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## The Market Potential of Oil Palm Empty-Fruit Bunches Particleboard as a Furniture Material

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**Abstract:** The study evaluated the consumer perceptions towards particleboard as a premier furniture material. The data for this study was collected from a questionnaire survey, completed by 500 buyers who attended the international furniture fairs in Malaysia in 2008. Correlation analysis showed that the success factors of particleboard as a furniture stock are primarily its low cost and environmental friendly status. Further, the study also revealed that the major advantages of particleboard made from oil palm empty-fruit bunch (EFB), a potential substitute for the conventional wood-based particleboard, are its comparatively lower cost and greater environmental friendliness. Since, particleboard-based furniture are perceived as being inexpensive and fragile, the choice of using particleboard in furniture manufacturing is driven primarily on cost, rather than performance. Therefore, the market potential of oil palm EFB particleboard is dependent on its comparative cost, which could increase market share if the material is available at a competitive price.

**Key words:** Particleboard, consumer perception, furniture material, low cost, environmental friendly

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### INTRODUCTION

Although Malaysia remains a large exporter of tropical hardwood value-added products, the wooden furniture has emerged as the predominant export. In 2007, the total of wood furniture exports amounted to US \$ 2.1 billion while furniture made from panel products, such as plywood, medium density fiberboard and particleboard accounted for US \$ 0.5 billion in export earnings (Anonymous, 2008).

Although the demand for wooden furniture is increasing in the global market, the supply of solid wood resources in Malaysia has been steadily reducing and hence, the furniture manufacturing industry in Malaysia importing wood supplies from neighboring Indonesia and Thailand to fulfill its demand (Anonymous, 2008). Consequently, the utilization of wood-based panels in the furniture manufacturing industry, particularly particleboard (PB) has been on the increase in recent years. Particleboard is a wood composite made up of particles, derived from wood materials that cannot be used in the saw-milling sector i.e., waste wood which includes branches, off-cuts, etc. Although particleboard is a matured product, its market is increasingly threatened by the escalating cost, diminishing fiber supply and environmental concerns of the fiber source (Anonymous,

2008). Earlier researches have shown that non-wood fiber resources, such as sunflower stalk, cotton stalk, kenaf, etc. can be used as the raw material for particleboard manufacturing (Alma *et al.*, 2005; Kalaycioglu and Gökay, 2006). In recent years however, particleboard manufactured from the oil palm empty-fruit bunches (EFB) fibers has emerged as a viable substitute to the conventional particleboard (Ratnasingam *et al.*, 2007). The oil palm (*Elaeis guineensis* Jacq.) is an important plantation crop cultivated primarily for palm oil production, which is extracted from the fruit-bunches. The residue produces a large amount of fiber resource, which has been successfully used in the manufacture of particleboard (Law *et al.*, 2007). Nevertheless, being a new product in the market the market potential of the oil palm EFB particleboard remains unknown (Ratnasingam *et al.*, 2007). Although particleboard is widely consumed in the furniture industry, the consumers' perception of the material has not been studied, unlike the extensive studies on consumer perception of different wood species (Bumgardner and Bowe, 2002; Buehlmann and Schuler, 2002). The lack of information on the customer perception of particleboard used in furniture may limit the marketing and product development opportunities for furniture made from this wood-based panel. It must also be recognized that perceptions result in beliefs about the

**Table 1: Perception of the importance of furniture**

Survey questions	Agree (%)	Not sure (%)	Disagree (%)
Furnishing is a reflection of social status	85	8	7
Furnishing reflects my personality	71	15	14
Furnishing is an indicator of life-style	55	14	31
The choice of furnishing is determined by the opinion of others	10	4	86
The choice of furnishing is governed by the availability of information and knowledge pertaining to the product	52	15	33

Source: Ratnasingam (2001)

material, which combine to create attitudes that ultimately influence furniture-purchasing behavior (Ratnasingam, 2000).

The particleboard-based furniture from Malaysia is destined predominantly for the United States of America market. Table 1 presents the findings concerning the importance of furnishing (includes both home and office) to Americans, who constitute the largest consumers of Malaysian furniture. 61% of the respondents mentioned furniture as a significant object in their lives, which clearly emphasizes the need to know the end-users' preferences when furniture is to be purchased.

Earlier studies by Levitt (1980) and Bennington (1996) have pointed out that inadequate market analysis is the main reason for the failure of new furniture products. Since, most new innovations come from customers, it is important to know the customers' needs and desires in order to develop customer-oriented products. The fact that furniture is fashion cannot be underestimated and the materials used have a far-reaching implication on its perception among consumers (Bennington, 1996).

Against this background, the objectives of this study were to determine how customers perceive particleboard-based furniture and determine the characteristics of particleboard that are important for furniture application. Further, the study also evaluated the market acceptance of oil palm empty-fruit bunches (EFB) particleboard, among customers who are currently using particleboard-based furniture.

## MATERIALS AND METHODS

The study was conducted in two parts. The first part aimed to determine the characteristics of particleboard desirable for furniture. A structured questionnaire was prepared to collect information from foreign furniture buyers attending furniture fairs, whose intention was to buy particleboard-based furniture. The questionnaire was developed through discussions with experts and by examining existing literature (Cooper, 1991; Bennington, 1996; Ozane and Smith, 1996; Ratnasingam and Ioras, 2003; Nemli *et al.*, 2007). The questionnaire had two parts. Part one contained questions dealing with the use of

**Table 2: Characteristics of particleboard as a furniture material**

Attractive
Low cost
Environmental friendly
Weight
Machining
Finishing
Strength
Dimensional stability
Uniform thickness
Warp-free
Screw-holding
Surface smoothness

particleboard as furniture material, while part two contained questions related to the perception of particleboard-based furniture.

The research instrument that was developed contained twelve characteristics describing particleboard as a furniture material (Table 2). The respondents were asked to rate each of these characters on a five-point scale: 1 = total agreement and 5 = total disagreement.

To determine the perception of particleboard-based furniture, the following theoretical factors were evaluated: (1) Quality (fragile vs. durable), (2) Price (expensive vs. inexpensive), (3) Style (casual vs. formal) and (4) Environmental Considerations (sustainable vs. depleting). The respondents were requested to pick the item that described the chosen factor in relation to particleboard-based furniture.

The questionnaire was pre-tested to eliminate difficult or confusing questions. Pre-testing was carried out with 30 potential respondents in the vicinity of the Klang Valley in Malaysia, who were furniture-buying representatives for foreign consumers. After receiving the test group's comments, several changes were made to improve the questionnaire's clarity and its length.

The survey was conducted in March 2008, during the Malaysian International Furniture Fair (MIFF) and the Malaysian Furniture Exporters Exhibition (MAFEX). The questionnaire was handed out to foreign buyers who had visited the exhibitions and who were willing to complete the questionnaire on site. A total of 500 respondents participated in this survey. The respondents were predominantly male, in the age group 35-45, with a college degree and had been involved in the furniture business, both manufacturing and retailing, for at least 10 years. The

sample used in this study provided a good representation of the furniture buyers who attended the two largest annual furniture fairs in the country, as reported by Ratnasingam (2004).

The second part of the study involved direct interviews of manufacturers of particleboard-based furniture, who were exhibiting at the furniture fairs. A total of 100 manufacturers agreed to participate in the study to evaluate the market acceptance of the oil palm empty-fruit bunches (EFB) particleboard as a furniture raw material. The respondents were given sufficient sample boards of the OPEFB particleboard to be tested at their respective factories over a period of two months (April-May). The characteristics of the OPEFB particleboard (Table 2) were then ranked from a scale of 1 = very poor to 5 = excellent, to reflect its suitability as a furniture material. The respondents were also asked to identify the unique factors of the OPEFB particleboard compared to the conventional particleboard, which could encourage its use as a furniture material.

Multivariate data analysis, which are commonly used in market research, are also used in this study. The principal analysis carried out were the correlation between the attributes of particleboard and the ranking of the variables on the basis of its importance towards the success of particleboard as a furniture stock. The principal correlation analysis between the attributes was calculated with the statistical package, SPSS.

**RESULTS**

The basic assumption applied in principal component analysis is that there is a correlation between the variables (Hair *et al.*, 1995). A correlation matrix (Spearman’s rank

correlation coefficient) was calculated for the variables and is shown in Table 3. The correlation coefficient values were between -0.39 and 0.68. The highest correlation in the matrix was 0.68, between the characteristics cost and finishing and the lowest was -0.39 between the characteristics machining and warp-free. The correlations were strong enough to justify analysis.

The mean of most characteristics were quite low (Table 4), which means that the respondents in most cases agreed with the statements. Respondents mostly disagreed with the particleboard characteristics attractive, machining, finishing, strength, dimensional stability, uniform thickness and warp free. The deviation in the characteristics indicate consensus among the respondents. It seems that consumer opinions differ most in the case of the characteristics environmental friendly and attractive. The lowest value of deviation, for the characteristics low cost, indicated that consumers strongly agreed that particleboard-based furniture is perceived to be low cost.

The correlations between the variables attractive, machining, dimensional stability and warp-free, against all other variables, were negative, while all other correlations were positive. This indicates that consumers do not agree with these statements.

Further, 81% of the respondents indicated that particleboard-based furniture were inexpensive, fragile, casual and sustainable (Fig. 1). Hence, such furniture is not considered premier and its sales is driven primarily by price and functionality rather than perceived value, as in the case of wooden furniture (Bennington, 1996).

Besides ranking the twelve characteristics on the basis of its validity (Table 5), the respondents were asked to give their opinion concerning the superior attributes of

**Table 3: Correlation matrix of the characteristics**

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
A1	1.00											
A2	-0.39	1.00										
A3	-0.19	0.27	1.00									
A4	-0.29	0.33	0.22	1.00								
A5	-0.24	-0.25	-0.30	-0.21	1.00							
A6	-0.37	0.68	0.24	0.42	-0.28	1.00						
A7	-0.23	0.43	0.27	0.39	-0.19	0.43	1.00					
A8	-0.25	0.49	-0.21	-0.33	-0.23	-0.31	-0.39	1.00				
A9	-0.19	-0.22	-0.27	-0.11	-0.28	-0.23	-0.20	-0.21	1.00			
A10	-0.21	-0.29	-0.14	-0.31	-0.39	-0.31	-0.32	-0.31	-0.20	1.00		
A11	-0.31	0.34	0.19	0.37	-0.24	0.31	0.36	-0.22	0.29	-0.27	1.00	
A12	-0.21	0.23	0.22	0.21	-0.27	0.21	0.18	-0.17	0.10	-0.11	0.18	1.00

A1: Attractive, A2: Cost, A3: Environmental friendly, A4: Weight, A5: Machining, A6: Finishing, A7: Strength, A8: Dimensional stability, A9: Uniform thickness, A10: Warp-Free, A11: Screw-Holding, A12: Surface smoothness

**Table 4: Mean and standard deviations of the characteristics**

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
Mean	3.03	1.56	2.18	2.94	3.20	3.08	3.11	3.41	3.08	3.41	2.74	2.71
SD	0.40	0.33	0.62	0.91	0.72	0.83	0.49	0.46	0.53	0.69	0.47	0.51

A1: Attractive, A2: Cost, A3: Environmental friendly, A4: Weight, A5: Machining, A6: Finishing, A7: Strength, A8: Dimensional stability, A9: Uniform thickness, A10: Warp-Free, A11: Screw-Holding, A12: Surface smoothness

the oil palm EFB particleboard compared to the conventional particleboard used in furniture manufacturing. Sixty eight percent of all respondents agreed that oil palm EFB particleboard had some superior attributes, with 32% not being able to find factors making the material a furniture stock of choice. The respondents were also asked to name all the characteristics that they thought would contribute to the material's superiority. In all, 5 variables were name, i.e., low cost, recycled waste fiber, environmental friendly, good screw-holding strength and acceptable strength.

The result of this study clearly shows that the superior characteristics of the oil palm EFB particleboard are its comparatively lower cost and greater environmental friendliness. However, in comparison to the conventional particleboard, the oil palm EFB particleboard was inferior in several aspects (Fig. 2). The inherent fiber quality of the

empty-fruit bunches (EFB) poses several challenges in producing particleboard with acceptable working properties as reported previously by Ratnasingam *et al.* (2008a-c). Inevitably, the market penetration and acceptance of this material appears to be driven by its

Table 5: Ranking of characteristics of OPEFB particleboard

Characteristics	Respondents (%)	Ranking allocation
Low cost	72	59
Environmental friendly	69	45
Screw-holding	58	38
Strength	52	32
Attractive	45	25
Finishing	37	20
Ease of machining	35	18
Surface smoothness	32	16
Weight	25	15
Uniform thickness	22	15
Dimensional stability	21	14
Warp free	18	12

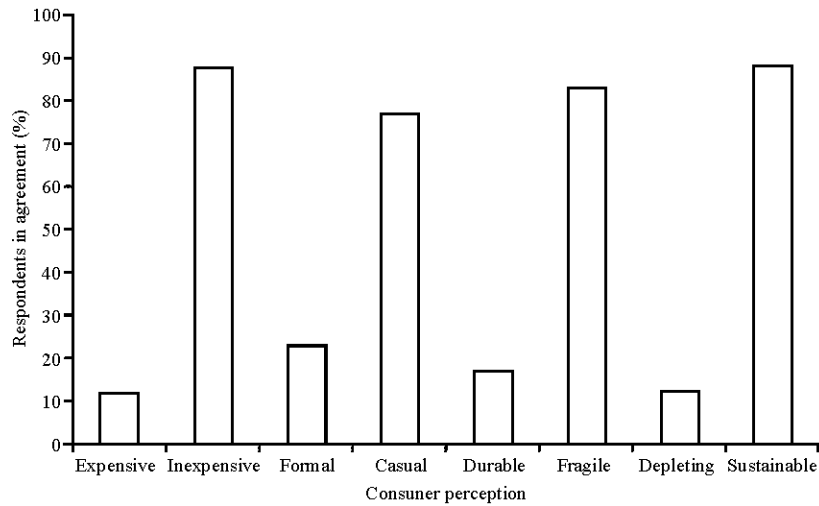


Fig. 1: Perception of particleboard-based furniture

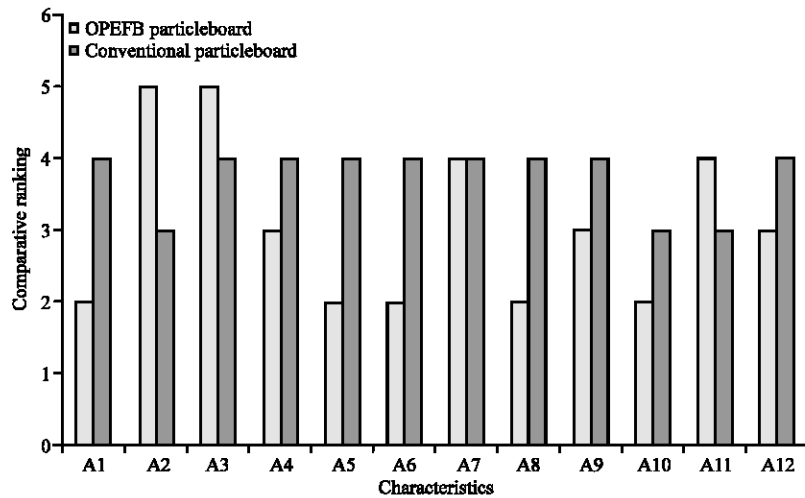


Fig. 2: Comparative characteristics of OPEFB particleboard

lower price, rather than its properties, which encouraged manufacturers to use this material. On this account, the furniture manufacturers who participated in this study indicated that furniture manufactured from the oil palm EFB particleboard was generally perceived as inexpensive and meant for general utility, which confirms the close relationship between the perception of the raw material used and the final finished product, as reported in earlier studies by Buehlmann and Schuler (2002) and Bumgardner and Bowe (2002). Inevitably, the oil palm EFB particleboard must be improved in terms of its working properties and moisture resistance, if it is to become a potential substitute for the conventional particleboard in the furniture manufacturing industry.

**Industrial implications:** The results of this study clearly show that the oil palm EFB particleboard's comparatively lower cost and greater environmental friendly status render some advantages to the material over the conventional particleboard. However, its poor working properties and low moisture resistance hampers its utilization in exposed applications in furniture. This is evident by the increasing demand for the material to be used as the base stock in upholstered seating and sofa production, as reported by Ratnasingam *et al.* (2007). Hence, in order to promote the material as a premier furniture stock, efforts must be made to improve its working properties by improving or modifying the inherent fiber quality of the oil palm empty-fruit bunches (EFB), which in turn will improve the consumer's acceptance of this material in the furniture manufacturing industry (Ratnasingam *et al.*, 2008a-c). Therefore, the current market potential of this material appears to be somewhat limited due to its poorer working properties, although its lower cost could be perceived as an advantage. Inevitably, the marketing strategy for this material would be to promote its greater environmental friendliness for applications in furniture where environmental concerns are considered high priority, such as niche products (Ratnasingam and Ioras, 2003). This study also suggests that contrary to common belief, price/cost, working properties and environmental status of particleboard are of equal importance in ensuring its success as furniture raw materials.

## CONCLUSIONS

This study reaffirms the fact that particleboard-based furniture is perceived as being inexpensive and fragile. Therefore, particleboard is not considered a premier furniture making raw material. Further, the oil palm EFB particleboard also suffers from a similar perception, as its

superiority with regard to cost and being environmental friendly could not be translated into significant inducements to encourage its wider use in furniture manufacturing. Nevertheless, with improvements in its working properties and moisture resistance, the oil palm EFB particleboard may become a potential substitute to the conventional particleboard in the furniture manufacturing industry.

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