



**SOARING
UPWARDS**
MALAYSIAN HIGHER EDUCATION



UNIVERSITI
TEKNOLOGI
MARA

KONAKA

KONFERENSI AKADEMIK

2016

Pengkongsian Ilmu Dari Perspektif Islam

30 November 2016 | Rabu
UiTM Cawangan Pahang
Kampus Jengka



Chess Square Table from Machining Wood Waste

Nur Hannani Abdul Latif^{1*}, Norashikin Kamarudin², Junaiza Ahmad Zaki³,
Shaikh Abdul Karim Yamani Zakaria⁴, Ahmad Fauzi Othman⁵,
Amran Shafie⁶, Amy Saiful Affendy⁷

¹⁻⁷ Department of Wood Industry, Faculty of Applied Sciences, Universiti Teknologi MARA Pahang,
Kampus Jengka, 26400 Bandar Tun Razak Jengka, Pahang, Malaysia
hannani@pahang.uitm.edu.my, sheken@pahang.uitm.edu.my, junaiza@pahang.uitm.edu.my,
syamani@pahang.uitm.edu.my, ahmad_fauzi@pahang.uitm.edu.my,
amran453@pahang.uitm.edu.my
*Corresponding Author

Abstract: Machining wood waste may be occurred due to several numbers of factors such as split end, left over, rejects from cut up and drying defects on timber. So, it is important to explore the best solution in managing machining wood waste, as now it becoming increased and may affect others. Hence, wasting is also prohibited in Islam, as it means that a thing was not fully utilized. Improper machining wood waste management can cause pollution to the environment and may affect others comfortability and health. In this study, machining wood waste (long-off cut and short-off cut) from different wood species was used as a raw material. The objectives of this study was to design and produce a Chess Square Table at lower production cost by using machining wood waste. A survey (set of questionnaires was undertaken to evaluate the properties of the product after completely designed and manufactured. It was distributed to 85 correspondents (in UiTM) based on gender and range of age. The properties that been evaluated were suitability of material, design, aesthetic values, ergonomics and anthropometrics, commercialization and price. Result shows that there is no significant different on the evaluation based on gender and range of age. It is proven that machining wood waste can be value added by turned them out into furniture, thus producing new product at lower production cost and reducing their amount. Overall, Chess Square Table has great potential to be commercialized in the furniture industry in Malaysia.

Keywords: Anthropometrics, Chess Square Table, Furniture Design, Machining Wood Waste

1. Introduction

Furniture is known as something that can be moved, thus can be extended through its usage-body supporting, storage and tool. It is also plays an important role in explaining the lifestyle of the user, besides providing a better environment and comfortability towards user. Well-planned furniture design and manufacturing process is needed in ensuring the high quality of end product, with perfect design and accurate measurement. Basically, there are many types of furniture such as residential furniture, office furniture and institutional furniture. Each types of furniture have their own super characteristics, design and function (Harry, 2011).

Design can be referred to a whole process of imagining and creating, determining the materials to be used, as well as considering the production process, shape, materials and colors of the product (Effie, 2009). The critical part in design process is the interpretation of the thoughts and views. Then, design of a high end product also can be influenced by three important aspects aspect such as aesthetic, function and engineering (Rosman, 2013). Moreover, ergonomics and anthropometrics are two main aspects that need to be fulfilled in designing and producing furniture. Ergonomics can be defined as practice of learning about human characteristics and then applied that knowledge in improving user's interaction with the furniture they use and working environment (Brooks, 1998). The goal of ergonomics is to ensure a good fit between the users and their activities, thus to achieve optimum comfortability, safety and efficiency (Wright, 1994). Meanwhile, anthropometric is a study of human body dimensions, as human come in differ of body measurements and builds (Chou & Hsiao, 2005).

Anthropometric data can be used in ergonomics to specify the physical dimensions of workspaces, workstation and equipment as well as applied to product design.

It is also important to choose the most suitable raw materials for furniture production. It is due to different materials will give different properties and workability. Solid wood is the most famous material for furniture due to its physical and mechanical properties. Recently, there are increasing of wood waste due to three main source which are municipal solid waste, new development and demolition waste and wood deposits from essential machining and manufacturing process (McKeever, 1995). However, machining wood waste is costly for companies to dispose off (Davis, 1998). On other side, they may be suitable as an alternative materials for furniture production as they can be combined (between long and short lengths wood), been finger jointed to form longer wood and make ribbon wood from short pieces of wood glued (Davis, 1998). The objectives of this study were to design and produce a product (Chess Square Table) from machining wood waste, and also at lower production cost.

2. Materials and Methods

2.1 Materials

Machining wood waste and plywood were collected from Wood Industry Workshop, UiTM (Pahang). Fasteners, polyvinyl acetate (PVAc) and glass top also provided by Wood Industry Workshop, UiTM (Pahang).

2.2 Methodology

2.2.1 Design Process

In design process (Rosman, 2013), it started with collections of information till prototype confirm as shown by Figure 1.

Collects information- Research been conducted through internet search, survey, brainstorming and other related source to obtain idea.

Problem Identification- Problem occurred been identified and evaluated.

Research analysis- Analyzed and proposed solution to the problem chosen.

Design- Constructed sketches, 3D drawings and mock up built.

Prototype construction- Built prototype based on process chosen design, scale and measurement.

Prototype Analysis and Confirm- Analyzed the characteristic of the prototype, if need to be amended before prototype confirmed.

Production- Realization process.

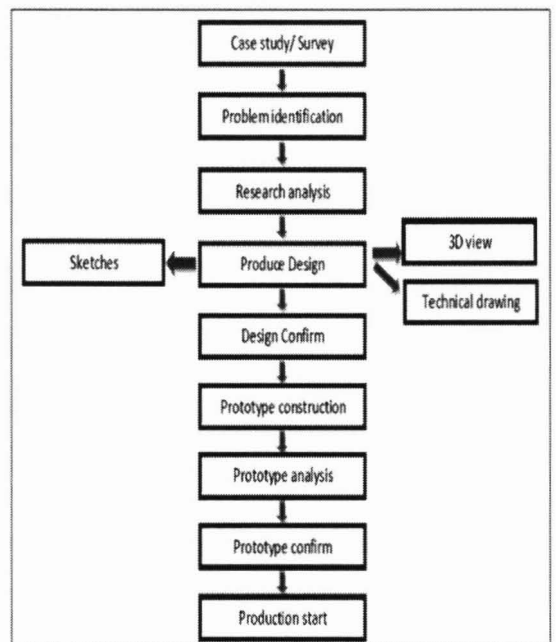


Fig.1 Flowchart of design

2.2.2 Production Process

There are four main phases been conducted during production process which started with preparation of raw material, then followed by manufacturing process, assembly process and ended with finishing process. The production of final product was conducted based on route sheet. The machining wood waste (randomized choosen) were glued together by using polyvinyl acetate (PVAc) to form a square shape with end size 15cm x 15cm x 10cm (width x length x thickness). Sixteen boxes of the square shape were prepared and then been covered by using plywood. All these boxes were then assemble together by using PVAc and hinges to perform table top with size 60cm (width) x 56cm (length) x 10 cm (thickness). The exploded view of the product as illustrated in Plate 1.

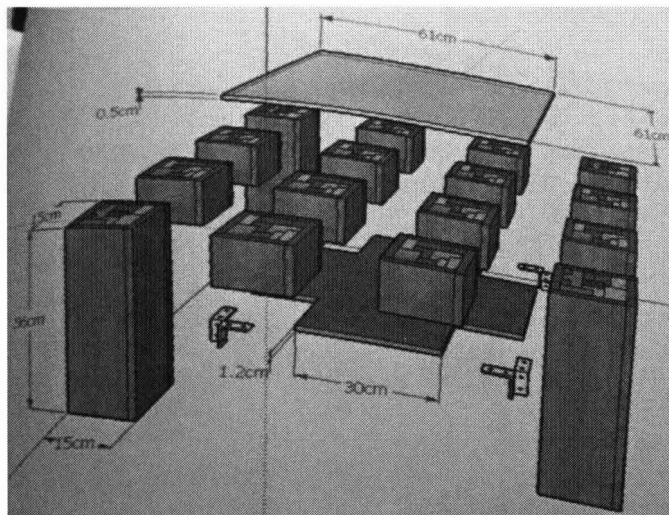


Plate 1. Exploded View of Chess Square Table

Meanwhile, for table leg, the machining wood waste also glued together to form rectangular shape with dimension 15cm (width) x 15cm (length) x 56cm (thickness) and were then covered with plywood. Four replicates of table legs were produced. After cutting process, it been continued with edging process and till assembling process. After completely been assembled, the product was sent to finishing phase. Sanding process was applied to produce a smooth surface and then sealer had been applied as undercoats, to cover the tiny hole on the surface product. Two layer of sealer were applied to the product. Clear lacquer was used as topcoat to make the product shines and also as a protective layer. Lastly, glass was placed on the table top to enhance its appearance.

2.2.3 Survey/Questionnaire

A set of survey questions were distributed to 85 correspondents (in UiTM) based on gender and range of age factors. This is to gather information regarding the characteristics of this product. The characteristics evaluated were suitability of material, design, aesthetic value, ergonomics and anthropometrics, price and commercialization. A value rates between 1.0 to 5.0 were used (1:poor, 2:moderate, 3:good, 4:very good, 5:excellent).

3. Results and Discussions

3.1 Statistical Analysis

Table 1. Statistical Analysis of ANOVA on the Effect of Gender and Range of Age on the Characteristic of Chess Square Table

SoV	df	Material	Reduce waste	Design	Aesthetic	Ergo Anthro	Price	Commercial
Gender	1	1.106 ^{ns}	0.040 ^{ns}	0.070 ^{ns}	0.070 ^{ns}	0.010 ^{ns}	0.232 ^{ns}	0.297 ^{ns}
Age	2	4.006*	0.844 ^{ns}	1.042 ^{ns}	1.042 ^{ns}	0.414 ^{ns}	2.290 ^{ns}	0.161 ^{ns}

* -Significant $P < 0.05$, ns-Not Significant $P > 0.05$

Seven characteristics of Chess Square table were evaluated based on different gender and range of age. There was no significant different on the evaluation of the characteristics of product based on gender as tabulated in Table 1. This result pattern same goes to range of age factors except for suitability of materials (machining wood waste). There is significant different for that characteristic with value 4.006.

3.2 The Effects of Gender and Range of Age on the Characteristics of Chess Square Table

The mean rating of the characteristics of Chess Square Table based on different gender and range of age were as tabulated in Table 2. Based on gender, male correspondent rated all seven characteristics of the product as very good (rating 4 and above). They rated them between 4.0 till 4.7. The result pattern was slightly similar when been rated by female correspondent, whereas all characteristics been rated at 4.0 (very good and above) except for price of product, with 3.4 (good).

Table 2. Mean Rating on the Characteristic of Chess Square Table Based on Gender and Age

Factor		Material	Reduce waste	Design	Aesthetic	Ergo & Anthro	Price	Commercial
Gender	Male	4.2	4.7	4.0	4.0	4.0	4.0	4.3
	Female	4.2	4.5	4.2	4.2	4.0	3.4	4.1
Age	20-25	4.3	4.6	4.2	4.2	4.1	3.2	4.1
	26-30	4.0	5.0	3.8	3.8	3.6	4.0	4.6
	31 and above	4.2	4.6	4.0	4.0	4.0	4.0	4.2

Rating: 1:poor, 2:moderate, 3:good, 4:very good, 5:excellent

Both gender rated the suitability of machining wood waste as main material for the product as very good (4.2) as shown in Plate 2. The reason might be because the product had high dimensional stability and sturdy just like using solid wood but at lower production cost. Hence, may reduce the dependency on solid wood. Range of age factor also shows that all correspondent agreed that machining wood waste was a very suitable material for this product (rating 4). Moreover, male and female correspondents rated the highest for reducing wood waste, with rates 4.7 and 4.5 respectively. In addition, the product was rated between 4.6 to 5.0 based on range of age. The rates was almost achieve excellent rate. They totally agreed that the machining wood waste can be reduced and utilized when been converted into the product, besides may due to their awareness regarding on the importance of protect and preserve the environment.

Simple and modern design (chess board design) that been applied on the product were accepted as both factors rated it at 3.8 till 4.2, which can be considered as very good. Female correspondents rates it slightly higher than male correspondents, with difference 0.2. The arrangement of the sixteen wood cubes (consist of machining wood waste) to immitate chess board for the table top part was succeed. The uniqueness of the product was shown in Plate 3.

This product also proven been designed and produced based on ergonomics and anthropometrics concept (rated 4.0). The reason might be because the product had a good interaction with the measurement of their body dimensions (shape and size) and working environment. The aesthetic value of the product also been recognized by all correspondents as they rated it between 3.8 to 4.2. Correspondents with age 20-25 years old favor it more than elder correspondents. The randomized arrangement of the machining wood waste with wood grain appearance on it make it look more attractive.

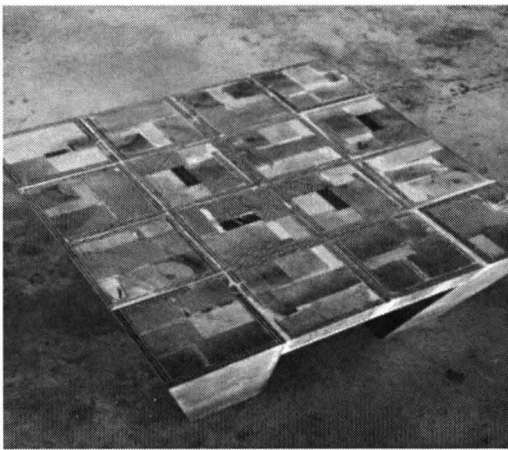


Plate 2. Chess Square Table from machining wood waste



Plate 3. Aesthetic appearance of the table top

In addition, selling price at RM100-RM150 been rated between 3.2 till 4.0. Female correspondent rated it the lowest with 3.2 as they think the price is not really reasonable and compatible with the characteristics proposed by the product. The price should be higher due to its uniqueness and as it can perform almost equal with a coffee table that produced using solid wood. In terms of range of age, elder correspondent rated the price as very good (4.0). The reason was because the price is affordable but at high quality. It is believed that they got many experinces in buying furniture and they realize the limitation in buying furniture that made up of solid wood. Plate 3. Due to the high evaluations towards this product, they suggested it to be commercialized to the market as they think it has great potential to be sold, has demand and good value for money.

4. Conclusion

It can be concluded that machining wood waste can be a suitable material for this Chess Square Table, as it was accepted by all of the correspondents based on questionnaires/survey that been conducted. It was agreed that it may reduced the production cost, but with same quality as solid wood. Hence, the machining wood waste had been value added and their amount succeeded been reduced, in taking care of environment from pollution. This Chess Square Table also has potential to be commercialized to the furniture industry.

5. References

- Brooks, A. (1998). Ergonomic Approaches to Office Layout and Space Planning Facilities. Vol 16. Issues 3. Pp 73-78.
- Chou, J. R., & Hsiao, S. W. (2005). An Anthropometric Measurement For Developing Product. *International Journal Of Industry Ergonomics*. 35. Pp:1047-1063.
- Davis, S. (1998). Reducing Wood Waste from Wood Shops. Pollution Prevention Institute. Kansas State University.
- Effie, M. S. (2009). Helium: An introduction to furniture design. *Furniture Design Book*.
- Harry, J. C. (2011). Creative Overflow: 45 Super Creative Furniture Designs.
- McKeever, D. B. (1995). Resource Potential of Wood Based Wastes in United States. In Proc 2nd Biomass Conference of The Americas: Energy, Environment, Agriculture and Industry. Pp 77-87.
- Rosman, N. (2013). Furniture Design and Engineering Note (Fur 478). Universiti Teknologi MARA.
- Wright, M. P. (1994). Ergonomics is Good For Business. *Work Study*. Vol.43. Iss 8. Pp 7-12.