

Ergonomic Design of Anjat Rattan Sling Bag Strap Products in Indonesia

Dwi Cahyadi^{1,2*}, Siti Haida Ismail¹, Mohd Yusof MD Daud¹, Roslina Mohammad¹,
Muh Irwan³

¹ Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia

² Department of Design, Politeknik Negeri Samarinda, Samarinda, Indonesia

³ Department of Chemical Engineering, Politeknik Negeri Samarinda, Samarinda, Indonesia

*Corresponding Author: dwicahyadi@polnes.ac.id

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Abstract: *Anjat is a backpack or tote bag made of rattan which is the result of woven handicrafts from the Dayak tribe in Kalimantan. This type of Anjat developed into several types of smaller bags, one of which is in the form of a sling bag. One of the important things in the Anjat production process is the design of the length of the sling bag strap. The strap of this rattan sling bag cannot be adjusted because it cannot be extended or shortened according to the user's needs. This is because the rattan woven binding system at the end of the bag strap on the body of the bag is permanent. It is very important to determine the right bag strap length for a rattan sling bag that is in accordance with the anthropometric data of users in Indonesia. This study aims to design a long strap sling bag made of rattan that is in accordance with Indonesian human anthropometry. This research method uses calculations using Indonesian anthropometric data for women aged 17-45 years to determine 3 sizes of sling bag straps, namely the 5th percentile (small size), the 50th percentile (medium size) and the 95th percentile (large size). The contribution of this research is to provide input for small and medium industries that make Anjat types of rattan sling bags in the form of recommendations on the size of the ergonomic sling bag strap according to the anthropometry of the human body in Indonesia. This study provides recommendations for sling bag strap lengths of 80 cm, 100 cm and 140 cm for small, medium, and large sizes.*

Keywords: Anjat, sling bag strap, anthropometry

1. Introduction

Indonesia has tropical forests that still have natural wealth in the form of non-timber forest products, one of which is rattan. Non-timber forest products in the form of rattans owned by Indonesia cover around 70-80 percent of the raw rattan material produced in the world (Octavia & Nugroho, 2019). This large amount of rattan provides an opportunity for Indonesia to process rattan into products with economic value. This is included in one of the priorities for industrial development in Indonesia, which is in Indonesia National Industrial Development Master Plan 2015-2035 for the use of rattan as an industrial product (Industry, 2015). One of the rattan processed products that has economic value for the people in Indonesia is a handicraft. Rattan is one of the materials in making handicraft products since ancient times. Rattan materials are flexible, lightweight, and durable for handicraft products (Gu & Zhang, 2020; Pratono, 2019).

Rattan handicrafts have existed since ancient times in Indonesia and have been made manually for generations (Ichwansyah et al., 2015). With the development of current trends, innovation and quality of handcrafted products are very much needed. Product design and development are the keys to successful marketing by improving the quality in handcrafted products (Armougum, Gaston-Bellegarde, Joie-La Marle, & Piolino, 2020). Handicraft enthusiasts between 2006 and 2020 are under 35 years old (Council, 2020). This provides an opportunity for the development of rattan handicraft products to be used for fashion products (HIMKI, 2019).

One of the rattan products that exist in Indonesia and comes from the Kalimantan region is *Anjat* (Cahyadi & Ismail, 2023). *Anjat* is a backpack or tote bag made of rattan which is the result of woven handicrafts from the Dayak tribe in Kalimantan, especially East Kalimantan. *Anjat* has a cylinder shape with a height of about 70 cm and a circle line of about 50 cm as shown in figure 1. For men, *Anjat* is used as a container for supplies when hunting in the forest. Meanwhile, women use *Anjat* to store clothes or food when gardening (Kebudayaan, 2016).



Figure 1: *Anjat* (Kebudayaan, 2016)

This *Anjat* bag handicraft product has a role in boosting the people's economy and tourist visits (Manika, 2021). This type of *Anjat* as a backpack developed into several types of smaller bags, one of which is in the form of a sling bag, which is used to store smaller and lighter items when traveling as shown in figure 2 (Suteja, 2020).



Figure 2: One type of *Anjat* is a rattan sling bag

The development of this sling bag product innovation has led to with a variety of designs that are in demand by customers because this product is made 100% from rattan. One of the important things in the *Anjat* production process is the design of the length of the sling bag strap. The strap of this rattan sling bag cannot be adjusted because it cannot be extended or shortened according to the user needs. This is because the rattan woven binding system at the end of the bag strap on the body of the bag is permanent, as shown in Figure 3.

In order to produce a sling bag, especially for the design of a long bag strap made of rattan, the size of the sling bag strap must be determined at the beginning of the process. Based on survey results on direct and online sales, it was found that the strap of this bag has a general length of 100 cm. The sling bag strap size of 100 cm can only be used by customers with a body size above the average adult human in Indonesia.



Figure 3: Rattan bag sling straps design

Previous studies found that it is very important to choose the right length of bag strap when carrying a single strap bag to prevent musculoskeletal disorders in the body (J. Y. Yoon, Lim, & Oh, 2012). When carrying a bag, the activity of the muscles of the body is more influenced by the type of bag than the length of the strap (J.-g. Yoon, 2014). If one has to carry a single strap bag, then it is highly recommended to carry it over one shoulder (An, Yoon, Yoo, & Kim, 2010).

Based on this, it is very important to determine the right bag strap length for a rattan sling bag that is in accordance with the anthropometric data of users in Indonesia. This is because the rattan material used in the sling bag strap design is woven and permanently tied, so the bag strap cannot be extended or shortened according to the user's height. Anthropometric data are measurements of the human body that are used in ergonomics to determine physical dimensions. Several studies on anthropometry for the variety and original design of the product were carried out using the dimensions of the user's body based on age, gender and ethnicity (Adnan & Dawal, 2019; Kahya, 2019; Lee, Kim, Lee, & Yun, 2018; Taifa & Desai, 2017; Yanto, Lu, & Lu, 2017).

This study aims to design a long sling bag strap made of rattan in accordance with Indonesian human anthropometry so that 3 sizes of sling bag straps will be produced, namely the 5th percentile (small size), the 50th percentile (medium size), and the 95th percentile (large size). The contribution of this research is to provide input for small and medium industries that make

Anjat types of rattan sling bags in the form of recommendations on the size of the ergonomic sling bag strap according to the anthropometry of the human body in Indonesia. So that product variations can be selected based on the needs and body size of the user.

2. Materials and Methods

To design an ergonomic bag strap length that adapts to users in Indonesia, Indonesian anthropometric data is needed as a basis for measuring the length of a bag strap. Anthropometric data was used for the sex of adult women, aged 17 - 45 years. Anthropometric data were obtained from Indonesian anthropometric data tables. The data to be used in this study were the length of the upper arm (UAL), the width of the upper shoulder (USW) and the body depth (BD).

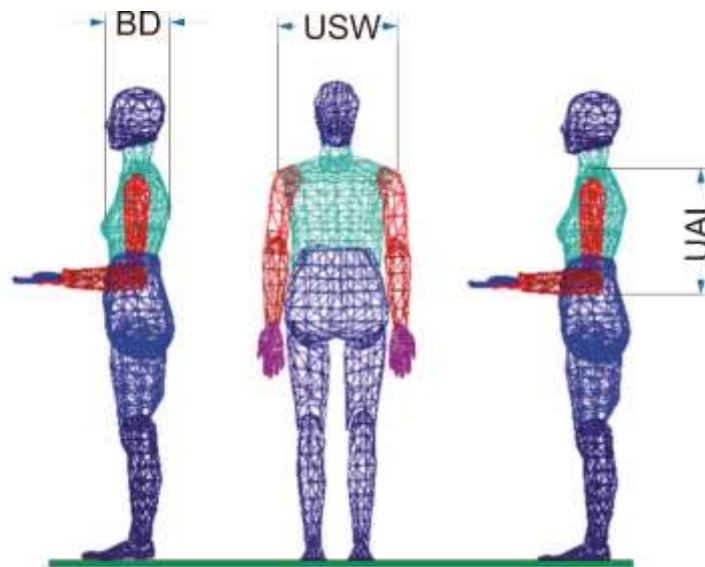


Figure 4: The anthropometric dimension

Figure 4 is an illustration of the anthropometric dimension that will be used in this study. Table 1 shows the Indonesian anthropometric data used in this study for female gender and ages 17-45 years.

Table 1: Indonesian anthropometric data, female, aged 17-45 years, in cm (PEI, 2023)

Dimension	Information	5th percentile	50th percentile	95th percentile	SD
USW	Upper shoulder width	24.15	32.04	39.92	4.79
BD	Body depth	13.86	18.85	23.83	3.03
UAL	Upper arm length	23.48	33.77	44.06	6.26

In designing the length of this sling bag strap, the bag strap is in a diagonal position on the human body. To find the diagonal value, use the formula to find the value of the diagonal side of a right triangle, as shown in Figure 5 and Figure 6.

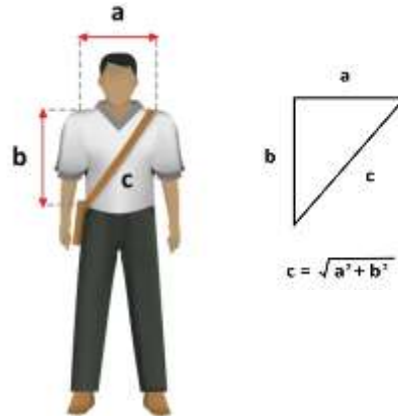


Figure 5: The formula to find the value of the diagonal side

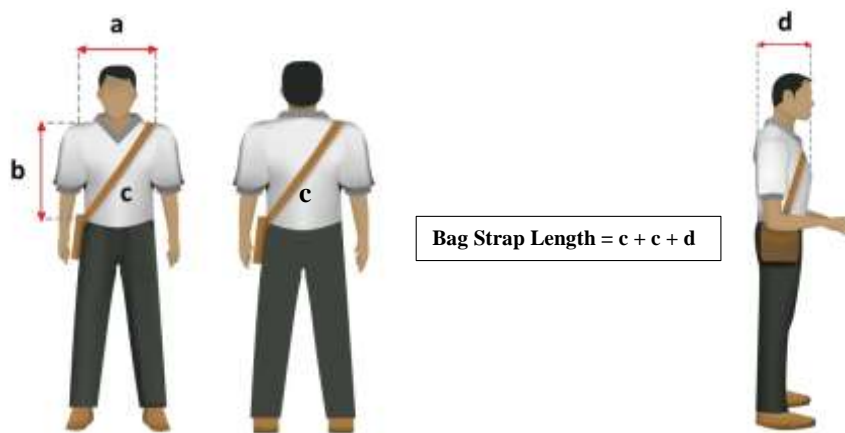


Figure 6: The formula for the length of the sling bag strap

The value a was obtained from the anthropometric data on the upper shoulder width (USW) in the Indonesian anthropometric table 1. The value b was obtained from anthropometric data on upper arm length (UAL), while the value c was obtained from the results of searching the diagonal sides using the formula in Figure 5. To get an ergonomic bag strap length, it was obtained from the sum of the two diagonal sides c plus the value d (BD), where the value d was anthropometric data from body depth using the formula in Figure 6.

3. Results and Discussions

To find the length of a rattan sling strap, the data needed was anthropometric data for the 5th, 50th, and 95th percentiles, female gender, aged 17-45 years in Indonesia (Table 1). The anthropometric data used are the width of the upper shoulder (USW) and the upper arm length (UAL) to find the diagonal side c using the calculation:

$$a = \text{USW} = \text{upper shoulder}$$

$$b = \text{UAL} = \text{upper arm length}$$

$$c = \sqrt{a^2 + b^2}$$

The value a was obtained from the anthropometric data of the upper shoulder width (USW) in the Indonesian anthropometric (Table 1). The value b is data from the upper arm length anthropometry (UAL), while the value c is obtained from the search results on the diagonal side using the formula shown in Figure 5. After getting the value c , then to determine the length

of the sling bag strap from the sum of the value c as the diagonal of the front and back of the human body plus the value d , namely body depth (BD):

$$\text{Bag strap length} = c + c + d$$

To find the length of the rattan sling bag strap for small users, the anthropometric data in Table 1 used is the 5th percentile.

$$\begin{aligned} a &= \text{USW} = 24.15 \text{ cm} \\ b &= \text{UAL} = 23.48 \text{ cm} \\ c &= \sqrt{a^2 + b^2} \\ &= \sqrt{24.15^2 + 23.48^2} \\ &= 33.92 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Bag strap length (small size)} &= c + c + d \\ &= 33.92 \text{ cm} + 33.92 \text{ cm} + 13,86 \text{ cm} \\ &= 81.70 \text{ cm} \end{aligned}$$

From these calculations, the length of the bag strap is 81.70 cm. This value is the maximum value for the length of the 5th percentile (small size) bag strap, so the recommendation for the length of a small *Anjat* sling bag strap to be applied in the rattan handicraft industry is 80 cm. For medium or average sized users, the anthropometric data in Table 1 used is the 50th percentile.

$$\begin{aligned} a &= \text{USW} = 32.04 \text{ cm} \\ b &= \text{UAL} = 33.77 \text{ cm} \\ c &= \sqrt{a^2 + b^2} \\ &= \sqrt{32.04^2 + 33.77^2} \\ &= 46.55 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Bag strap length (medium size)} &= c + c + d \\ &= 46.55 \text{ cm} + 46.55 \text{ cm} + 18.85 \text{ cm} \\ &= 111.95 \text{ cm} \end{aligned}$$

The length of the bag strap length was 111.95 cm. This value was the maximum value for a bag strap length in the 50th percentile (medium size). The recommended sling bag strap length for the 50th percentile medium size is 100 cm. To find the length of the rattan sling bag strap for larger users, the anthropometric data in Table 1 used is the 95th percentile.

$$\begin{aligned} a &= \text{USW} = 39.92 \text{ cm} \\ b &= \text{UAL} = 44.06 \text{ cm} \\ c &= \sqrt{a^2 + b^2} \\ &= \sqrt{39.92^2 + 44.06^2} \\ &= 59.45 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Bag strap length (large size)} &= c + c + d \\ &= 59.45 \text{ cm} + 59.45 \text{ cm} + 23.83 \text{ cm} \\ &= 142.74 \text{ cm} \end{aligned}$$

From these calculations, the length of the bag strap length was 142.74 cm. This value was the maximum value for a bag strap length of the 95th percentile (large size), so the recommendation for a bag strap length of the 95th percentile was 140 cm.

Rattan has long been known as a handicraft material in Indonesia; currently, it is developing with innovation, and the quality of handicraft products is much needed. The development of rattan handicraft products such as *Anjat* is the key to marketing success by improving quality according to user needs. The development of *Anjat* product innovation as a sling bag is developing with various motif designs that are in demand by customers because this product is 100% made from rattan. One of the important things in the *Anjat* production process is the length of the sling bag strap. This study found a standard size for the length of the *Anjat* bag strap that fits Indonesia's anthropometric data with small, medium and large sizes that can be applied in the rattan bag industry.

4. Conclusion

This study aims to design a long sling bag strap made of rattan in accordance with Indonesian human anthropometry so that 3 sizes of sling bag straps will be produced, namely the 5th percentile (small size), the 50th percentile (medium size) and the 95th percentile (large size). To design an ergonomic bag strap length that adapts to users in Indonesia, Indonesian anthropometric data is needed as a basis for measuring the length of a bag strap. Anthropometric data was used for the sex of adult women, aged 17 - 45 years. Anthropometric data were obtained from Indonesian anthropometric data tables. The data to be used in this study were the length of the upper arm (UAL), the width of the upper shoulder (USW) and the body depth (BD). This study provides recommendations for the length of sling bag straps made of rattan, namely 80 cm for small users, 100 cm for medium sized users and 140 cm for large users in Indonesia. The next research that can be done is to adjust the latest anthropometric data so that it can be used in determining the length of the rattan sling bag strap which has been updated. This is because anthropometric data is always undergoing developments adapted to the anthropometry of users in the future.

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