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Discipline Research

Consumer Preferences for Veneer in Wood Products in Malaysia.

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This study provides an insight into preferences for wood veneer among value-added wood product manufacturers and gives useful insights into the relevant marketing strategies for future product development.

The wood products' industry in Malaysia is an important socioeconomic sector, generating almost USD5 billion annually in foreign exchange earnings, while providing employment to almost 180,000 people. The sector contributes almost 3% to the country's Gross Domestic Product (GDP) and has been ear-marked as one of the focus sectors under Malaysia's 3rd Industrial Master Plan. However, the industry is challenged by the reducing supply of solid wood resources, and hence the increasing use of wood-based panels overlaid with wood veneer, which is increasingly used as a substitute for solid wood resources. This study evaluated trends in use of wood veneers in value-added wood product manufacturing in Malaysia.

METHODOLOGY

Target Respondents

A questionnaire-based survey was conducted with 30 large value-added wood product manufacturing companies in Malaysia with the assistance of the Malaysian Timber Council (MTC). MTC maintains a list of companies that use wood veneers, as they have registered previously for their import assistance program (IAP). A total of 42 companies were initially identified as potential respondents for the study, and 30 consented to participate. Three types of value-added wood product manufacturers were chosen for this study, which included door, engineered-flooring and furniture manufacturers, classified as large manufacturing companies (employing more than 100 workers and with an annual turnover in excess of US \$12.5 million). These product types were chosen due to the increasing use of wood veneers in their manufacture (Lim *et al.* 2016).

Questionnaire-based Survey

A four-part questionnaire was prepared through consultation with industrial experts who import wood veneer and by referring to the previous study by Ratnasingam *et al.* (2007).

The first part of the questionnaire covered background information about production in their respective factories. Part two covered the common wood veneer used, the quantity, and the source of origin. The third part evaluated factors that influence the choice of wood veneers used, categorised into 10 attributes relevant to its selection for particular product application. These attributes were rated using a five-point Likert scale, from 1 (strongly unimportant) to 5 (strongly important).

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The fourth part evaluated the application method commonly used for wood veneering and the type of adhesive used.

Data Collection

In April 2017, the questionnaire was piloted with 8 randomly selected value-added wood product manufacturers in Selangor and Johor in Malaysia. The questionnaire was then modified for greater clarity and ease of implementation. The revised questionnaires were mailed to the 30 selected value-added wood products manufacturers in June 2017. After two weeks, an interview appointment was arranged in each of these mills, to facilitate a face-to-face interview with the mill manager who completed the questionnaire.

Data Analysis

The effect of wood veneer attributes and its source of the origin on the types of wood products manufactured (i.e., door, moulding, and furniture) were analysed. The comparison mean between the test factors was performed using non-parametric statistical tests i.e., Mann-Whitney U and Kruskal-Wallis tests, as the data in this study was an ordinal (Ho 2006). This was followed by a factor analysis of the ten attributes of wood veneer, to simplify it into smaller groups of several attributes that determine the choice of wood veneer used (Nicholls and Roos 2006).

RESULTS AND DISCUSSION

Choices of Wood Veneers

The selection of wood veneer species showed significant differences between manufacturers, based on the completed questionnaires. This is in line with the study by Brandt and Shook (2005), who reported that consumers' perceptions of different solid wood species vary, and these perceptions can be leveraged for marketing and development of new products. Sliced veneers were preferred by door and furniture manufacturers (86%), while flooring manufacturing preferred peeled veneers (69%). Sliced veneers of 0.5mm or less in thickness were suitable for door and furniture manufacturing as it is often used as an over-layer material for panels, particularly MDF and particleboard, while the peeled veneer of 1.5mm in thickness and above is often the face veneer on thin wood-based panels or as backing material in engineered-flooring production, similar to the report by Lim *et al.* 2016.

Preferences for imported wood veneer species

The results of the survey found that 9 different imported wood veneer species were utilised by door, flooring, and furniture manufacturers. Among all, the most preferred sawn timber species were White Oak

(*Quercus* spp.), Red Oak (*Quercus* sp.), White Ash (*Fraxinus* sp.), Pine (*Pinus* sp.), Walnut (*Juglans regia*), Beech (*Fagus* sp.), Maple (*Acer* sp.), Poplar (*Populus* sp.), and Cherry (*Prunus* sp.). Figure 1 shows the most common wood veneer species used by the three groups of manufacturers.

Preferences for local wood veneer species

A total of 8 different local wood veneer species were used by door, flooring and furniture manufacturers, and the most common wood veneers included rubberwood (*Hevea brasiliensis*), Meranti (*Shorea* sp.), Nyatoh (*Palaquium* sp.), Kembang Semangkok (*Scaphium* sp.), and Mersawa (*Anisoptera* sp.), Merbau (*Intsia bijuga*), Kasai (*Pometia pinnata*) and Bintangor (*Calophyllum* sp.). Figure 2 shows the most common sawn timber species preferred by the three groups of manufacturers.

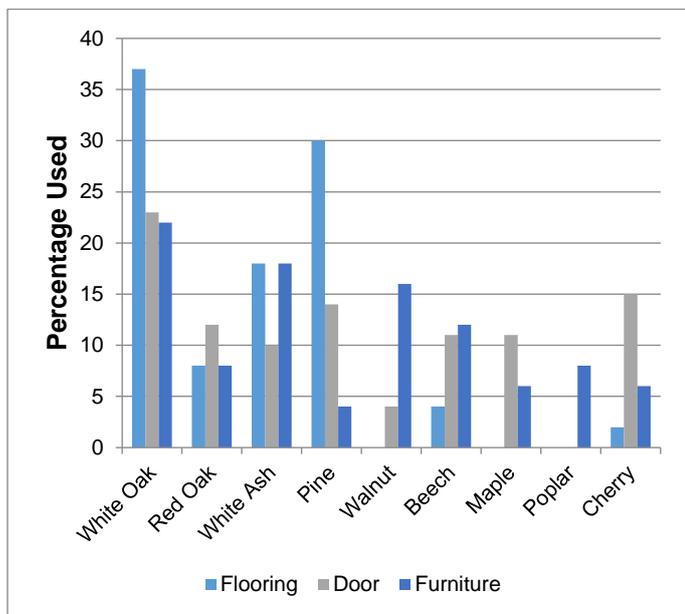


Figure 1. The most common imported wood veneer species used by value-added wood product manufacturers and percentage of their use.

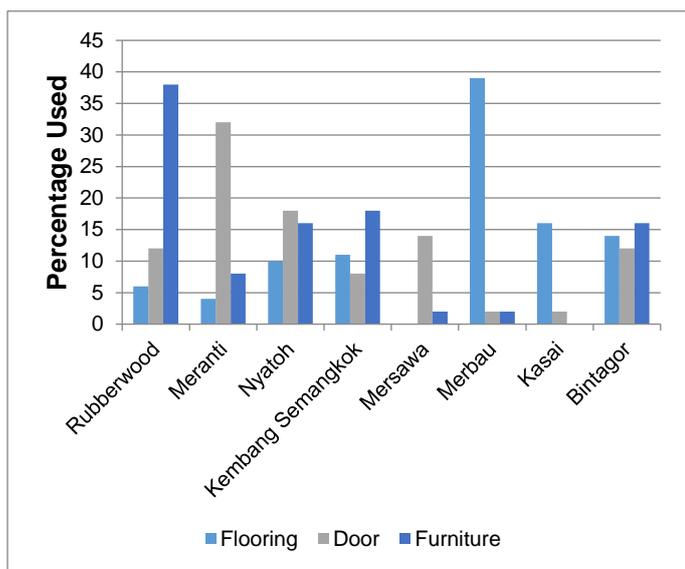


Figure 2. The most common local wood veneer species used by value-added wood products manufacture and percentage of their use.

The manufacturers of value-added wood products appear to have resorted to the use of wood veneer as a substitute for solid wood primarily to reduce product cost and also to allow the use of substitute raw materials, such as laminated boards and wood-based panels. The application of wood veneers enables maintenance of solid wood features without sacrificing product performance and improving product pricing (Tsoumis 1991). Several factors were reported by the manufacturers regarding their preferences for using wood veneers as shown in Table 1. Reducing product cost and minimising inventory and consistency in quality were the most common factors for use of wood veneer.

Wood Veneer Attributes

The attributes of wood veneer species preferred by manufacturers of specific value-added wood products evaluated in this study are shown in Table 2. Similar to solid wood resources (Ratnasingam *et al.* 2016), cost, market preferences, product specification, and supply factors were rated most highly across all three categories of manufacturer.

Unlike the previous study by Lim *et al.* (2016), the findings from this study were parallel to those reported by Nicholls and Roos (2006), who found that the appearance-related attributes were rated as of highest importance. The results of this study are also reinforced by the findings of Arowosoge and Tee (2010), who reported that appearance-based attributes of wood species, such as wood grain/figure, texture, visible defects, and colour were more important compared to mechanical strength of the material in its application for value-added wood products manufacturing.

The study also examined the attributes of wood veneer species in accordance with the source of origin (i.e., local or imported wood veneer), as shown in Table 3. Similar to solid wood resources, it is apparent that cost, market preferences, supply, aesthetic quality, and product specification were the primary factors that encouraged manufacturers to choose either local or imported wood veneer species for their product manufactured. As shown in Table 5, there were no significant differences between the local and imported wood veneer species for these attributes (Mann-Whitney U, $p < 0.05$).

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Factors for Using Wood Veneers		
Industry	Flooring	Replacing solid wood strips with hard wood-panels, which must be face veneered. Reducing product cost. Minimize inventory holding cost as these strips could be out-sourced
	Door	Market and buyer prefer wood veneer for consistent quality. Minimise inventory holding cost as over-laying can be out sourced. Price sensitive market. Veneer matching to enhance aesthetic appeal
	Furniture	Veneer matching enhances aesthetic appeal. Consistent quality in shaped parts using veneers. Large number of suppliers of laminated/edge-banded veneer components. Reduce product cost

Table 1. Factors for Choosing Wood Veneers by the Groups of Manufacturers

		Flooring (n=10)	Door (n=10)	Furniture (n=10)
Attributes	Cost	4.16	4.11	4.1
	Market preference	4.21	4.24	4.19
	Aesthetic quality	4.34	4.3	4.33
	Working properties	3.11	3.02	2.93
	Supply	3.8	3.68	3.78
	Environmental friendly	3.14	3.53	4.03
	Product specification	4.18	4.11	4.28
	Durability	4.03	3.94	3.01
	Strength and hardness	3.99	3.72	3.23
	Price premium for finished	3.01	3.13	3.67

Note: Figures in bold represent the highest ranking of attributes important for each category of wood product.

Table 2. Mean Importance Rating of Attributes According to Type of Wood Product by the Groups of Manufacturers.

		Local (n=15)	Import (n=15)
Attributes	Cost	4.61	4.87
	Market preference	4.73	4.41
	Aesthetic quality	4.01	4.38
	Working properties	3.13	3.27
	Supply	4.11	4.38
	Environmental friendly	2.93	3.17
	Product specification	4.53	4.56
	Durability	2.87	3.01
	Strength and hardness	3.13	3.26
	Price premium for finished goods	3.67	4.03

Note: Figures in bold represent the highest ranking of attributes important for each category of wood product.

Table 3. Mean Importance Rating of Attributes According to Origin.

		Test Factors	(n=10)	Mean Rank	Chi-square	Sig.
Attributes	Cost	Flooring	10	11.4	0.46	0.527
		Door	10	12		
		Furniture	10	12.3		
	Market preference	Flooring	10	13.1	0.694	0.043
		Door	10	13.6		
		Furniture	10	13.3		
	Product specification	Flooring	10	13.9	0.756	0.747
		Door	10	13.95		
		Furniture	10	14.05		
	Supply	Flooring	10	12.7	0.646	0.462
		Door	10	12.55		
		Furniture	10	12.95		
Aesthetic Quality	Flooring	10	15.6	0.752	0.039	
	Door	10	15.9			
	Furniture	10	16.25			

Note: Figures in bold represent the highest ranking of attributes important for each category of wood product.

Table 4. Effect of Groups of Manufacturers on Wood Veneer Attributes.

		Test Factors	(n=15)	Mean Rank	Mann-Whitney-U	Sig.
Attributes	Cost	Import	15	14.37	94.5	0.477
		Local	15	16.63		
	Market preference	Import	15	14.3	96	0.468
		Local	15	16.7		
	Product specification	Import	15	15.7	93.5	0.481
		Local	15	15.3		
	Supply	Import	15	18.57	63.4	0.239
		Local	15	12.43		
	Aesthetic Quality	Import	15	13.63	71.03	0.298
		Local	15	13.27		

Table 5. Effect of Origin on Wood Veneer Attributes

Application Technology

Interestingly, the study also revealed that value-added wood products manufacturers prefer to out-source the manufacture of veneered components as it reduces inventory, cost as well as ensuring consistent quality. Therefore, lamination, edge-banding and over-laying facilities using cold-press, edge-banders and membrane-press were found in the suppliers facilities, which in turn, leads to on-time-delivery as well as optimum stock levels. This is to be expected as these technologies are highly specialized and require high capital investments (Ratnasingam and Lim 2015). Further, all the respondents also indicated their preference for using fortified poly-vinyl acetate (PVAc) adhesive for bonding wood veneers, to ensure environmental emission compliance as well as its desirable color (Lim et al. 2016).

Factor Analysis

In statistical testing, factor analysis is based on the assumption that all variables are correlated to some degree (Ho 2006), and the degree of correlation among the variables is examined using the Kaiser-Meyer-Olkin method. The analysis showed a low index value of 0.316 of the correlation among the variables. Further, the Bartlett's test of sphericity resulted in a value of 86.13, with a level of significance of smaller than 0.001. Therefore, there were significant correlations among some of the variables.

The factor analysis grouped the ten variables into three main groups of attributes which could be defined as follows: (1) veneer properties; (2) sustainability; and (3) market determinants. The factor analysis resulted in the consolidation of the many variables into these three distinct groups, as shown in Table 6.

		Group 1 Veneer Properties	Group 2 Sustainability	Group 3 Market Determinants
Attributes	Working properties	0.881	-0.126	0.101
	Aesthetic quality	0.738	-0.131	-0.113
	Durability	0.647	0.414	-0.044
	Strength and hardness	0.593	0.426	-0.026
	Environmental friendly	0.352	0.583	0.055
	Supply	-0.143	0.599	0.054
	Price premium for finished goods	-0.153	0.541	-0.341
	Product specification	0.074	-0.152	0.707
	Cost	0.346	-0.186	0.741
	Market preference	0.418	-0.041	0.783

Table 6. Three Factor Solutions from Factor Analysis

Group 1 include variables such as working properties, aesthetic quality, durability, and strength and hardness. The variables in group 2 include environmental friendliness, supply, and price premium for the finished goods. Variables in the study for group 3 include product specification, cost, and market preferences. The variance explained accounted for 29.5%, 12.8%, and 21.1%, respectively, of the total variance observed. In this context, it is shown that in the manufacture of value-added wood products, the aesthetic quality and market determinants are more important than the sustainability for determining the choice of wood veneer species.

CONCLUSIONS

The study showed that aesthetic quality and market preference are the important determinants in choosing wood veneer for a particular type of value-added wood product. Further, the most common imported wood veneers used were White Oak, Red Oak, Pine and White Ash, while the important local wood veneer species include Rubberwood, Meranti, Nyatoh, Kembang Semangkok and Bintangor. The factor analysis of the 10 attributes of wood veneers simplified into to three main groups, *i.e.* veneer properties, sustainability, and market determinants indicated that wood veneer properties and market determinants had significant effects on the choice of wood veneer used for value-added wood product manufacturing. The results of the study suggests that wood veneer may be used as a value adding strategy in wood products manufacturing, as a viable alternative to substitute solid wood resources.

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