

Industry Brief 2010

**Vietnam's Wood Processing Sector
*and Potential for Pressed Bamboo***



Abstract

Strand Woven Bamboo (SWB) is a wood substitute material that could potentially reduce the shortage of natural wood resources used to supply Vietnam's growing demand for such products. Currently, the Compound Annual Growth Rate (CAGR) of the country's domestic wood market is between 26 and 30% due to economic growth, urbanization, an increase in investments in the construction industry, and strong government support for the export of furniture. Total market demand is approximately 8.5 million cubic meters, most of which is for imported woods. At present Vietnam's timber supply can only cover 37% of domestic demand for furniture, while imported wood makes up 75-70% of the supply. The demand for wood is projected to grow consistently and by 2020 the demand for large-sized timber is estimated to be nearly 12 million cubic meters.

Furniture and doors/windows are 2 major market segments that consume most of the total wood supply in Vietnam, accounting for 45.5% and 33% of market respectively. Flooring accounts for only 2.5% of total wood market value, while fixtures and fittings make up 19% of market value. Since the price of SWB is not competitive compared to imported material for the furniture market, it is not a suitable substitute material for the market at the moment. Rather, the focus for SWB should be on flooring and doors/windows segments. Future demand for these 2 market segments is closely linked to the construction sector, which is expected to grow in correlation to economic expansion and urbanization.

Strand Woven Bamboo is compared to other materials in the flooring and doors/windows segments in order to evaluate competitiveness based on physical characteristics, pricing, and consumer preferences. As a resource material in the flooring segment, SWB was found as unpromising since it has no advantage compared to other imported flooring materials in terms of performance, variety, and pricing. In contrast, in the door and windows segment, pressed bamboo holds an advantage over comparable forms of resource materials in pricing.

Content

Introduction	4
Socio-economic Background	4
Economic Growth	4
Urbanization and Construction Investment.....	4
Overview of the Wood Processing Industry in Vietnam	6
Production, Trade & Consumption	6
Supply of Timber.....	7
Status of Wood Processing Companies	7
Going forward	8
Analysis of Markets	9
Wood Flooring.....	9
<u>Natural Wood Flooring</u>	9
<u>Industrial Wood Flooring</u>	9
<u>Competitiveness Analysis</u>	10
Doors and Windows	10
Conclusion	11
Flooring Segment	11
Door/Window Segments.....	11
References	12
APPENDIX	13
APPENDIX 1 - COMPETITIVENESS ANALYSIS OF FLOORING MATERIALS	13
APPENDIX 2 - COMPETITIVENESS ANALYSIS OF DOOR FRAMES.....	16

Introduction

As the demand for wood products increases, a large market for new sources of wood materials, such as planted wood and industrial processed wood, has developed. Pressed bamboo, also known as Strand Woven Bamboo (SWB), is considered a substitute material for such wood.

SWB can be used to produce various products, including indoor or outdoor products as well as home and industrial items. This industry brief provides an overall assessment of Vietnam's domestic wood market and the industrial potential of pressed bamboo within the context of this market.

The first section of the report provides a snapshot of the socio-economic background in Vietnam that has influenced trends in domestic wood consumption. An overview of the wood processing industry follows. The second section of the report compares pressed bamboo to other materials as a resource for the 2 market segments deemed most promising for SWB—furniture and doors/windows. The final section outlines the report's key conclusions with regard to pressed bamboo in the Vietnamese market.

Socio-economic Background

A number of socio-economic factors have contributed to the growth of Vietnam's wood industry. Some of the most prominent factors include economic growth, urbanization, and an increase in investments in the construction industry.

Economic Growth

Vietnam's gross domestic product (GDP) has grown at a rate between 7-8% annually over the last decade. Living standards have improved significantly and GDP per capita nearly doubled from \$489 in 2003 to \$836 in 2007. Higher incomes led to stronger consumption, which triggered higher demand for many products and services, including wood products. Domestic consumption of wood products in the past 5 years has grown three-fold and was valued at 66 trillion dong (\approx USD 4 billion) in 2007.

	2003	2004	2005	2006	2007
GDP (USD bil)	39.5	45.4	53.1	61.0	71.2
GDP growth (%)	7.3%	7.8%	8.4%	8.2%	8.5%
GDP per capita (USD)	489	554	639	725	836
Domestic wood consumption (VND '000 billion)	27	34	43	56	66
Domestic wood consumption (USD billion)	1.6	2.1	2.7	3.4	4.0
forex (USD / VND)	16,068	16,174	15,967	16,435	16,421

Figure 1: Vietnam's GDP growth and domestic consumption of wood products (GSO, WDI database & PI calculations)

Urbanization and Construction Investment

Between 2004 and 2008, Vietnam's urbanization rate increased from 26.5% to 30.5%, representing the migration of 4.7 million people from rural to urban areas. The quality of housing in Vietnam also improved in accordance with a rise in income. Floor space per capita increased from 10 square meters in 2004 to 12 square meters in 2008. These 2 factors led to a significant increase in the number of construction projects carried out throughout the country, including housing construction and renovations. Records from the Ministry of Construction (MoC) indicate that 200 million square meters of living space was built during this period. Growth in domestic investment in construction was approximately 10% per annum and accounted for approximately 7% of GDP. FDI disbursement in the last 5 years for property and construction, as well as hotels and tourism, was approximately USD \$6 billion. This represents 23% of total FDI disbursement (USD \$27 billion) between 2004 and 2008. It is important to note that new FDI pledges for real estate development increased significantly in 2007 and

2008, recorded at USD \$5.1 billion and USD \$14.5 billion respectively. All of these factors had a significant impact on the wood industry by driving up demand for wood products.

	2004	2005	2006	2007	2008
Population (mil)	82	83	84	85	87
Urban population (mil)	22	22	23	23	26
Rural population (mil)	60	61	61	62	60
Urbanization rate	26.5%	26.9%	27.1%	27.4%	30.5%
Total floor space - (million sqm)	822	872	922	971	1,021
Floor space per capita (sqm)	10	10	11	11	12

Figure 2: Vietnam's Urbanization rate and floor space per capita (Vietnam Commission for Population, Family & Children and MoC)

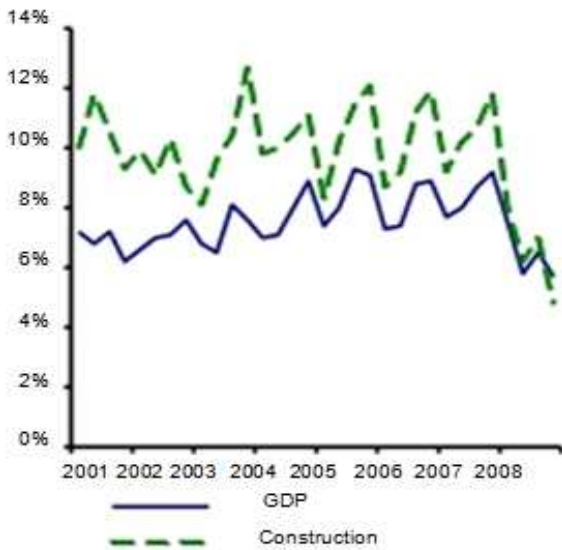


Figure 3: Domestic spending and construction trends (Standard Chartered Bank)

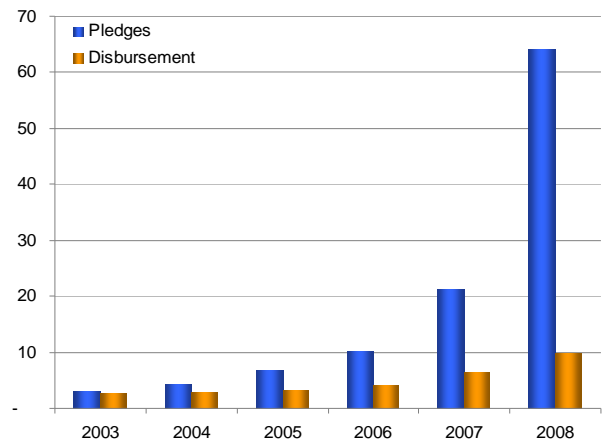


Figure 4: Value of FDI in Vietnam in terms of billion USD (FIA)

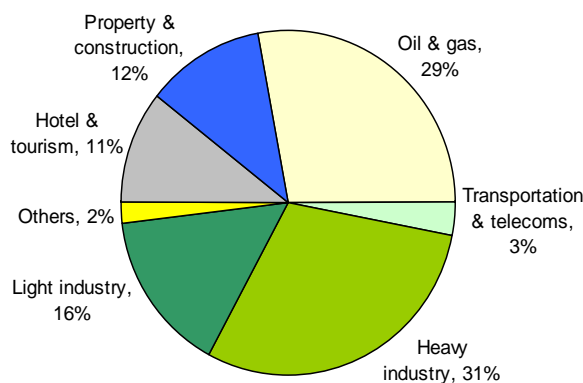
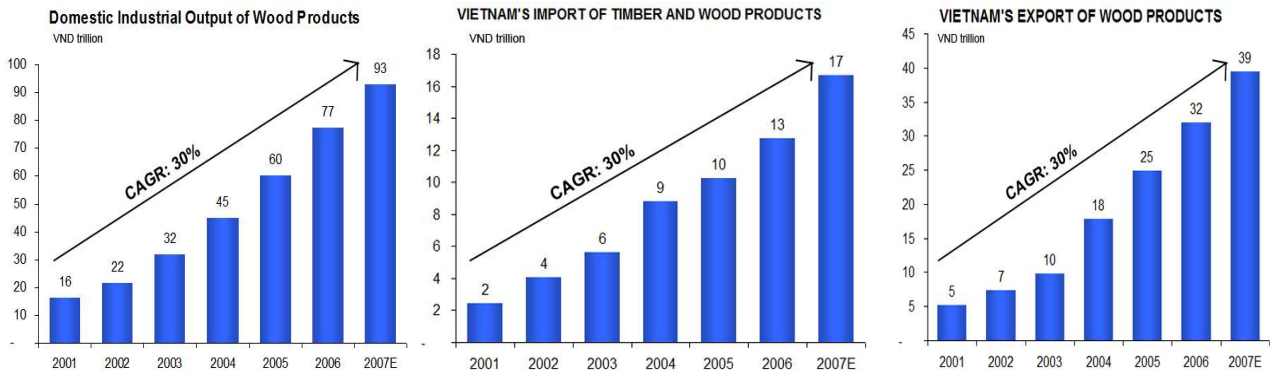


Figure 5: FDI Disbursement breakdown (FIA)

Overview of the Wood Processing Industry in Vietnam

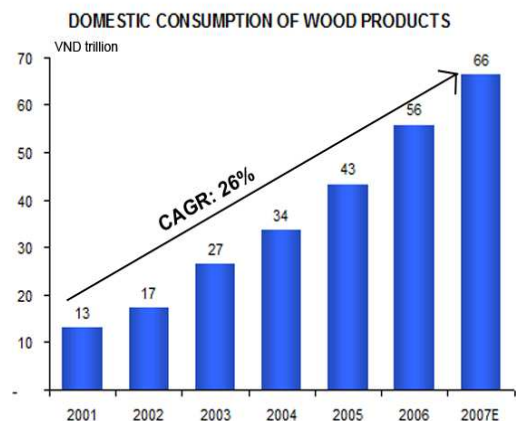
Production, Trade & Consumption

Economic growth, urbanization, real estate development, and strong government support for furniture exports have all facilitated the rapid expansion of the wood processing industry in Vietnam. The industry has scaled up progressively at an annual growth rate of 28% for the past 7 years and amounted to \$93 trillion dong (\approx USD \$5.7 billion) in industrial output value in 2007.



Vietnam has recently emerged as a major player in global furniture production with a growth rate of 30% per annum between 2001 and 2007 and exports reaching USD \$2.4 billion by the end of this period. Major export destinations, include the United States (39%), the EU (26%), Japan (13%) and China (7%).¹ In line with exports, imports of timber and wood products experienced a growth rate of 32%. The majority (75-80%)² of imports have been used as input material for furniture production. Only 20-25% of imports comprise of finished wood products ready for sale in the domestic market.

Domestic consumption of wood products quintupled between 2001 and 2007, reaching 66 trillion dong (\approx USD 4 billion) in 2007.³ Per household consumption was calculated at over \$3 million dong (\approx USD 170) in 2007,³ thus, matching data found in an independent survey conducted by a wood processing company that show per household consumption was also over \$3 million dong.⁴ Market share of different products are depicted below:



Market breakdown	Value	Share
Furniture	30,047	45.4%
Flooring	1,592	2.4%
Doors and windows	21,800	33.0%
Other fixtures and fittings	12,701	19.2%
TOTAL	66,141	100.0%

¹ Ministry of Trade. *IMEX Report*. Government of Vietnam (2009).

² General Statistics Office. Data provided by Vietnam's General Statistics Office. Government of Vietnam (2009).

³ Prosperity Initiative. Team estimation based on data collection and interview, (2009).

⁴ Hung Long, Co. Survey Conducted in 2008 on a Scope of 210 Households in Urban Areas of 7 Provinces. January 2010. (<http://www.dogohunglong.vn/>).

Supply of Timber

Currently, domestic supplies of timber do not meet demands for production. Domestic sourcing for 2007 was 3.2 million cubic meters and estimated to be worth around half a billion dollars.⁵ With planted forests only in their early stages and a strategy to preserve natural forests and limit logging in place, annual exploitation of Vietnam's planted and natural forests currently only meet 37% of total timber demands.⁶ As a result, the country relies heavily on imports to supply production.

Vietnam's import of wood materials experienced Compound Annual Growth Rate of 32% between 2001 and 2007 with trading values amounting to over USD \$1 billion in 2007. The United States and five of Vietnam's neighboring countries, including Malaysia, Laos, China, Thailand and Cambodia, comprise Vietnam's main import partners, making up 60% of annual import values.⁷ In reality, this

TIMBER OUTPUT	2001	2002	2003	2004	2005	2006	2007
Whole country ('000 m3)	2,376	2,504	2,436	2,628	2,996	3,129	3,259
Red river delta	133	113	98	93	103	103	95
North east	489	530	525	639	771	871	943
North west	246	207	185	171	280	252	248
North central coast	237	227	294	292	311	329	318
South central coast	276	314	325	429	482	501	561
Central highlands	373	420	313	324	309	329	340
South east	160	133	114	111	130	142	146
Mekong river delta	462	560	582	569	610	601	608

Figure 7: Vietnam's timber output 2001-2007 (GSO)

figure is even higher due to unrecorded illegal cross-border inflows. For example, witnesses claim that in one particular afternoon a fleet of 45 trucks laden with logs and timbers from Laos crossed at the Na-Phao border into Vietnam.⁸ Official statistics indicate that Malaysia has been Vietnam's largest timber sourcing base for the past 2 years with supplies constituting 15% of the market. While tropical timber is sourced mostly from neighbouring countries, certain hardwood, such as oak, walnut and eucalyptus, are usually imported from the United States and other western countries.

Moving forward, this situation may change. Plans to develop planted forests are being carried out throughout Vietnam with the aim of eventually achieving 70% self-sourcing of material for the wood processing industry by 2020. At the conclusion of 2006, Vietnam's national forest area was 12.67 million ha, mostly concentrated in 3 zones: the northeast region (23.9%), the central highlands (23.4%), and the north central coast (19.5%). Total timber supply is 8.13 million cubic meters with 94% from natural forests and 6% from planted forests. Vietnam plans to increase that figure to 16.24 million ha, of which 8.4 million ha will be production forests. Planted forests will account for 4.15 million ha and natural forests will account for 3.63 million ha.

Status of Wood Processing Companies

The wood industry in Vietnam is greatly fragmented and at the end of 2008, there were 2,526 companies engaged in wood processing, of which 87% were local/JVs and the remaining 13% were FDI enterprises.

- The majority of these companies (98%) are in the furniture manufacturing business with around 700 companies exporting.
- 25 are wood chip companies with total designed capacity of 1.8 million tonnes per year.
- 15 are doing wood-based panels, all operating at a fairly small-scale with production capacity under 60,000 cubic meters per year.

⁵ General Statistics Office. Data provided by Vietnam's General Statistics Office. Government of Vietnam (2009).

⁶ Ministry of Forestry. *Manual: Wood Processing Industry in Vietnam*. Government of Vietnam (2006).

⁷ Ministry of Trade. *IMEX Report*. Government of Vietnam (2009).

⁸ Voice of America (VOA). "Vietnam Furniture Industry Uses Illegal Timber from Laos. VOA (2008). (www.voanews.com/lao/archive/2008-04/2008-04-08-voa1.cfm).

- Companies engaged in developing particle boards and plywood have a production capacity of under 16,000 cubic meters per year and 15,000 cubic meters per year, respectively.

Presently, most wood processing companies are not based near raw timber sources. Rather, the majority are either in industrial parks or located near ports where access to imported materials is more convenient for exporting finished products.

If, in the future, the structure of material sources becomes 70% domestic–30% imports, production costs for these wood processing companies may rise due to inbound raw material transportation fees. This may become a point for consideration in the future.

Regions	Number of companies	Investment Capital (VND billion)	EBT (VND billion)	% EBT / Investment Capital
North	906	2,805	11	0.4%
Red River Delta	530	1,417	(10)	-0.7%
North - East	165	588	(2)	-0.3%
North - West	20	47	(3)	-6.4%
North Central Coast	191	753	26	3.5%
South	811	7,858	258	3.3%
South Central Coast	135	864	78	9.0%
Central Highlands	99	1,273	(4)	-0.3%
South - East	476	5,431	178	3.3%
Mekong Delta	101	290	6	2.1%
TOTAL	1,717	10,663	269	2.5%

Figure 8: Performance of Vietnam's wood processing companies for 2005 (Vifores)

Going forward

Positive economic growth is expected despite the current global crisis. In 2008, Vietnam's GDP per capita reached USD \$937, (a 12% gain over the previous year), which places Vietnam very close to the World Bank's "middle-income" bracket of USD \$1,000. Currently, spending on wood products in Vietnam is estimated at approximately USD 42.5 per person, which is less than 5% of GDP per capita. In comparison, China's spending on furniture alone in Beijing in 2004 was \$85 for urban areas and \$26 for rural areas.⁹ As living standards improve, people also tend to pay more attention to home decoration; hence, an increase in spending on wood products is expected in the future.

Further economic development in the coming years will continue to prompt higher urbanization rates and expansion of the construction industry. Vietnam's current urbanization rate is still quite modest compared to other parts of the world. For example, neighbouring China's urbanization rate is 40%. This implies that the urbanization trend will continue and robust growth in urban development will carry on. Furthermore, floor space per capita is also expected to increase and the Ministry of Construction predicts 14.5 square meters by 2010. Experience in other countries indicates that housing demand grows until floor space per capital reaches approximately 30-35 square meters.

These factors, coupled with a clear strategy to develop the export furniture segment, will undoubtedly continue to drive up demands for wood products in Vietnam. Forecasts from the Government show demand for large timber for industrial and civil uses will more than double from 5.3 million cubic meters in 2005 to nearly 12 million cubic meters in 2020. This is based on the scenario that Vietnam will be exporting \$7.8 billion worth of wood and wood products in 2020 and GDP growth between 2006 and 2020 stands at 7.2%.

	2003	2005	2010E	2015E	2020E
Large timber for industrial and civil uses ('000 m3)	4,461	5,373	8,030	10,266	11,993
Small timber for production of wood panels and wood chips for export ('000 m3)	1,649	2,032	2,464	2,922	1,682
TOTAL ('000 m3)	7,260	9,973	13,882	18,459	21,958

(Figure 9: Timber demand forecasts for Vietnam (Vietnam's forestry development strategy between 2006 and 2020)

⁹ National Bureau of Statistics. *China Statistics Yearbook*. Government of the People's Republic of China (2004).

Analysis of Markets

For the purpose of conducting a more detailed analysis, the industry will be broken down into the following sub-categories:

- Flooring
- Doors and windows
- Furniture, and
- Other fixtures and fittings, including residential staircases, other non-furniture office fittings, etc.

The furniture segment accounts for the biggest share, accounting for more than 45%. Interviews with furniture manufacturers reveal that they import material, such as oak, at \$500-600 USD per cubic meter. SWB, costing \$450-500 per cubic meter is not a competitive substitute, especially in the furniture market where the consumer preference for natural wood is dominant. As a result, this report concentrates on potential demand for pressed bamboo.

Wood Flooring

Popular flooring materials available in the market comprise of tiles and wood flooring. Previously considered luxury items, wood flooring has gradually become more affordable and familiar to middle-class consumers as living standards and household incomes rise. Nevertheless, wood flooring has captured less than 10% of the overall market as 90% of flooring materials are ceramic and granite tiles. The estimated market size for wood flooring in 2007 was \$1.6 trillion dong (\approx USD \$96 million). This calculation was based on the premise that construction space per year for the past 5 years averaged at 50 million square meters and assumed 8% of used wood flooring. Observations suggest that the average price per square meter of wood flooring was approximately 400,000 dong. Wood flooring is basically broken down into 2 segments: natural wood flooring and industrial wood flooring. Unfortunately, there is not enough information to determine the value of each individual segment.

Natural Wood Flooring

Natural wood flooring is available in a wide range of species with popular ones being ironwood (lim), pyinkado (căm xe) and red sandalwood (giáng hương). Bamboo material and palm flooring is also classified in this category. Several thousand small companies provide natural wood flooring and production materials, including raw logs and sawn wood, are primarily sourced from Laos due to natural forest logging restrictions in Vietnam. Presently, there are only 2 companies offering bamboo flooring and another 2 companies offering palm and woods (“Hoàn Thái” and “Palsa”) that are supplied domestically. In terms of price, natural wood flooring is 2-3 times more expensive than industrial wood flooring and domestically-produced tiles. Therefore, they are generally consumed by wealthy customers (i.e., high-income private home owners).

Industrial Wood Flooring

An array of industrial wood flooring brands are in the market, including Kronotex, Glomax, Robina, Vanatur, among others. The majority are imported from neighbouring countries, such as China, Malaysia and Thailand. A number of Vietnamese companies are also entering this market and striving to build up their brand names (i.e., Long Thanh with “New Sky”, Gosaco, and Truong Thanh). Production capacity of these companies is around 1.5 million square meters per annum. In terms of variety and price, flooring produced by Vietnamese companies is not very competitive compared to imported counterparts. Industrial wood flooring is primarily consumed by the urban middle-class. Besides the residential segment, industrial wood flooring is the preferred choice over natural wood flooring for installation in offices as the wood is much softer.

Competitiveness Analysis

The competitiveness of each type of flooring material depends on a variety of factors, including the product's physical characteristics, price, and social perception. Appendix 1 provides a closer look at the competitiveness of each type of material. The assessment was based on a number of different articles of both consumers' evaluation and construction experts' point of views.

In the wood flooring segment, natural wood is the most prestigious product due to its appearance, physical characteristics, and social image. Industrial wood, and in particular imported flooring, ranks second because of its competitive price. SWB is not competitive in terms of physical characteristics, consumer preference, or pricing.

Doors and Windows

Doors and windows available in the market are primarily made from one of the following materials: (1) timber (popular species include beechwood, balau, pyinkado), (2) aluminium, and (3) PVC / vinyl.

The market for wood doors and windows, including frames, is estimated at 22 trillion dong (≈ USD 1.3 billion) and demand is driven by the construction industry. This calculation is based on the construction of 300,000 private residential homes with 160 square meters of living space (4-storeys at 40 square meters per floor), which houses 1.2 million people. In addition, research conducted by Savills indicates that 20,000-30,000 new apartments are being built every year. Interviews with builders reveal the percentage of wood material used in residential construction is around 17-20% of per square meter costs. The percentage of wood material used for apartments/offices were 5-7% per square meter costs. The price of a set of wood doors or windows is around \$3.5-4 million dong.

There are thousands of small-scale suppliers. The well established ones have a capacity to develop around 500 sets per month (i.e., Gosaco, Thien Hung). Property developers source their needs from these well established ones, whereas individual consumers mainly go to smaller family businesses. Imported industrial wood doors are also available in the market at a much cheaper price than the traditional wood doors. Doors and windows made from wood are priced higher than other material but are not widely used among the general population due to building habits.

For doorframe and door applications, the domestic market size is quite substantial accounting for 33% of the total wood market. The continuous increase in construction shows promise for the future of this market.

Appendix 2 compares and contrasts the different types of doorframes/doors made from pressed bamboo versus natural wood, industrial wood, aluminum and uPVC under a number of criteria. Pressed bamboo doors are competitive with industrial wood and natural wood, especially in terms of pricing. The estimated price for a set of pressed bamboo doors and door frames are around 2 million dong. The price is compatible to industrial wood and definitely beats out natural wood, whose price ranges from \$4-5 million dong per set.

Conclusion

Flooring Segment

Future demand for wood flooring is closely linked to the construction sector (outlook discussed in Section 2). In addition, wood flooring is also culturally associated with the image of prosperity. Hence, a rise in income rates will likely push demand even further. Considering the competitiveness of bamboo flooring versus other substitutes and consumer preference, there are a number of issues that should be taken into account. Although positive economic growth and urbanization coupled with an increase in housing demand shows promise for the future of wood flooring applications, bamboo flooring does not have competitive advantage. In high-end segments, consumer preference toward natural wood is prevalent. Bamboo flooring with estimated price of 300,000 dong per square meter is not competitive compared to other imported products in both variety and pricing. Low-end segments will still use ceramic and granite tile. Therefore, the potential domestic market for bamboo flooring is not promising.

Investors who are interested in SWB should direct their products toward international markets where consumers have more awareness and concern for environmental issues, and therefore, value bamboo as green materials. However, entry into the international markets, such as the US or EU, requires that products meet certain standards of quality and safety. Pressed bamboo flooring is recommended for companies that already have access to the above markets.

Door/Window Segments

The market for doors and windows are driven by the construction industry, which is predicted to grow consistently at a rate of 10%. Pressed bamboo has certain advantages that enable it to compete in this market. It matches industrial wood in almost all criteria and surpasses it in pricing. Additionally, SWB can be pressed and tailored to measurement at the manufacturer's site, allowing for quicker installation and shorter construction time.

References

General Statistics Office. Data provided by Vietnam's General Statistics Office. Government of Vietnam (2009).

Global Trade Atlas. *Global Trade Atlas Database*. January 2010. (<http://www.gtis.com/english/>).

Hung Long, Co. *Survey Conducted in 2008 on a Scope of 210 Households in Urban Areas of 7 Provinces*. January 2010. (<http://www.dogohunglong.vn/>).

Ministry of Forestry. *Manual: Wood Processing Industry in Vietnam*. Government of Vietnam (2006).

Ministry of Trade. *IMEX Report*. Government of Vietnam (2009).

National Bureau of Statistics. *China Statistics Yearbook*. Government of the People's Republic of China (2004).

Voice of America (VOA). "Vietnam Furniture Industry Uses Illegal Timber from Laos. VOA (2008). (www.voanews.com/lao/archive/2008-04/2008-04-08-voa1.cfm).

APPENDIX

APPENDIX 1 - COMPETITIVENESS ANALYSIS OF FLOORING MATERIALS

1 – Highly competitive; 2 – Competitive; 3 – Not competitive

Comparative categories	Bamboo	Palm	Natural wood	Industrial wood	Ceramic & granite tiles
PHYSICAL CHARACTERISTICS					
Surface (color, pattern, texture)	(2) Only light and dark shades of yellow and brown (2) 3 patterns created by attaching different sides of bamboo lath. (horizontal-vertical diagonal attach) (3) Only 1 smooth texture	(3) Only 1 palm wood color (3) Only 1 palm wood pattern (3) Only 1 smooth texture	(1) Multiple natural colors (1) Multiple patterns (3) Only smooth texture	(1) Multiple colors (1) Multiple patterns, some resembling natural patterns (2) Both smooth and rough texture (smooth and glossy for a luxury feel, rough for safer use by kids and the elderly – not slippery)	(1) Multiple colors (1) Multiple patterns, some resembling natural patterns (2) Both smooth and rough texture (smooth and glossy for a luxury feel, rough for safer use by kids and the elderly – not slippery)
Size	(2) Flexible width as attached laths, popular with 180mm Flexible length (45-90)/ Only rectangle shape (3) Not easy to resize due to hardness	(2) Width 180mm Flexible length (45-90) Rectangle or square (3) Not easy to resize due to hardness	(3) Width 120 or 180mm Mainly 90mm length Only rectangle shape (2) Easy to resize	(2) Most flexible width Flexible length (45-90) Only rectangle shape (2) Easy to resize	(1) Various sizes in width, length and shape (2) Easy to resize
Thickness	(2) Min 15", need glue to attach, may have chinks between planks	(2) Min 16", need glue to attach, may have chinks between planks	(2) Min 15", need glue to attach, may have chinks between planks	(1) Most choices in thickness (8, 12, 15, 18"), easier for installation vs. natural min15" (attached without glue, no chink between planks)	(2) flexible chink between tiles, larger chinks are intended as decorative feature
Hardness	(1) One of the harder materials → resistance to pressure (3) Not easy to use bamboo flooring stationery because it is too hard to bend according to wall surface	(1) Said to be harder than ironwood, even harder than Bamboo because it is a complete palm plank >> attached bamboo laths to make a plank → best resistance to pressure (3) Not easy to use bamboo flooring stationery because it is too hard to bend according to wall surface	(1) Popular species, like sandalwood, ironwood, pyinkado: hard (3) Pomu: much softer → just suitable for small areas, bedrooms and ceilings. Larger areas or public places are not suitable. (1) Possible use of stationery of the same species → same surface	(2) Normal hardness, resistance to pressure depends on thickness (12") (1) Possible use of stationery of the same species → same surface	(2) (1) Possible use of stationary of the same type → same surface
Resistance to Moisture	(2) Observations are being conducted on 1 st floors in humid conditions. Said to maintain its original size without being	(2) Said to maintain its original size without being affected by cold/humid weather conditions	(2) sandalwood & ironwood: OK (3) pyinkado affected due to high oily content that can not be	(2) Said to maintain its original size without being affected by cold/humid weather conditions	(1)

		affected by cold/humid weather conditions (minimal shrinkage and swelling) Chemical content (glue) also supports resistance to moisture?	(minimal shrinkage and swelling) Chemical content (glue) also supports resistance to moisture?	removed (2) Poumu: OK	(minimal shrinkage and swelling)	
Resistance to insects/mold	(2) Observations are being conducted on 1 st floors in humid conditions. Chemical content (glue) also supports resistance to insects	(3)		(3) Vulnerable to insects, even harder species like ironwood	(1) Chemical content supports resistance to insects	(1)
Water proof	(3) Need significant care	(1) can be used in natural form without chemical content in watery conditions (outdoors, bathroom)		(3) Need significant care	(3) Common types: need significant care (1) Bathroom type: can be made water-proof, but not popular (only New Sky brand)	(1)
Scratch proof	(2)	(2)		(1) Harder species (sandalwood, ironwood, pyinkado) (3) Softer species (Poumu)	(1) Scratches can be erased when cleaned	(2)
Sound proof	(1) Due to thickness	(1) Due to thickness		(1) Due to thickness	(2)	
Use of chemicals	(3) Intensive use of chemicals (glue to attach) → hazardous to health	(1/2) Less use of chemicals due to complete palm wood plank → safer for health		(1) Less use of chemicals due to complete natural wood plank → safer for health	(3) Much use of chemicals during production of artificial products → hazardous to health	(2)
PRICE						
Price	(3) More: expensive 550,000d / m2 (attached laths – tre ghep), SWB estimated 300,000d/m2 (3) Pricing based on actual use of materials, not actual area	(3) More expensive: 600,000-700,000d / m2 (3) Pricing based on actual use of materials, not actual area		(3) Most expensive, double that of industrial floor sandalwood, ironwood: ~1mn pyinkado 600,000 (~Bamboo) Poumu: 400,000 (but regarded as other level) (3) Pricing based on actual use of materials, not actual area	(1) Affordable for average-income earners, from 200,000d/ m2 (1) Pricing based on actual area	(1) Wide range of prices due to quality and C/O
SOCIAL PERCEPTION						
Sophistication	(1) Highly valued in Vietnam (3) Cheap material, similar to artificial → Too expensive as bamboo, would rather choose natural wood at similar price or just some dong more expensive	(3) Cheap material		(1) Most valuable (1) Luxury, prosperity, sophistication	(3) Artificial	(3) Artificial
Consumer's feeling	(1) Natural cooling effect; warmth?	(1) Natural cooling effect; warmth?		(1) Natural cooling effect and warmth	(3) Cold of artificial things	(3) Cold of artificial things
TARGET MARKET						
	Middle class who can afford natural	Middle class who can afford natural material		Middle class who can afford natural	Normal consumers	Normal consumers

		material (1) High-end (resorts, hotels) and foreign consumers		material Suitable for older people and formal spaces (guestroom etc.) due to dark color (1) High-end consumers (resorts,hotels) who not only care for the natural origin but also for other social perceptions (luxury, prosperity)-Giang Huong, Lim	Suitable for office & commercial area to save costs (thinner cheaper) Light colors are more suitable for younger people	Imported high-quality materials (from Spain) can target high-end consumers who care for C/O and social perceptions (prosperity)
	Total marks	45	38	46	36	27

APPENDIX 2 - COMPETITIVENESS ANALYSIS OF DOOR FRAMES

1 – Highly competitive; 2 – Competitive; 3 – Not competitive

Comparative categories	Pressed Bamboo door	Natural wood beechwood (nghiến), balau (chò chỉ), pyinkado (căm xe)	Industrial wood	Aluminum door	PVC door
PHYSICAL CHARACTERISTICS					
Surface (color, pattern, texture)	(2) Dark shades of yellow and brown Pattern created by pressing different rough slides	(1) Natural color	(1) Multiple color Multiple patterns	(3) Limited color – aluminum or dark brown	(1) Multiple color but not natural
Size	(1) Easy to have tailor made in standard size in large quantities (molding) (3) Not easy to resize due to hardness	(2) Easy to resize but take times to produce	(1) Easy to resize	(1) Easy to resize	(1) Easy to resize
Thickness	(1) Panel thickness is up to 1.8 cm Frame thickness	(1) Panel thickness is up to 1.8 cm	(1) Panel thickness is up to 1.8 cm	(3) Not thick	(3) Not thick and not solid
Hardness	(1) One of the hardest materials comparable to iron wood, resistance to pressure	(1) Only some species like ironwood, are used for door frames	(1) High resistance to pressure	(3) Distorted under pressure	(2) Distorted under pressure
Resistance to Moisture	(1) Chemical content may help to increase the resistance to moisture but hasn't been tested	(1) Ironwood – OK	(1) Chemical content – industrial processing helps to increase the resistance to moisture	(1) Nature of metal – high resistance to moisture	(1) Nature of PVC – High resistance to moisture
Resistance to insects/mold	(1) Chemical content (glue) supports resistance to insects	(3) Vulnerable to insects	(1) Chemical content (glue) supports resistance to insects	(1) Nature of metal – high resistance to insects/ mold	(1) Nature of PVC – High resistance to insects/mold
Water proof	(3) Should not be exposed to the outdoors – suitable for indoor construction	(2) Needs significant care, should not be exposed to outdoors frequently	(3) Should not be exposed to the outdoors	(1) Nature of metal – water proof	(1) High resistance to water
Scratch proof	(2) Easy to be scratch	(2) Easy to be sratch	(2) Easy to be scratch	(3) Easy to be scratch	(3) Easy to get scratch
Sound proof	(1) Due to thickness	(1) Due to thickness	(2) Due to thickness	(3) Thin aluminum layer – not sound	(1) Due to thickness and

				proof	technology	
	Use of chemicals	(3) Intensive use of chemical	(1) Less use of chemicals due to complete natural wood plank → safe for health	(3) Intensive use of chemical	(2) Less use of chemical	(2) Less use of chemical
	PRICE					
	Price	9500K/ m3 raw material → estimation Doorframes: 200K/m length Door: 1000K/m2	Door frames (frame only) - Iron wood – 750K/m length - Balau – 300 – 400K/m length The door - Iron wood – 2 – 2.5M/ m2 - Doi – 1.2 – 1.3M/ m2 \$4- 5 Million dong/ set	Cheaper 30% than natural wood Door frames: 200 – 280K/m length Door: 700 – 1,100K/m2 \$2-3 Million dong/set	Cheap Frame & door 600K – 1000K/m2 1500K – 1800K/m2	Frame & door 800K – 1000K/m2 2.2 – 2.6 tr/m2
	SOCIAL PERCEPTION					
	Sophistication	(3) Cheap material, similar to industrial wood, artificial	(1) Most valuable (1) Perceived as a sign of luxury , prosperity and sophistication	(3) Artificial, cheap	(3) Cheap	(3) Artificial, cheap
	Consumer’s feeling	(3) Not premium	(1) Sustainable, long lasting	(3) Not premium	(3) Cheap, not premium, use for office or store only	(3) Not premium
	TARGET MARKET					
	Target consumers	High-end consumers (resorts,hotels) users who care not only for the natural origin but also for other social perceptions (luxury, prosperity)-Giang Huong, Lim	Middle to upper class who can afford natural materials	Normal consumers who look for affordable materials	Normal consumers who look for affordable materials	Normal consumers who look for affordable materials
	TOTAL Mark	25	20	25	27	25