*Journal of Applied Engineering and Technological Science*
Vol 4(1) 2022: 561-567

# *PORTABLE COOLBOX DESIGN FOR MILK STORAGE*

**Enty Nur Hayati[1], Moh. Riza Radyanto[2], Firman Ardiansyah Ekoanindiyo[3*], Endro Prihastono[4]**
Department of Industrial Engineering, Universitas Stikubank Semarang, Indonesia[1234]
firman@edu.unisbank.ac.id

Received : 19 November 2022, Revised: 14 December 2022, Accepted : 14 December 2022
**Corresponding Author*

***ABSTRACT***
*The SN Multi-Business Cooperative (KSU) was founded in 2011 in Semarang Regency. This cooperative operates in the storage of pure cow's milk with a total of around 300 milk farmers located around the cooperative. The problem that often arises is the dependency on receiving milk by the milk factory. Milk that has been sent to the dairy factory can be rejected by the milk factory for various reasons. In the field of marketing, KSU SN established a business entity with the name CV MSN which is located on Jalan Tirto Agung, Semarang. Product delivery logistics activities have so far been carried out with four-wheeled vehicles and using two-wheeled vehicles. To transport milk, each driver uses a bag or styrofoam which is used to transport milk products. Apart from being impractical, the transport process is messy, and the milk temperature cannot be maintained. To overcome this problem, milk transport boxes are designed to be able to transport milk more effectively, maintain product temperature, be ergonomic and increase the capacity of milk that can be distributed because previously they used boxes made of cork or styrofoam. This motorbike will be equipped with a milk storage device in the form of a detachable cooler box or a portable cool box. In this design the anthropometry or body dimensions used are the forward span with the 50th percentile so that all workers can use this tool. with the portable tolbox design, increasing the duration of milk storage time from 8 hours to 24 hours so that marketing and sales departments can take longer to distribute milk products and distribute more capacity*

***Keywords:*** *Product Design, Coolbox Portable, Milk Storage*

## 1. Introduction

The SN Multi-Business Cooperative (KSU) was founded in 2011 in Semarang Regency. This cooperative operates in the storage of pure cow's milk with a total of around 300 milk farmers located around the cooperative. The problem that often arises is the dependency on receiving milk by the milk factory. Milk that has been sent to the dairy factory can be rejected by the milk factory for various reasons. Therefore, at the beginning of 2022, KSU SN will develop its business specifically in milk production so that the product can be further processed into ready-to-drink processed milk products so that it can be marketed itself to the wider community. In the field of marketing, KSU SN established a business entity with the name CV MSN which is located on Jalan Tirto Agung, Semarang. Product delivery logistics activities have so far been carried out with four-wheeled vehicles and using two-wheeled vehicles. To transport milk, each driver uses a bag or styrofoam which is used to transport milk products. Apart from being impractical, the transport process is messy, and the milk temperature cannot be maintained (Pratama, 2018; Sukania, 2020; Soenandi et al., 2021; Ojo et al., 2021; Hayati et al., 2022).

To overcome this problem, milk transport boxes are designed to be able to transport milk more effectively, maintain product temperature, be ergonomic and increase the capacity of milk that can be distributed because previously they used boxes made of cork or styrofoam. This motorbike will be equipped with a milk storage device in the form of a detachable cooler box or a portable cool box. In this design the anthropometry or body dimensions used are the forward span length with the 50th percentile so that all workers can use this tool (Purnomo et al., 2019; Syafiq & Hayati, 2020; Salomon et al., 2019).

Good design requires input from various sides by involving various disciplines (Andira & Wiratmoko, 2019). With the main goal of achieving the best quality of work without neglecting the aspects of health, safety, and the comfort of the human users (Ariyanti & Arifin, 2019). By knowing the dimensions of the worker's body, work equipment, work stations and products can

be designed according to the worker's body dimensions so as to create comfort, health and work safety (Frans, 2018). Previous research was designed trolleys to increase productivity in rice mills and transport 3 sacks of grain. Whereas before the design, the operator could only carry 1 sack of grain. The design of a corn sheller machine can reduce farmers' pain in the back, waist and neck, thighs, calves and feet (Ekoanindiyo et al., 2020; Ekoanindiyo et al., 2020; Ekoanindiyo et al., 2022). Research by Pakpahan et al., (2016) the results of the 50th and 95th percentile anthropometric REBA values of 12 mean that the level of risk of injury is very high and the conditions are very dangerous and actions need to be changed now to reduce risk. By redesigning work equipment, workers feel comfortable when using plastic punching tools for tempe wrap and can reduce non-ergonomic work postures thereby reducing the risk of musculoskeletal disorders in workers (Nurrohman & Yohanes, 2017; Marfuah, 2018; Mahardini, 2019; Kasan & Yohanes, 2017)

## 2. Research Methods

Data processing, data that has been collected, is then processed/tested using various methods, including:

1. Test the adequacy of the data

   This data processing aims to test whether the data collected is sufficient or still lacking, if the amount of data is still not sufficient then additional observation data will be carried out. Adequacy of data is calculated using the formula below:

$$N' = \left[ \frac{k/s\sqrt{(N\sum X^2) - (\sum X)^2}}{\Sigma X} \right]^2 \quad (1)$$

2. Test the uniformity of data

   Data uniformity testing is carried out to obtain uniform data. The data used is anthropometric data obtained from the body measurements of milk producer employees who are directly related. Data is said to be uniform if it is in BKA and BKB. The formula used to calculate BKA and BKB is as follows:

   Upper Control Limit (BKA) = $\bar{x} + k_{\sigma}$

   Lower control limit (BKB) = $\bar{x} - k_{\sigma}$

   Before determining BKA and BKB, first determine the standard deviation with the formula:

$$\sigma = \left[ \sqrt{\frac{\Sigma(\overline{X} - Xi)^2}{N-1}} \right] \quad (2)$$

3. Percentile

   This data processing aims to determine the size of a product through the 5th, 50th, or 95th percentile. The objects of observation are employees of the marketing and sales division of milk producers. The research flow chart is as follows:

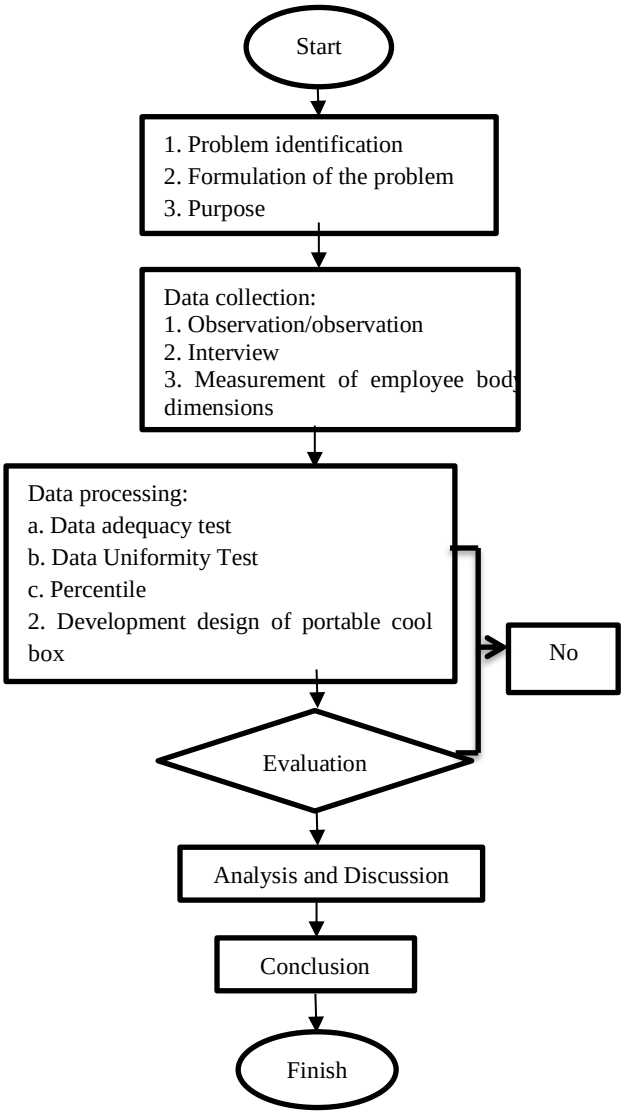


Figure 1. Research flowchart

## 4. Results and Discussions

The primary data collection method was carried out by measuring the body dimensions of employees in the marketing and sales division of CV MSN Semarang city. From measuring the dimensions of the employee's body, the results are obtained in the following table:

Table 1 - Data on the results of employee anthropometry measurements in the marketing and sales division of CV. MSN city of Semarang

| No. | Name | Gender (L/P) | Length Span Forward (Cm) |
|---|---|---|---|
| 1. | Kus | L | 75 |
| 2. | Kas | L | 84 |
| 3. | Dal | L | 83 |
| 4. | Driw | L | 79 |
| 5. | Mah | L | 82 |
| 6. | Yon | L | 79 |
| 7. | Mar | L | 82 |
| 8. | Ali | L | 78 |

| | | | | |
|---|---|---|---|---|
| | 9. | Rind | L | 79 |
| | 10. | Hag | L | 79 |
| Table 2. Average Measurement | 11. | Yed | L | 75 |
| | 12. | Dar | L | 85 |

Data Results

Anthropometry

| No | Name | Length Span Forward (Cm) |
|---|---|---|
| 1. | Kus | 75 |
| 2. | Kas | 84 |
| 3. | Dal | 83 |
| 4. | Driw | 79 |
| 5. | Mah | 82 |
| 6. | Yon | 79 |
| 7. | Mar | 82 |
| 8. | Ali | 78 |
| 9. | Rind | 79 |
| 10. | Hag | 79 |
| 11. | Yed | 75 |
| 12. | Dar | 85 |
| ∑X | | 960 |
| $\overline{X}$ | | 80 |

This study will use anthropometric data that is directly related to the design of a portable coolbox. The anthropometric data that is directly related is the long-range going forward.

Data Adequacy Test
If N' < N then the data is sufficient
N'> N then the data is lacking and needs to be added The confidence level used (k) is 95%.

Forward span
K = 95% = 2
S = (100% - 95%)
= 5% ≈ 0,05

$$N' = [\frac{2/0,05\sqrt{(12(76916) - (960)^2}}{960}]2$$

$$N' = \left[\frac{40\sqrt{922992 - 921600}}{960}\right]2$$

$$N' = \left[\frac{40\sqrt{1392}}{960}\right]2$$

$$N' = \left[\frac{40(37,31)}{960}\right]2$$

$N' = 2,40$
N' < N then the data is enough

Data Uniformity Test
a. Standard Deviation

$$\sigma = \left[\sqrt{\frac{\Sigma(\overline{X} - Xi)^2}{N-1}}\right]$$

$\sigma = 3,24 \approx 3$
b. Upper Control Limit BKA = $\bar{x}$ + k$\sigma$

BKA = 80 + 3 (3)

BKA = 89

c. Lower Control Limit BKB = $\bar{x} - k\sigma$

BKB = 80 – 3(3)

BKB = 74

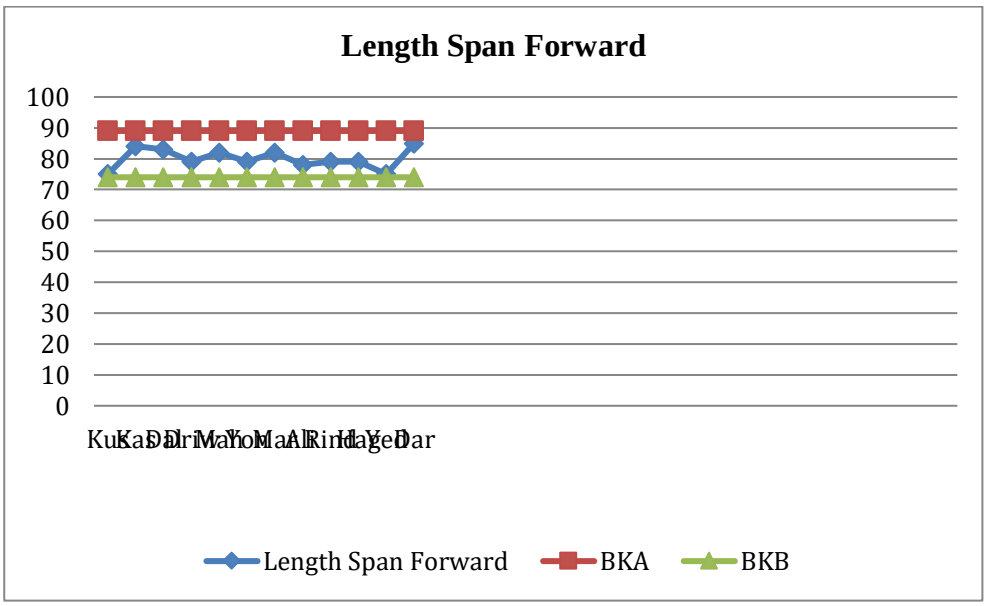


Fig. 2. Control Chart of Length Span Forward

Based on the data obtained and the data from the calculation results, it was found that the data obtained was uniform. Because the data is still between the upper control limits and lower control limits.

Percentile

The selection of the 5th percentile means that the measurement is carried out on 5% of the small population, while the 50th percentile means that the measurement is carried out on 50% of the population with an average size and for the 95th percentile it means that the measurement is carried out on 95% of the population with a large size. For the size of the portable toolbox design, use the 50th percentile so that all employees can reach the height of the portable toolbox.

Tool Design

The data that has been obtained and processed is then followed by determining the size of the tools and materials used. Determination of these sizes is based on anthropometric data and related tool data as in the following table:

Table 3 - Determination of Design Size

| No. | Design Size | Anthropometric data | Size | Reason |
|---|---|---|---|---|
| 1. | Portable toolbox height | Long range forward | 80 cm (use the 50th percentile | Workers can reach the height of the portable toolbox to enter and retrieve milk |

Fig. 3. Image of Milk Storage with Styrofoam

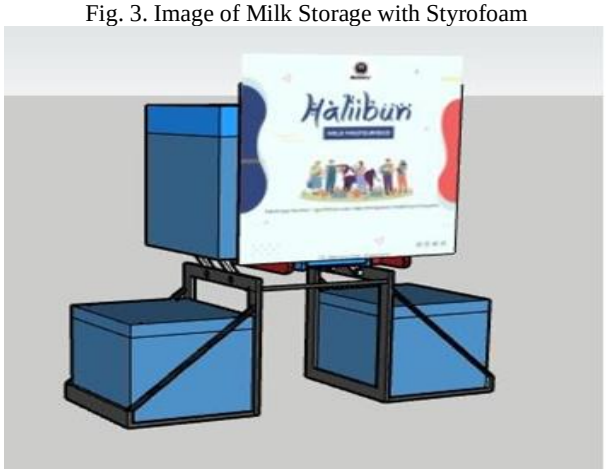


Fig. 4. Coolbox Portable Design Image

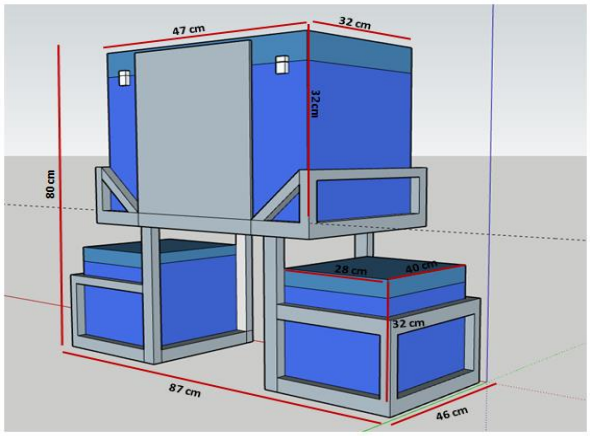


Fig. 5. Dimensions of the Portable Toolbox

Box dimensions
Upper Box = L. 47 x W.32 x H .32
Side Box = L. 50 x W.28 x H .32
Frame Dimensions = L.46 x W.87 x H.80

## 5. Conclusion

After making observations, measuring anthropometric data on body dimensions, calculations, and overall analysis, conclusions can be drawn relating to the portable tow box design as follows: with the portable tow box design, increasing the duration of milk storage time from 8 hours to 24 hours so that the marketing department and sales can take longer to distribute dairy products as well as more distributed capacity.

**References**


Andira, A., & Wiratmoko, D. (2019). Pengembangan Produk dan Analisis Kelayakan Bisnis Alat Bantu Mencuci Clean Washing MC Sebagai Pengganti Sistem Kerja Mesin Cuci. *Jurnal Ilmiah Teknik Industri, 6*(3).

Ariyanti, S., & Arifin, K. (2019). Perancangan Ulang Extrusion Torque Untuk Instalasi Panel Kaca Dengan Pendekatan Ergonomi. *Jurnal Ilmiah Teknik Industri, 7*(1).

Ekoanindyo, F. A., Yohanes, A., & Ernawati, R. (2020). Perancangan Mesin Pembersih Usus Untuk Meningkatkan Produktivitas Di Ukm Kecamatan Bandar Kabupaten Batang. *Jurnal Sains dan Teknologi: Jurnal Keilmuan dan Aplikasi Teknologi Industri, 20*(2), 196-202.

Ekoanindiyo, F. A., Yohanes, A., & Prihastono, E. (2020). Perancangan Mesin Pemipil Jagung Ramah Lingkungan Dengan Pendekatan Nordic Body Map. *Jurnal Rekayasa Sistem Industri, 6*(1), 26-31.

Ekoanindiyo, F. A., Yohanes, A., & Prihastono, E. (2022). Perancangan Sikat Pembersih Babat Sapi Untuk Meningkatkan Kenyamanan Pekerja. *Jurnal Sains dan Teknologi: Jurnal Keilmuan dan Aplikasi Teknologi Industri, 22*(1), 1-9.

Frans, J. R. (2018). Analisis Perancangan Produk "Alat Pencetak Spasi Semen Batu Bata Untuk Meningkatkan Produktivitas"(Studi Kasus: CV. Mangku Putra*). Jurnal Ilmiah Dinamika Teknik.*

Hayati, E. N., Ekoanindiyo, F. A., Radyanto, M. R., & Prihastono, E. (2022). Peningkatan Kualitas Produk Ikm Rumah Sabun Dengan Pendekatan Quality Function Deployment. *Jurnal Rekayasa Sistem Industri, 8*(1), 13-21.

Kasan, A., & Yohanes, A. (2017). Improvement produk hammock sleeping bag dengan metode qfd (quality function deployment). *Jurnal Ilmiah Dinamika Teknik*.

Mahardini, K. A. (2019). Analisa Pengembangan Produk Warmer Lamp Dengan Menggunakan Hoq. *Jurnal Ilmiah Teknik Industri, 7*(1).

Marfuah, H. H. (2018). Perbaikan Sistem Kerja Yang Ergonomis Untuk Mengurangi Kelelahan Dan Keluhan Muskuloskeletaldengan Pendekatan Ergonomi Partisipator. *Jurnal Ilmiah Dinamika Teknik.*

Nurrohman, N., & Yohanes, A. (2017). Perancangan Alat Pengepresan Jenang Dengan Metode Antropometri Dan Ergonomi (Studi Kasus Di UKM Agape Pemalang). *Jurnal Ilmiah Dinamika Teknik.*

Ojo, O., Adeleke, K., Ajayeoba, A., & Bello, K. (2021). Development of a Prototype Inverter Powered Baking Oven. *Journal of Applied Engineering and Technological Science (JAETS), 3*(1), 26-39.

Salomon, L. L., Kosasih, W., Ricko, R., Prayogo, A., & Julius, J. (2019). Pengembangan Dan Pembuatan Prototype Dispenser Untuk Kesehatan Dengan Pendekatan Ergonomi. *Jurnal Ilmiah Teknik Industri, 7*(2).

Soenandi, I. A., Marcelle, M., Ondang, R. J., & Sundoro, A. N. (2021). Perancangan Dan Pengembangan Produk Desk Organizer Dengan Metode Kansei Engineering Dan Model Kano. *Jurnal Ilmiah Teknik Industri, 9*(2), 117-128.

Syafiq, N., & Hayati, E. N. (2020). Perancangan Dan Pengembangan Alat Pemotong Styrofoam Semi Otomatis Menggunakan Metode Rula Di Desa Kalisari. *Jurnal Ilmiah Dinamika Teknik.*

Sukania, I. W. (2020). Perancangan Alat Bantu Kerja Berdasarkan Analisis Ergonomi Postur Kerja Dan Keluhan Biomekanik Tenaga Mekanik Motor Di Sebuah Bengkel Motor Di Tangerang. *Jurnal Ilmiah Teknik Industri, 8*(1).

Pakpahan, F., Kuswana, W. S., & Noor, R. A. (2016). Analisis ergonomi pada praktik memelihara roda dan ban menggunakan metode REBA. *Journal of Mechanical Engineering Education, 3*(1), 60-65.

Pratama, A. Y. (2018). Perancangan Kursi Tunggu Untuk Ibu Hamil Dan Lansia Pada Stasiun Kereta Secara Ergonomis. *Jurnal Ilmiah Teknik Industri, 4(*3).

Purnomo, P., Setiawan, R., & Wisnu, F. S. (2019). Analisis Strategi dan Pengembangan Produk Unggulan pada Industri Kecil Menengah Bahan Kaca Di Malang. *Jurnal Ilmiah Teknik Industri, 7*(2).