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Implementation of Ergonomics in the Management of Crop Yields Using Combine Harvesters

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ABSTRACT

The discipline human engineering or ergonomics is widely applied both in various product designing processes (man-made objects) and daily work operation, especially in agriculture and particularly in combine harvesters. Results of the research into the implementation of ergonomics in combine harvesters, namely the body dimension from the elbow to the floor in the anthropometric body dimension, which, in a product, is applied in the height of the handle on the steering wheel; the body dimension of half the height of the knee, which is applied in the height of the foot control position when the foot is in the position of operating the machine; the body dimension of the height of the knee, which is applied in the height of the lower big tub position, the knee while operating the combine harvester should be in a position which enables it to move freely when controlling the operation of the machine; the body dimension of the length of the palm, which is applied in the pulled handle on the small tub, location of the pulled handle on the small tub and the other buttons; and the body dimension of the arm's reach which is applied in the pulled handle on the big tub, the range of the machine on/off button, and the range of the clutch.

Key Words: *Application, Anthropometry, Ergonomics, Combine Harvester.*

1. INTRODUCTION

Indonesia is one of the respectable agricultural countries in the world which produces rice by up to 70.8 million tons per annum. Nowadays, with the advancement of technology, everything, whether it is related to machines or not, always relates to technology. The tools used in the process of harvesting are still not optimal, where the aspects of relations between humans and the tool itself are not taken into account or, in other words, it is not ergonomic. The use of tools in the process of harvesting generally lacks incompatibility with regard to the tools/machines, humans, and the environment on the farm. On the other hand, ergonomics is intended to improve the work performance of humans and utilization of human resources so that humans/workers do not easily feel fatigued so as to prevent the occurrence of human errors. There are numerous possible risks such as occupational accidents, which might lead to disability, and illness such as pain in a particular area of the body. Thus, in designing work equipment, both the facilities and the environment of the workplace must suit human behavior or the characteristics of employees' body dimension.

Pinrang Regency, one of the areas in South Sulawesi, Indonesia, is the largest rice producer in Indonesia or, other words, a rice barn. Every year, rice is harvested in this area at least three times a year. The tool used in the management of crop yields is combine harvesters, which cut rice plants and thresh. There is no fixed standard size for the design of these combine harvesters, meaning that the size of combine harvesters produced by each manufacturer is adjusted to the demand of consumers, whether they order the small size or the big one, where the big-sized machine has a capacity of more than 50 Kg, while the small-sized machine has a capacity below 50 Kg. The manufacture of this product is neither based on the intended utilization nor the body dimensions of employees' whole body. This research aims to apply the ergonomic functions to users of combine harvesters, so that they can be used to design an ergonomic combine harvester.

2. LITERATURE REVIEW

Ergonomics comes from the Greek, Ergo is meant work and Nomos which means rule / law. So ergonomics can also briefly be interpreted rules / laws in work. In general, ergonomics is defined as the science that deals with the frequency of work, work tools and work with workers. Application of ergonomics science to product design, improve health and improve work productivity. By doing ergonomic in the workplace can be obtained 3 advantages that is: 1) Reduce the potential for accidents, 2) Reduce the potential health problems to workers, 3) improve productivity and job performance

The intent and purpose of the ergonomics discipline is the full knowledge of human problems with technology and its products, making it possible to construct an optimal human-machine (technology) system. Thus the ergonomic discipline sees the changes that occur with the system with system-solving problems.

Implementation of ergonomics in general is a design (redesign) or redesign (design) activity. This can include hardware such as work tools (benches), platforms, chairs, hand tools, control systems, props, walkways / doors, doors, windows, etc. Still in this case is the discussion of building the environment, because if the hardware system will also change the work environment.

According to Wignjosoebroto (2001) in his book the term anthropometry comes from "anthro" which means man and "metri" which means size. Anthropometry will be used as ergonomic considerations in the design process of the product or work system that will facilitate human interaction. Successful anthropometry data will be applied generally in terms of: 1) Design of working area (work station, car interior, 2) Design of work equipment such as machinery, tools, tools (tools) etc. 3) Consumptive products design such as clothing, chair / computer table, 4) Design of physical work environment.

3. RESEARCH METHOD

The research was conducted in Pinrang Regency, South Sulawesi Province, Indonesia. In this area, many use combine harvesters to carry out the post-harvesting process.

The type and source of data needed in this research were primary data, i.e. the data obtained by way of studying or observing on the research object through direct observation of the users of combine harvesters, and secondary data, i.e. the data obtained from books, scientific journals, and previous research from various literature related to the research.

4. RESULTS AND DISCUSSION

4.1 Results

Anthropometric Characteristics of the Body Dimension, the anthropometric characteristics of the body dimension varied between respondents or employees, where the data on the body dimension of the elbow ranged from 100 to 198 cm, the height of the knee ranged from 37 to 65 cm, half the height of the knee ranged from 22 to 48 cm, the sole of the foot ranged from 22.8 to 25.5 cm, and the arm's reach ranged from 175.6 to 193.02 cm. This indicates data variations which certainly affect the tool design. Therefore, the design of an ergonomic combine harvester investigated in this research can be used by all employees.

In Table 1. Ergonomic Values, the anthropometry shows the measurement results for the anthropometric percentile test used as standards in the determination of the dimensions of the tool or product to be designed. The results presented in Table 3 have undergone a series of statistical tests, namely adequacy, normality, and percentile tests with the following values: P5, P50, and P95.

Table 1. Ergonomic Values, The Anthropometry

No.	The Body Dimension	Nilai Ergonomis, Antropometri (cm)		
		5%	50%	95%
1	The elbow to the floor	97,66	101,22	104,78
2	The of half the height of the knee	45,47	47,50	49,53
3	The height of the knee	22,74	23,75	24,74
4	The length of the palm	22,75	23,75	24,25
5	The arm's reach	174,86	184,22	193,58

Based on the results of the anthropometric percentile test, the following standards for the development of a design were obtained:

1. for the measurements from the elbow to the floor, the body dimensions used were those from the elbow to the floor, the percentile used was 95% = 104.78 cm,
2. for the measurements of half the height of the knee, the body dimensions used were those of half the height of the knee, the percentile used was 95% = 24.75 cm,
3. for the measurements of the height of the knee, the body dimensions used were those of the height of the knee, the percentile used was 95% = 49.53 cm,

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4. for the measurements of the length of the palm, the body dimensions used were those of the length of the palm, the percentile used was 95% = 24.25 cm, and
5. for the measurements of the arm's reach, the body dimensions used were those of the arm's reach, the percentile used was 95% = 193.58 cm.

4.2 Discussion

Based on results of the research relating to the anthropometric ergonomic values, the size which is compatible with the machine design was generated and the application is described below:

1. The measurement of the body dimension from the elbow to the floor is equal to 104.78 cm in the anthropometric body dimension, which, in a product, is applied in the height of the handle on the steering wheel, the body is in a standing position parallel to the work piece or the steering wheel on the combine harvester product where hands are put in a straight position.
2. The measurement of the body dimension of half the height of the knee is equal to 24.76 cm, which, in the combine harvester, is applied in the height of the foot control position, the foot while operating the machine should be in a position which enables it to freely control the machine when the tub is full, the engine will be deflected left or right.
3. The measurement of the body dimension of the height of the knee is equal to 49.53 cm, which, in the combine harvester, is applied in the height of the lower big tub position, the knee while operating the combine harvester should be in a position which enables it to move freely when controlling the operation of the machine, the knee is free to move under the tube, and the tub position while in operation remains parallel to the knee.
4. The measurement of the body dimension of the length of the palm is equal to 24.25, which, in the combine harvester, is applied in the pulled handle on the small tub, where the location of the pulled handle on the small tub must be adjusted to the size of users' hand.
5. The measurement of the body dimension of the arm's reach is equal to 193.58 cm, which, in the combine harvester, is applied in the pulled handle on the big tub, the range of the machine on/off button, the range of the clutch, the range to adjust the position which users want when doing the work, where the location of the pulled handle on the small tub must be adjusted to the size of users' hand. Table 2 presents the implementation of the anthropometric body dimensions.

Tabel 2. Presents The Implementation Of Antropometric Body Dimensions

Description	The Implementatation of produck	Product Size on Design (cm)
Body dimension the elbow to the floor	the handle on the steering wheel	104,78
body dimension of half the height of the knee	the height of the foot control position	24,76
body dimension of the height of the knee	the height of the lower big tub position	49,53
body dimension of the length of the palm	the pulled handle on the small tub	24,25
body dimension of the arm's reach	the pulled handle on the big tub, the range of the machine on/off button, the range of the clutch.	193,58

RESEARCH FINDINGS

Findings of the research into product designing are in the forms of the aspects of anthropometric body dimensions of the users. First, product designs must take into account the characteristics of users in each region where the product will be used. Second, the application of ergonomics in product designs is vital where employees/users integrate with the machine so as to create a sense of comfort and security. Third, the agricultural sector has not been explored by manufacturers.

5. CONCLUSIONS

Based on the findings of the research into the need for the application of ergonomics on combine harvesters, the body dimension from the elbow to the floor in a product is applied in the height of the handle on the steering wheel, where the body is in a standing position parallel to the work piece or the steering wheel of the combine harvester product with hands put in a straight position; the body dimension of half the height of the knee in the combine harvester is applied in the height of the foot control position, the foot while operating the machine should be in a position which enables it to freely control the machine when the tub is full, the engine will be deflected left or right; the body dimension of the height of the knee in the combine harvester is applied in the height of the

lower big tub position, the knee while operating the combine harvester should be in a position which enables it to move freely when controlling the operation of the machine, the knee is free to move under the tube, and the tub position while in operation remains parallel to the knee; the body dimension of the length of the palm in the combine harvester is applied in the pulled handle on the small tub, where the location of the pulled handle on the small tub must be adjusted to the size of users' hand; and the body dimension of the arm's reach in the combine harvester is applied in the pulled handle on the big tub, the range of the machine on/off button, the range of the clutch, the range to adjust the position which users want when doing the work, where the location of the pulled handle on the small tub must be adjusted to the size of users' hand.

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REFERENCES

[1] Ahmad Hanafie, Andi Haslindah, Saripuddin M (2017), **Karakteristik Antropometri Pengguna Mesin Perontok Padi (Combine Harverter) Pengelolaan Hasil Panen yang Ergonomis,** Prosiding Seminar Nasional Telnologi Indonesia V, hal 52-57, Makassar 12 Juli 2017.

[2] Ahmad Hanafie (2007), **Modifikasi Helm Standar Kendaraan Roda Dua Yang Ergonomis Bagi Penguna Telpon Seluler,** Jurnal Iltek, Vol. II, Nomor 4, April 2007, Hal 313-319, Fakultas Teknik Univ. Islam Makassar.

[3] Ahmad Hanafie, A.Haslindah, Muh. Fadhli (2015)**, Pengembangan Mesin Perontok Padi (Combine Harverter) yang Ergonomis Untuk Meningkatkan Produksi, Prosiding Seminar Nasional Tahunan Teknik Mesin Indonesia-XIV, Banjarmasing, 7-8 Oktober 2015.**

[4] Ahmad Hanafie, Hammada Abbas, Lawalenna, Sumarni Hami (2016), **Study Of Vehicles Utilities And Load-Unloading Facilities Of City Public Transport Based On Ergonomics Assessment,** International Journal of Advances in Scientific Research and Engineering (ijasre.net) Volume-1, Issue-3, December – 2016.

[5] Astika (2007), **Ergonomi Pertumbuhan Dan Peranannya Dalam Pembangunan,** http://www.baliheag.org

[6] Eko Nurmianto (2007)**, Ergonomi, konsep dasar & aplikasinya**, Penerbit Guna Widya, Jakarta.

[7] Iftikar Z. Sutalaksana; Ruhana A; John H. T (2006), **Analisa dan Perancangan Sistem Kerja.** Jurusan TI ITB.

[8] Muh. Yani Syafei Dr,H.,ST.,MT, (2007)**, Aplikasi Konsep Ergonomi Dalam Pengembangan Design Produk Akan Memberikan Nilai Jual Produk yang Tinggi dan dan Keunggulan Bersaing.** Seminar Nasional Ergonomics in product Development.

[9] Noor Fitrihana, (2007), ***Memperbaiki Kondisi Kerja di Industri Garmen***, Ergonomi Kerja, B4D3 Consultants, hal 1- 12.

[10]Karl T. Ulrich, Steven D. Eppinger (2001), **Perancangan dan Pengembangan Produk,** Mc Graw Hill

[11]Roche; Davila, USA (1972), Dalam bukunya Wignjosoebroto, Sritomo Sritomo (2000), **Ergonomi, Studi Gerak & waktu**. Penerbit Guna widya, Jakarta.

[12]Sritomo Wignjosoebroto, (2008), **Ergonomi, Studi Gerak & waktu**. Penerbit Guna widya, Jakarta.

[13]Sritomo Wignjosoebroto, Srigunani, Ahmad Hanafie. (2003), **Modifikasi mesin perontok Padi yang Ergonomis**. PEI, Yogyakarta.

[14]Sudjana (1989), **Metoda Statistika**, penerbit Tarsito, Bandung.

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