing, especially in big cities that have a dependence on electronic equipment for activities. Jakarta, the capital city of Indonesia has a high urban population so that the electronic waste production is also increasing. The Environmental Agency of Jakarta, DKI Provence, said that in the period January to May 2019, the number was recorded at around 5776.59 tons [4]. Therefore, this study of recycling electronic waste become an interesting case to be implemented on the image of Jakarta which represent how the problem of the city should come up with a solution within aesthetical aspects. Retracing the culture and historical story, Jakarta has the root of the local culture of its native Betawi people. Betawi Ethnic became new immigrants to Jakarta during the Dutch Colonial era [5]. Migration from various Javanese, Chinese, Arabian, Sundanese, Malay, Balinese, Bugis, Makasarese, Ambonese, formed cultural assimilation in Betawi tribe which is currently located in Jakarta back then. Betawi culture has a distinctive character that can be a source of inspiration for the creation of electronic waste processing design into other forms. Betawi has a unique character in its ethnic simplicity related to history, artifacts, culture, art, fabric motifs, food and also traditional ceremonies. Although the process of urban formation shifted Betawi culture, the process of assimilation with various cultures of the shaper made the Betawi tribe still recognized [6]. To implement the sustainability practice for the electronic waste on its aesthetical potentials, we choose wickering (anyaman) exploration. This is a handicraft that displays natural material onto utility product fulfilled by the wisdom of human creation [7]. Tocharman said that wickering as a ribbon are constructed from more than two directions of line then create a form (2009). Wickering itself as a traditional technique has been practiced by the ancient tribes for hundred years. This technique used to make functional homewares and tools to help their daily activities. The cultural practitioneers are able to develop wicker craft into technique and tools, design development, and material development [8]. This research focuses on the manufacture of home accessories designs. The exploration design of e-waste materials brings a positive impact to extend the life of the material through recycling process.

2. Methods
The methodology–qualitative design thinking explores how to apply wickering technique to specific parts of e-waste came from obsolete electronic devices. Qualitative research stages are conducted through field observation, literature studying and video-based wickering learning. After analyzing the collected data, we conducted experiments from e-waste materials by making our own examples of interior accessories products inspired by local Betawi culture. The results of this experiment are the implementation of e-waste material products that can be developed into other interior products. The
collection of data aims to gather information related to e-waste, local content Betawi and techniques of processing materials in depth. Based on data, we process electronic waste through several recycle possibilities that fit in design interior accessories.

For design thinking methods, the stages performed are understand, observe, point of view, ideate, prototype and test [9]. In this study we applied Brown's idea of design thinking with three focuses of model process namely inspiration, ideation and implementation. The selection of this method aims to conduct creative design experiments to find a way of utilizing e-waste into a new form of interior accessories. The practical implications discussed in this paper are recommendation to consider the possibility of reuse of e-waste parts instead of throwing them immediately into the bin.

3. Result and Discussion

Nowadays, electronic devices consumer prefers to buy a brand-new device rather than improves and maintains the previous device capability. The amount of e-waste increases due to the amount of the latest technology creates consumer products, especially electronic devices. In short term many electronic brands keep launching a new model, while innovation to process an e-waste goes slow and takes a long time. During the pandemic condition we are facing today, the number of electronic using at home are significantly increasing. Estimated that electronic waste in DKI Jakarta is soaring. It is happening because of disposal electronic devices by the owners is done through giving away or selling them to second-hand store [10]. Getting an e-waste material for recycle purposes that unveil in TPS, whether from the community that cares about e-waste or used electronic collectors.

In terms of design, we see the material produced by e-waste as something that can be processed and utilized. Based on the field observation, most of electronic devices have wires. Material made of copper and plastic have flexible character that can be processed as a new form, for different functions. We pick gadget as an e-waste material research-based which consist of wires and chipboard that suits to project exploration.

Next exploring component is wickering technique is used on wires material that easily to wicker. So, there are various patterns that provided by Betawi people can be applied using wickering technique. Thus, the focus of design thinking is exploring the e-waste material in a way finding many possibilities result that can be applied in interior accessories. Wickering is a tradition that local people do to create handicrafts. Each region has a distinctive form, related to the material and tools they used.

Brown's next step in design thinking explained that after achieving the right pattern, materials, and tools then the process can run the implementation of the ideas. Based on inspiration of Betawi culture, it comes up with 3 sources: traditional cuisine, house decoration symbol and pattern of kain Betawi.

3.1. Kembang Goyang Represents Betawi Cuisine

Betawi people have snacks that taste and shape are distinctive. One of the famous is Kembang Goyang Cracker, which is made from rice flour and sugar. In the making process this snack required a special mold made of flower-shaped iron. The snack usually appears at important day commemorated of Betawi people.

From the fundamental shape of Kembang Goyang Cracker, the idea of a two-dimensional design was The circle shape inspired by Kembang Goyang as developed using wicker cables came from e-waste. The formation of circular wicker is a combination of chip and wire material taken from used mobile phones, now has a new function as an attractive coaster. developed into a coaster as follows in figure 1, 2, 3 and 4.
3.2. Gigi Balang Represents Decoration Symbol of Betawi Traditional House

In every traditional house of Betawi lies a variety of ornament as decoration containing the noble values of people’s life, including aesthetic value. This variety of ornament gives a distinctive touch to the architecture. One of them was raised as inspiration for the pattern of wickering in this research is *Gigi Balang*. Sharp ornamental shapes such as locust teeth are placed on canopy or fence which is arranged without a gap and continuously side-by-side till ended. Such a stacking pattern; this lined-up triangle, symbolizes wisdom on living a life must be honest, diligent, true, tenacious, and patiently instilled in Betawi society.

From the motif of the ornamental variety of the house is developed two-dimensional form to be functioned into a table runner as follows. E-waste material in the form of chipboard that is widely found on mobile phones combined with jute fiber formed a tablecloth with a fringe shaped-like *Gigi Balang* in the form of a triangle that serves for interior accessories. As shown in figure 5, 6, 7, 8 and 9.
3.3. Kembang Kelapa Represents Pattern of Betawi’s fabric

The fabric called kain commonly worn by Betawi people has a characteristic theme of bright color composition and patterns that tell about the life and cultural rituals of society since immemorial time. Betawi batik pattern on kain shows the history of assimilation of the indigenous Betawi ethnic with the immigrant community, both from Nusantara and other countries. It explains that the pattern on kain is loaded with meanings of many periods in the time travel of Betawi people's lives concentrated in DKI Jakarta as shown in figure 10, 11, 12 and 13.
The cultural influences of other nation namely Arab, Indian, Dutch, and Chinese brought a permanent impact to the society. The form of the patterns such as Tumpal, the motif of the sarong shows a meeting of the spear heads. Another pattern Kembang Kelapa pattern is commonly assembled as Ondel-ondel (Betawi puppet) crown and Betawi bride stage.

Inspiration started from Betawi kain batik produced the idea of designing hanging lamp with wickering technique using cables as e-waste. Hanging lamp includes a group of interior accessories in residential dwelling as shown in figure 14.
4. Conclusion
Addressing the behavior of consumerism society today is by conscious movement of environmental impact due to lifestyle and consumption pattern of electronic devices. Today's lifestyle encourages the spending of various electronic devices due to the overlap of advertising on social media into the consumption every day. This research offers solution for active users of these electronic devices doing creations as an act of responsibility for device no longer used. Electronic devices, especially gadget, the focus of this research is to apply the utilization of electronic wastes as a recycling effort to extend their lifelong.

Research conducts the most popular electronic waste sorting and high turn-over; gadget. Mobile phone, android, earphones, charger, PC, laptop, mouse, speaker, joystick etc., all have cables and chipboards, besides casing in addition to different material spec. The built-in cables of each gadget are available so much and are abandoned unused. This is because each gadget not always having the same port model and is easily malfunctioning at very intense use. Another consideration is related to the wickering skill that can be learned through experimentation on these malfunctioning cables. Then this experiment requires implementation instructions that provide art value and benefit. Therefore, the research established Betawi ornamental patterns to be the inspiration, so that this exploration is charged with a strong local culture.

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