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Survey on the Use of Laminated Bamboo Panel in Malaysia

Muhammad Syahmi Shaiful Mu'azzam[1], Siti Juita Minoor Shaharizal[1], Nur Alia Najiihah Azman[1], Salman Salim[1]*

[1]Department of Civil Engineering, Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh Education Hub, 84600 Pagoh, Johor, Malaysia

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Abstract: Bamboo is known as the fastest-growing plant in the world. It is officially able to be one of the main materials in building construction because of its advantages which have strong properties, are durable, environmentally friendly, and easily available compared to wood. There are many advantages of bamboo that are still hidden and not disclosed to the public in Malaysia which makes it more difficult for the bamboo industry to achieve a high level of development. But nowadays, society is not exposed to the benefits of bamboo compared to wood. There are several industries and companies in Malaysia that produce bamboo-based products. Many unique bamboo-based products have been successfully produced. The questionnaire was distributed to respondents who are engaged in the bamboo industry sector. The objective of this study is to identify the problems of using a laminated bamboo panel in bamboo industries, to make recommendations to improve the common problems of using the laminated bamboo panel and to investigate the awareness of using the laminated bamboo panel in public. The awareness of using the laminated bamboo panel in the community was measured. There are several problems of using laminated bamboo panel was analyzed and some recommendations to improve the common problems of using the laminated bamboo panel.

Keywords: Awareness, Bamboo Panel, Community, Problems, Recommendations

1. Introduction

Bamboo is one of the most important non-wood forest products and known as a wood substitute. It is a strong, fast growing and very sustainable material, having been used structurally for thousands of years in many parts of the world [1]. It can be used as construction materials for village houses, bridges, furniture, household utensils and handicrafts due to its high strength and durability [2]. Besides, bamboo is a renewable resource, characterised by high strength and low weight, and is easily worked using simple tools [3]. As a result, bamboo structures are simple to build, resistant to wind and even earthquake forces. Even though it is used for housing, crafts, paper, flooring and fabrics. Products of

*Corresponding author: salman@uthm.edu.my

bamboos are using everywhere and bamboo industries are now thriving in Asia.

Bamboo is known as a highly sustainable building material due to its strength. If bamboo is laminated to form structural components, the material properties become significantly better than those of laminated wood [4]. Laminated bamboo panel is bamboo material consisting of flat rectangular bamboo strips cut from the bamboo stem and comprised of three and five layers were manufactured [2]. It also a relatively concept that involves gluing bamboo material together in a number of ways [5]. It has been used for many applications such as floor, walls, handicrafts, and music instruments as well as becoming a material of interest to designers due to its high strength, durability, low-weight and eco-friendlier compared to wood. The aim of this study is to identify the problems of using laminated bamboo panel in bamboo industries, to make recommendations to improve the common problems of using the laminated bamboo panel and to investigate the awareness of using the laminated bamboo panel in public. This study was carried out based on selected sample and data collected from the questionnaire among the companies and agencies were involve on bamboo industries in Malaysia.

2. Survey of Laminated Bamboo Lumber

Based on the previous survey of laminated bamboo panel lumber, the researchers performed the survey in order to reduce the wood consumption among industry. This research used a combined method consisting of survey method which to identify problems in the community that is related to the low consumption of bamboo compared to wood as well as collecting information from industries that have the potential to develop laminated bamboo products. The researcher found out that most craftsmen are able to produce handicraft and musical instruments from the laminated bamboo lumber. From the survey conducted, laminated bamboo lumber having big potential to reduce the consumption of woods as well as giving benefits to many industries.

2.1 Type of Laminated Bamboo Panel

There are many type of laminated bamboo panel that have been created and used among the various type of industry in our country. For example, flattened bamboo panel, laminated bamboo lumber, bamboo particle board and bamboo scrimber [6].

2.2 Laminated Bamboo Panel in Construction Industry

In the construction industry, laminated bamboo is used as a decorative building material and as a structural part of a home. Bamboo use for building has been around since ancient times as supports, trusses, flooring, ceiling, roof, window and door frames, footbridges, fence posts and floors. They are also used as scaffolds in modern times to support slabs when construction. Bamboo can be sliced and laminated into sheets and boards. This method includes chopping stalks into thin strips, flattening them and drying the strips [4]. They're then glued, pressed, and done.

2.3 Laminated Bamboo Panel in Other Industry

Due to the advantages possessed by laminated bamboo panel, it has been used in various industries in countries such as wood industry, furniture industry, handicraft industry and musical instrument industry. It is because of their characteristics, advantages and more friendly compared to the timber or wood. Believe or not, the laminated bamboo panel have been used widely by the industry of our country.

2.4 Advantages and Disadvantages of Laminated Bamboo Panel

The advantage of laminated bamboo panel is easy to cut because of the size of bamboo that are small and the weight of the bamboo is light to carry around. The laminated bamboo panel easily to handle because bamboo can bend and more flexible as well as can do a reposition like before this so it still fulfills client's desire. Besides, laminated bamboo panel can make to other shape without the need for sophisticated equipment. Bamboo has their own weakness point. As the bamboo panel has been more and more applied in building and decoration fields, the chance of fire accident occurrence also

increases because bamboo material belongs to combustible material [7]. Bamboo laminated panel can easily burn when fire exist. The manufacturing of laminated bamboo panel is requiring high cost to make it .The company must prepare amount of money to manufacture that laminated bamboo panel.

3. Methods

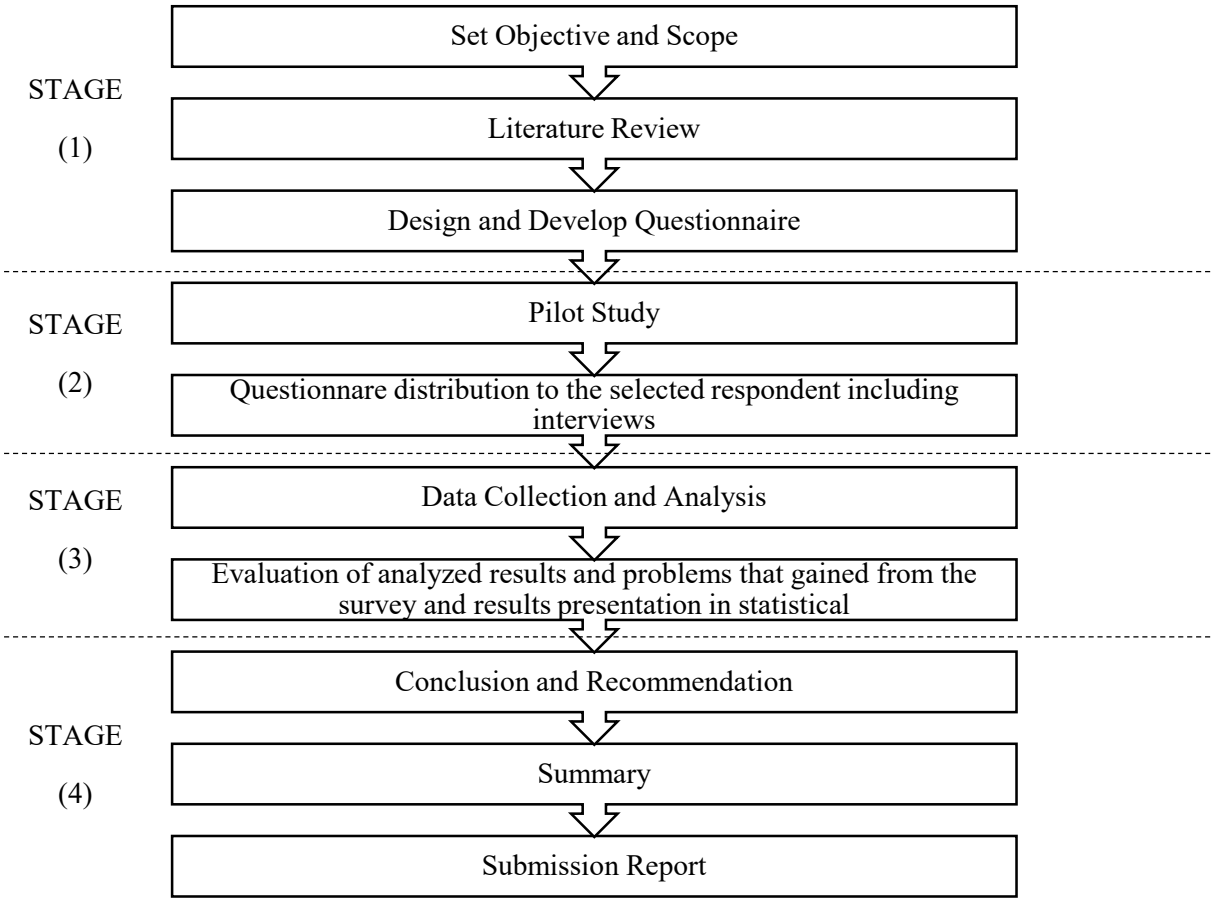

Figure 1: Flowchart of methodology

From **Figure 1**, flowchart above, our study starts from stage 1 which is the selection title for Final Year Project. Then we decide the scope and the objective of the study that we focused. After all of that settled, we make a questionnaire survey by using a Google Form and guided by the Supervisor. During stage 2, after we got a permission from Supervisor to spread the Google Form to pilot study, then we gave the questionnaire survey to them and let them answer it. At stage 3, we collected a data analysis after gave them 1 week to answer it. Next, one of the members doing an analysis by using SPSS software to get a perfect data analysis. The last stage after got all data analysis, so we can make a conclusion and recommendation based on the answer that they gave. Before the submission report, we make summary from our study as long as we do the Final Year Project.

4. Results and Discussion

A total of 25 respondents have responded the questionnaire. This questionnaire consists of demographic part, second part and the third part.

4.1 Results

For the result, data from Google Form inserted in Microsoft Excel which helps in analyzing data automatically. From this software, frequency and percentage data can be analyzed.

4.1.1 Results for part I: Demographic part.

Below is the result of the demographic question from the respondent.

Table 1: Response for demographic part

Item	Category	Frequency	Percentage (%)
Company organization	Government	13	52
	Non-government	12	48
Major profession	Project Manager/ Contract Manager / Contract Administrator	2	8
	Project Director/ General Manager / Commercial Manager	5	20
	Engineer / Architect /Site Agent	2	8
	Researcher / Lecturer	9	36
	Others	6	24
Race	Malay	16	64
	Chinese	2	8
	Indian	2	8
	Others	5	20
Age	18-25	1	4
	26-30	1	4
	Above 30	23	92
Education level	SPM	3	12
	Diploma	6	24
	Degree	4	16
	Master	10	40
	PhD	2	8
Gender	Male	24	96
	Female	1	4

Table 1 shows the number of respondents involved in this survey. A total of 25 respondents which works in bamboo industries sector have participated in this survey. A total of 13 people (52%) of them were from government organization and the other 12 people (48%) were from non-government organization. For races, majority respondents were Malays with a total of 16 person (64%) which is highest votes. This is because Malay race are the highest among the nation's most vibrant student at this faculty. Respondents aged 30 years and above is the highest number of respondents which is 23 people (92%). This is because mostly of them are researchers and lecturer. Besides, a total of 3 (12%) of the respondent were graduated from SPM, 6 (24%) from Diploma, 4 (16%) from Degree, 10 (40%) from Master and 2 (8%) were from Phd level. For gender, only 1 female which is 4% of the respondents and the rest were male which is 24 people (96%). This shows that the bamboo-based job is more suitable for men because of its relatively hard and rugged work.

4.1.2 To identify the common problems of using the laminated bamboo panel in the building construction and recommendations to improve the problems.

There are 5 questions asked to investigate the problems of using the laminated bamboo panel and some suggestions to overcome the problems.

Table 2: Data for response question about industry that concerns with the use of bamboo

1. Which industry do you know that concerns with the using bamboo?	Frequency	Percent
Instrument music, construction, furniture, handicraft and interior design	9	36.0
Instrument music, furniture, handicraft and interior design	2	8.0
Construction, furniture, handicraft and interior design	1	4.0
Construction, furniture and interior design	1	4.0
Furniture, handicraft and interior design	3	12.0
Furniture and handicraft	2	8.0
Furniture and interior design	2	8.0
Instrument music	1	4.0
Construction	1	4.0
Furniture	3	12.0

From **Table 2**, 9 people (36%) of the respondents know about most of industries that concerns with the using of bamboo which are instrument music, construction, furniture, handicraft and interior design. while 3 people (12%) know only about furniture industry. This means that there are also respondents who only know that the industry that produces bamboo-based products in Malaysia is only the furniture industry.

Table 3: Data for question about factors that can make the company regarding bamboo thrive.

2. What are the factors that can make the company regarding bamboo thrive?	Frequency	Percent
Initiative and cooperation from government	4	16.0
Consistent manufacturing	1	4.0
Aesthetic, unique, green and eco-friendly	7	28.0
Availability of quality bamboo from plantation	1	4.0
Variety of products from bamboo	4	16.0
Adequate and consistent supplier	4	16.0
Multipurpose and reusable	3	12.0
Low costs	1	4.0

From **Table 3**, 8 factors have been listed which probably will make the company regarding bamboo thrive. Majority of the respondents which is 7 people (28%) agreed about factor aesthetic, unique, green and eco-friendly.

Table 4: Data for question about main characteristics of bamboo that form the basis of selection.

3. Based on your knowledge, what are the main characteristics of bamboo that form the basis of selection?	Frequency	Percent
Light and strong	2	8.0
Thick and long-lasting	6	24.0
Flexibility and maturity	2	8.0
Good quality	1	4.0
Durability	3	12.0

Fast growing	4	16.0
Unique and functional	5	20.0
Quite ripe	2	8.0

Table 4 shows several main characteristics of bamboo that form the basics of selection. Thick and long-lasting is the highest votes which is 6 people (24%) of the respondents.

Table 5: Data for question about main problem for bamboo during pandemic season.

4. What is the main problem for bamboo during pandemic season?	Frequency	Percent
No problem	3	12.0
Less supplier	6	24.0
Less order	3	12.0
Sector not running smoothly	1	4.0
Cannot be marketed	3	12.0
Harvesting and curing process being postponed	1	4.0
The whole culm or colony dies	1	4.0
Small industries cannot be operated	1	4.0
People not aware about usages of bamboo	2	8.0
Not sure	4	16.0

From **Table 5**, there are several problems stated. Less supplier got the highest vote which is 6 (24%) of 25 respondents. 4 people (16%) are not very sure about the problems.

Table 6: Data for question about the most appropriate suggestion to overcome the common problem of using laminated bamboo panels.

5. In your opinion, what is the most appropriate suggestion to overcome the common problem of using laminated bamboo panels?	Frequency	Percent
Multiply modern technology	1	4.0
Multiply supplier	1	4.0
Need better quality bamboo	2	8.0
Exposure to the community about bamboo	3	12.0
Diversity products and design	1	4.0
Need better process such as use only FDA/TUV/ SGS tested and certified naturally made coatings	9	36.0
Reduce cost	1	4.0
Not sure	7	28.0

From **Table 6**, it shows that 9 people (36%) which got most votes were agreed for suggestion need better process such as use only FDA/TUV/ SGS tested and certified naturally made coatings.

4.1.3 Results for several questions to investigate the awareness of using the laminated bamboo panel.

Below is the result of part III. This part is to study the awareness of using the laminated bamboo panel in public. 18 questions asked to respondents to find out that how far or do they really know about laminated bamboo panel.

Table 7: Data for question about agency body related to the bamboo industry in Malaysia.

1. Did you know that we have a managing agency body related to the bamboo industry in Malaysia?	Frequency	Percent
Yes	15	60.0
No	10	40.0

Table 7 shows that 15 people (60%) of the respondent know that we have a managing agency body related to the bamboo industry in Malaysia while another 10 people (40%) does not.

Table 8: Data for 11 questions regarding bamboo to investigate the awareness of using the laminated bamboo panel.

Statement	Not significant (%)	Slightly significant (%)	Moderately significant (%)	Very significant (%)	Extremely significant (%)
2. How well do you know about the bamboo industry in the construction sector in Malaysia?	5 (20)	5 (20)	7 (28)	5 (20)	3 (12)
3. Do you think laminated bamboo is stronger than wood? Give your rate about this statement.	0 (0)	1 (4)	8 (32)	6 (24)	10 (40)
4. Do you think by replacing wood with laminated bamboo can guarantee more durability of the construction?	0 (0)	3 (12)	6 (24)	10 (40)	6 (24)
5. How much do you rate the difficulty of flexing to produce laminated bamboo panel?	2 (8)	1 (4)	12 (48)	6 (24)	4 (16)
6. Does producing laminated bamboo require high cost?	1 (4)	3 (12)	13 (52)	6 (24)	2 (8)
7. How would you rate the laminated bamboo panel flexibility?	0 (0)	1 (4)	12 (48)	7 (28)	5 (20)
8. Does making a laminated bamboo panel take a long time?	1 (4)	4 (16)	11 (44)	6 (24)	3 (12)
9. Does laminated bamboo panel industry in Malaysia achieve a success?	6 (24)	9 (36)	5 (20)	4 (16)	1 (4)
10. Do you think Malaysia's bamboo company can go further to the international level?	0 (0)	4 (16)	2 (8)	10 (40)	9 (36)
11. Do you think that bamboo can be multipurpose such as fabric and handicraft?	0 (0)	0 (0)	3 (12)	6 (24)	17 (68)
12. Did you know that laminated bamboo lumber has undergone a curing process before being used either outdoors or indoors?	1 (4)	2 (8)	3 (12)	3 (12)	16 (64)

For **Table 8**, it shows that question 2 until 8. For question 2, 7 people (28%) votes for moderately significant, and people who extremely significant got the lowest votes which is 3 people (12%). This shows that the respondents' knowledge of the bamboo industry in the construction sector is weak. For question 3, extremely significant got highest vote which is 10 people (40%). This shows that most of respondent significant about laminated bamboo is stronger compared to wood. For question 4, 10 people (40%) voted for very significant which is highest votes. Showed that respondents quite agreed if wood was replaced with bamboo, it could guarantee the strength and durability of the construction.

For question 5, most of respondent which is 12 people (48%) voted for moderately significant. This shows that bamboo is a material that is not very easy to bend. For question 6, most of respondent voted for moderately significant which is 13 people (52%). This shows that the market price of bamboo is neither too expensive nor too cheap. For question 7, moderately significant also got highest votes which is 12 people (48%). For question 8, 11 people (44%) voted for moderately significant. So, it means producing laminated bamboo panel also takes quite a long time.

For question 9, 9 people (36%) voted for slightly significant which shows that the level of progress for this industry has not yet reached a satisfactory level. But for question 10, it looks like respondents are still maintaining that the industry can still reach a better level of progress which 10 people (40%) voted for very significant and 9 people (36%) voted for extremely significant. For question 11, respondent is mostly extremely significant about bamboo can be multipurpose such as fabric and handicraft which it shows that 68%, 17 of respondent voted for extremely significant. For question 12, respondent also aware that laminated bamboo lumber has undergone a curing process before being used either outdoors or indoors. 16 people (64%) voted for extremely significant. To conclude part II, there are a number of significant problems that can be identified and suggestions for those problems are also obtained.

Table 9: Data for 6 questions regarding bamboo to investigate the awareness of using the laminated bamboo panel.

Statement	Not significant (%)	Slightly significant (%)	Moderately significant (%)	Very significant (%)	Extremely significant (%)
13. Difficult in installation and lack of skills	2 (8)	6 (24)	10 (40)	5 (25)	2 (8)
14. Expensive	2 (8)	7 (28)	9 (36)	5 (25)	2 (8)
15. Less confident with the bamboo-based products	1 (4)	8 (32)	7 (28)	5 (25)	4 (16)
16. Bamboo-based products are non-durable.	4 (16)	7 (28)	10 (40)	2 (8)	2 (8)
17. Lack of modern technology	0 (0)	9 (36)	8 (32)	5 (25)	3 (12)
18. Less expose to the information related to the using of bamboo	1 (4)	5 (25)	9 (36)	4 (16)	6 (24)

For **Table 9**, there are 6 scale questions. Most respondent voted for moderately significant for question 13 which is 40% of them. This means that quite difficult in installation and lack of skills to

produce bamboo-based products. Regarding price which is question 14, most respondents moderately significant. This shows that bamboo pricing not too cheap and not too expensive according to its advantages. Based on question 15, shows that there are also those who are less confident with bamboo-based products. 8 people (32%) were voted for slightly significant. For question 16, 10 people (40%) voted for moderately significant. Question 17 shows that, shows that the bamboo industry in this country is also facing a lack of modern technology which 9 people (36%) voted for slightly significant. For the last question, 9 people (36%) voted for moderately significant. This shows that there are also respondents who think that society are less expose to the information related to the using of bamboo. In the conclusion for part III, the community is not very skilled and mastered about the knowledge of bamboo. Several steps need to be taken to ensure that this problem can be solved thus able to bring this industry towards progress.

4.2 Discussion

Based on the data obtained, the awareness of using the laminated bamboo panel in public is very low and this may be the cause of the underdevelopment of the bamboo industry. The data obtained on the question of bamboo mostly got the least votes which is most respondents were not very aware of the facts as well as the advantages of bamboo and were not confident to rate their knowledge about bamboo.

There are several problems that keep off this bamboo industry from thriving further. The main problem that can be identified where getting the highest percentage of votes is the lack of suppliers for raw materials. This is also due to the covid-19 pandemic that hit the world and Malaysia is no exception. Suppliers of imported bamboo's raw materials cannot import bamboo's raw materials into Malaysia. Due to this, the demand from consumers become lesser and even the bamboo industries are mostly unable to market their products due to lack of support from the government.

Therefore, there are also some suggestions for improvement for the problems raised which is increase the number of raw material suppliers from Malaysia. This can helps increase the source of bamboo raw materials and also reduce the cost of raw materials compared to the cost of imported raw materials. In addition, respondents also suggest to improve the curing process for bamboo to further strengthen the physical properties of bamboo. Modern technologies should be applied to help improve the properties of bamboo to be used as a building material and also a material for bamboo-based products. Most respondents are not very exposed to knowledge about the advantages of bamboo over wood. Therefore, some parties, especially the government needs to implement several methods to carry out activities on the disclosure of knowledge about bamboo to the community today.

As a whole from this survey, all respondents answered those questions very well and achieved the objective for this questionnaire.

5. Conclusion

As a conclusion, the objectives were successfully achieved out and completed. From the survey conducted, laminated bamboo panel is able to be one of the main materials in a building construction because of its advantages which are durable, environmentally friendly and easily available compared to wood. Besides, there are many respondents have been used bamboo materials in their industries such as handicraft, furniture, construction industry and more. However, there are some problems regarding to the laminated bamboo panel and the recommendation has been made which is using the better process such as FDA and improve the curing process of laminated bamboo panel. Furthermore, the awareness of using the laminated bamboo panel in public is very low and this may be the cause of the underdevelopment of the bamboo industry. As the use of laminated bamboo panel in Malaysia is a new thing, so many people are unaware of the existence of consumption of laminated bamboo panel. So, some recommendations have been made such as revealing about the use of laminated bamboo panel to public by held the campaign by the government and promote it through newspaper, magazine or social

media. Therefore, the public can be exposed to the use of laminated bamboo panel. It is hoped that the public will be more aware on the use of laminated bamboo panel as well as can be widely used in the many industries in order to reduce the impact on the environment and pollution that is becoming more in our country.

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