20. New Bamboo Industries and Pro-Poor Impacts: Lessons from China and Potential for Mekong Countries

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Introduction

Oxfam Hong Kong (OHK) and the Mekong Private Sector Development Facility (MPDF) have carried out a bamboo sector feasibility study for Vietnam, Lao PDR and Cambodia\(^1\). The Study was conducted in close conjunction with a bamboo value chain pilot led by MPDF in Thanh Hoa province, Viet Nam which over the past 18 months has been carried out in partnership with the domestic private sector, farmers and international buyers\(^2\).

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1 Feasibility Study (US$ 250,000) jointly funded by OHK and MPDF.
2 Supply Chain pilot (US$ 315,000) main donor IFC – MPDF. Other contributions from M4P project of ADB, IKEA.

Together, the study and the pilot demonstrate that an efficient high-value pro-poor industry includes the critical component of near-source pre-processing of bamboo. Near-source pre-processing, where farmer businesses split the culms into parts and channel these parts and residues into separate product chains, creates an efficient industrial supply chain. China, having coupled this supply chain innovation with technology and new product development, has led the growth of the now US $7 billion global bamboo market, which also include bamboo shoots and handicrafts. The industry where 75% of the total market value is pro-poor – in terms of farmer returns and worker salaries – has potential for the Mekong countries as a scaleable rural industrial model, transferring value to growers, creating viable local businesses and leading to more widespread economic transformation.
Government, donors and development agencies have made large investments to tackle poverty in the region. While these efforts may have contributed to development in general, the evidence shows that they have been less effective in tackling more entrenched issues in remote and upland communities. Development of integrated value chains for bamboo products, appropriate training and technology, access to capital, business development services and practical government policies are required for the poor to access markets and transform poverty.

This paper presents findings and conclusions from the feasibility study which was composed of contributions by more than 20 consultants from 14 organisations who carried out component studies in Vietnam, Lao PDR, Cambodia, China and globally during the first half of 2006. The study explored the potential of the sector through analyses of bamboo resources and farming systems, technology processes, global and domestic product markets and business environments. This paper presents a selection of the analysis and main conclusions including:

- Recent developments in the bamboo industry.
- The global bamboo market.
- Potential for the bamboo sector in Mekong countries.
- Lessons from China.

**Recent developments in the bamboo industry**

**New commercial uses of bamboo**

Many people’s experience of bamboo products is limited to sitting on bamboo furniture and matting, using bamboo baskets or using bamboo chopsticks to eat some bamboo shoots. The last 15 years has seen a dramatic growth in the variety of commercial bamboo products such as flooring, laminated furniture, building panels (similar to timber-based plywood, chipboard or MDF), high quality yarn and fabrics, activated carbon and bamboo extracts. The emergence of bamboo as a timber substitute has coincided with a growing demand for timber. Bamboo’s appearance, strength and hardness combined with its rapid growth cycle and capacity for sustainable harvesting make it an increasingly attractive wood substitute. The market outlook for bamboo is strong.

These recent developments have created new opportunities for bamboo markets to be targeted for rural development and poverty reduction. In particular, the emergence of near-source value-adding in modern supply chains increases the sector’s potential economic impact on poor rural communities. The feasibility study shows that in Vietnam today, every ton of bamboo used for producing bamboo flooring has almost 5 times the pro-poor financial impact than if it were used to make paper.

**Bamboo in three distinct sub-sectors**

It is useful to divide the sector into three stand-alone sub-sectors:

1. **Handicrafts**: characterized by manual processing and extremely high value-adding to relatively small volumes of raw bamboo.
2. **Bamboo shoots**: a high-value agricultural food crop that can also be grown in parallel with the production of culms.
3. **Industrial processing**: semi-mechanized and mechanized processing of large volumes of bamboo culms. The industrial processing sub-sector offers many opportunities for major growth and
pro-poor impacts on rural farming communities. Industrial processing can be further divided according to the value of the processing and the grade of material used:

- Premium processing (eg. flooring, laminated furniture)
- Medium value processing (eg. chopsticks, mat boards)
- Low value and bulk processing (eg. charcoal, paper & pulp)
- Unprocessed culms (eg. scaffolding and traditional construction)

Premium processing requires the highest value parts of the bamboo, typically the middle lower part of large culms. Lower value products can be made with upper and residue parts. So modern bamboo supply chains now comprise different businesses producing a variety of products, with premium bamboo parts going for high value uses such as flooring, laminated furniture, mid quality parts going to medium value-added processing such as blinds, mats, and chopsticks, and the leftover or residue parts, such as the use of sawdust in paper, charcoal or chipboard.

**The pre-processing revolution in bamboo**

The revolution in the industrial bamboo sub-sector began in China 15 years ago when it was forced to innovate in response to scarce timber resources. Previously, factories would purchase whole culms for production and were forced to deal with mountains of culm residue and waste. This led ultimately to technical and supply chain innovations which produced the critical supply chain step of pre-processing. At, or near-source, pre-processing workshops with specialized but simple machinery separate bamboo culms into various parts and direct these parts into different supply chains. This creates industry-wide efficiency and greater value-adding at the local level.

The revolution in industrial bamboo practices permitted transportation and waste handling savings, the potential for 100% utilization rates and zero wastes, in short, resulting in a model for achieving maximum resource utility. Business, research institutes and government all contributed to the technology development driving this innovation.

The new premium processing industries generate the highest rates of pro-poor development of all the industrial bamboo processing industries. However, they cannot exist in isolation and must operate within a diversified industry for maximum industry-wide value and value creation.

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3 Zhejiang Province in China now has more than 20 industrial plant and equipment suppliers providing the specialised equipment required for all levels within the industrial supply chain from pre-processing to production lines for premium end products

**World bamboo market and Mekong countries’ potential**

**Overview**

The Study estimates that at present, bamboo markets have a combined annual value of approximately USD $7 billion. Traditional products account for almost 95% of this value. Newer industries offer growth potential and are expected to rival traditional bamboo-related markets over the medium-term.

Markets for bamboo can be grouped into ‘traditional’ and ‘non-traditional’ or ‘emerging’ markets.
Demand remains strong in traditional markets such as handicrafts, blinds and bamboo shoots with profitable opportunities despite moderate growth. Other traditional markets, such as chopsticks, are highly commoditized with low growth and low profit margins. Emerging bamboo markets include flooring, building products and laminated furniture. These represent the largest growth opportunities for bamboo. Strong international demand coupled with China’s export growth and existing bamboo-based industries has produced a growing bamboo sector within wood-based product industries. Supply problems, including the high demand for certified timber, create a positive market outlook for bamboo. Overall prospects for a diversified bamboo sector look strong.

**Growth and future global bamboo markets**

Current demand is heavily concentrated in traditional bamboo markets. But growth for bamboo products is highest in the emerging wood product substitute-based markets. The scale of future demand for bamboo products will be driven by:

- **Global market growth rate**: Growth in global markets in which bamboo products compete, and are linked to global GDP growth.
- **Penetration rates of bamboo into these global markets**: Driven by attitudes of buyers and the price/performance competitiveness of bamboo products compared to alternatives.

We explored various growth scenarios, and conservative ‘mid-level’ scenarios are reported. The ‘mid-level’ scenario estimates that by 2017 the total market for bamboo products will be around US$ 17 billion, with much of this growth coming from the non-traditional segment of bamboo products including laminated furniture, flooring and panels.

**Mekong bamboo sector potential**

Two approaches have been used to develop scenarios for the Mekong sector:

- **Demand Driven**: through analysis of the potential share of the global bamboo markets that could be captured by the Mekong region.
- **Supply Driven**: through analysis of the development of the sector under different industrial models.

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4 Including: handicrafts, bamboo shoots, chopsticks, blinds, flooring, furniture, panels, builders’ joinery & carpentry, charcoal and activated carbon. Excluding paper/pulp and unprocessed bamboo used in construction and household uses.

5 Additional niche market opportunities exist for processed bamboo charcoal driven by growing demand for bio-fuels. Bamboo-based activated carbon has the potential to develop strongly in the growing activated carbon market.

6 The complete feasibility study contains more data and justifications on these scenarios.

**Demand driven scenarios**

The assessment of potential market share is informed by analysis of current production levels in the
Mekong bamboo industries as well as national export performance in other light manufacturing and agricultural sectors. Mekong countries already capture a good share of some world markets (e.g. 3% of wooden furniture with Vietnam and growing at over 40% per annum, 7% of coffee exports and 7% of global exports in basket and wickerwork).

Given the Mekong countries’ demonstrated ability in bamboo production, three different 2017 world market share scenarios of 2%, 5% and 8% are used for each of the 10 bamboo product industries. The feasibility of each is then estimated based on the current state of each of the domestic bamboo industries and the past performance in other similar industries (Table 1).

Demand driven scenarios suggest that under favorable domestic conditions, by 2017 the Mekong sector could be worth around:

- US$ 0.6 billion p.a. by capturing a greater share of the *existing* world bamboo markets (World Bamboo Market Scenario 1 – zero growth)
- US$ 1.2 billion p.a. by capturing a greater share of a *growing* world bamboo market (World Bamboo Market Scenario 2 – mid-level growth)

### Table 1: “Demand driven” Mekong scenarios

**World Bamboo Market Scenario 2 (Future mid level world growth)**

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World market (US$ m)</td>
<td>2%</td>
<td>5%</td>
<td>8%</td>
<td>(US$ m)</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>Handicrafts (Bamboo &amp; rattan)</td>
<td>3,000</td>
<td>60</td>
<td>150</td>
<td>240</td>
<td>240</td>
<td>4,200</td>
<td>84</td>
</tr>
<tr>
<td>Bamboo shoots</td>
<td>1,500</td>
<td>30</td>
<td>75</td>
<td>120</td>
<td>120</td>
<td>1,700</td>
<td>34</td>
</tr>
<tr>
<td>Wood furniture</td>
<td>1,100</td>
<td>22</td>
<td>55</td>
<td>88</td>
<td>55</td>
<td>5,600</td>
<td>112</td>
</tr>
<tr>
<td>Wood flooring</td>
<td>100</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>1,200</td>
<td>24</td>
</tr>
<tr>
<td>Wood panels</td>
<td>200</td>
<td>4</td>
<td>10</td>
<td>22</td>
<td>22</td>
<td>2,200</td>
<td>44</td>
</tr>
<tr>
<td>Blinds (incl. fish gear)</td>
<td>500</td>
<td>10</td>
<td>25</td>
<td>40</td>
<td>25</td>
<td>1,200</td>
<td>24</td>
</tr>
<tr>
<td>Chopsticks</td>
<td>300</td>
<td>6</td>
<td>15</td>
<td>24</td>
<td>15</td>
<td>400</td>
<td>8</td>
</tr>
<tr>
<td>Charcoal</td>
<td>100</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>130</td>
<td>3</td>
</tr>
<tr>
<td>Activated carbon</td>
<td>20</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>170</td>
<td>3</td>
</tr>
<tr>
<td>Paper/pulp</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>80</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Raw bamboo / construction</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>60</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>6,825</td>
<td>137</td>
<td>341</td>
<td>552</td>
<td>630</td>
<td>16,830</td>
<td>337</td>
</tr>
</tbody>
</table>
These scenarios show that within the existing world bamboo markets (scenario 1) handicraft, bamboo shoots and paper would continue to be the main bamboo industries of scale in the Mekong. However, in a growing world market (scenario 2), furniture would become increasingly important and begin to rival handicrafts as the leading Mekong bamboo industry. Flooring, panels and blinds would also become industries of scale.

7 VN production of pressed woven mat boards is estimated at US$ 22m, hence current market share may be 11%
8 Paper/pulp and raw bamboo market size data is not presented as it was not reviewed during this study. However, estimates of future Vietnamese bamboo paper/pulp production and raw bamboo consumption for domestic demand are included here to better illustrate the overall potential scale of the sector.

When grouped by sub-sector, the growing importance of industrial processing becomes apparent.

Table 2: Contributions of each sub-sector under different scenarios

<table>
<thead>
<tr>
<th>Sub sector</th>
<th>Mekong Demand Scenario 1 (Existing market– zero world growth)</th>
<th>Mekong Demand Scenario 2 (Future mid level world growth)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall financial output (US$ m) %</td>
<td>Overall financial output (US$ m) %</td>
</tr>
<tr>
<td>Handicrafts</td>
<td>240 38%</td>
<td>336 28%</td>
</tr>
<tr>
<td>Bamboo Shoots</td>
<td>120 19%</td>
<td>138 12%</td>
</tr>
<tr>
<td>Industrial Processing</td>
<td>270 43%</td>
<td>710 60%</td>
</tr>
<tr>
<td>(incl. Raw culms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>630 100%</td>
<td>1185 100%</td>
</tr>
</tbody>
</table>

The evidence from the recent trade performance of the Mekong countries demonstrates that these scenarios are achievable. Other commodities in which the Mekong countries have achieved similar world export market shares include:

- 8%: Footwear, basketwork, ornamental ceramics, pepper, coffee.
- 5%: Rice, men and women’s overcoats, natural rubber, bicycles.
- 2%: Wooden furniture, various garments and agricultural products.

Furthermore, the required growth rates appear to be feasible, if bullish, as they are within the range of annual growth rates achieved by Vietnam in several similar sectors since 1999. Of particular relevance may be the emergence of the wood furniture sector which has grown from US$ 12 million in 1999 to US$ 1.1 billion by 2004, a sustained average annual growth rate over 40% per annum (ITTO 2004 & 2005).

Supply driven scenarios

Supply driven scenarios for the Mekong bamboo sector are based on the available resource base relevant to each of the sub-sectors.
**Handicrafts and Shoots.** In the case of the handicrafts and bamboo shoots sub-sectors, they require only 24,000 ha (Demand Scenario 1) and 36,000 ha (Demand Scenario 2).

**Industrial Processing.** A key variable in the resource scenario is the sustainable yield per ha of bamboo. This is approximately 9.5 tons per ha per year (“luong” bamboo) in the active bamboo processing areas of the Mekong countries covered by the study. In Anji, China, in 2003 the maximum yields achieved by farmers were around 14 tons per ha per year of Moso, an equivalent quality and type of bamboo. Average yields across China are around 9 tons/ha.

Current official estimates for bamboo in the three Mekong countries are: Viet Nam 1.4 million ha, Lao PDR 1.5 million ha and Cambodia 30,000 ha. Allowing for some unreliability in these government estimates, we can still assume a total area of 500,000 ha would be available for bamboo production in the Mekong countries.

The “New industrial model” explained below is used to illustrate the potential scale of the sector.

### Table 3: “Supply driven” Mekong sector scenarios

<table>
<thead>
<tr>
<th>Sub sector</th>
<th>Mekong Supply Scenario 1 500,000 ha, 9.5 t/ha/yr</th>
<th>Mekong Supply Scenario 2 500,000 ha 14 t/ha/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area of bamboo (ha)</td>
<td>Financial output (US$ m)</td>
</tr>
<tr>
<td>Handicrafts</td>
<td>24,000</td>
<td>336</td>
</tr>
<tr>
<td>Bamboo Shoots</td>
<td>36,000</td>
<td>138</td>
</tr>
<tr>
<td>Industrial Processing (New model)</td>
<td>440,000</td>
<td>495</td>
</tr>
<tr>
<td>Total</td>
<td>500,000</td>
<td>970</td>
</tr>
</tbody>
</table>

Table 3 summarizes the likely scale of industry that could be supported under different supply scenarios. The supply scenarios indicate that under current raw material production practice and yields, an area of 500,000 ha of bamboo could support an industry worth US$ 970 million per year. With improved production practice and increased yields the same area of 500,000 ha could support an industry worth US$ 1.2 billion per year.

9 OHK and MPDF are currently funding remote sensing work to upgrade these estimates.

### Summarizing 2017 Mekong potential

Linking Mekong demand and supply side scenarios with global bamboo market scenarios provides the overall estimate of potential for the Mekong. Table 4 indicates that the conservative mid-level global economic growth scenario could result in a US$ 1.2 billion per year bamboo sector in the Mekong countries.

### Table 4: Summary of Mekong sector scenarios

<table>
<thead>
<tr>
<th>Sub sector</th>
<th>Mekong Scenario 1</th>
<th>Mekong Scenario 2</th>
</tr>
</thead>
</table>

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### Socio-economic and environmental impacts

The potential socio-economic and environmental impacts of the sector have been assessed using a combination of the following measures.

#### Socio-economic impacts

- **Overall financial impacts:** the total output value of the sector or supply chain.
- **Pro-poor financial impacts:** At the centre of this approach is the use of measurements for pro-poor financial impacts. These are components of the overall financial impacts linked to waged income, and income to farmers and small businesses close to sources. The feasibility study suggests that this typically amounts to around 75% for the sector (except for products like pulp/paper).
- **Employment creation:** the total number of Full Time Equivalent (FTE) jobs created in farming, pre-processing, secondary processing and associated activities such as transport and loading, trading and wholesale.
- **Total direct beneficiaries:** the total number of workers and farmers gaining direct benefit from the sector. The number of direct beneficiaries will be higher than the FTE employment creation as most farmers only spend part of their time growing bamboo.
- **Distribution of benefits between men and women:** the percentage distribution of benefits analysis between men and women is also carried out for each supply chain, based on the share of employment creation.
- **Rural distribution of benefits:** the distribution of employment creation along each supply chain, between farmers, traders, pre-processing and secondary processing workers, is used as a proxy measure for the potential geographical distribution of benefits and hence the potential for benefits to be captured by more remote, poor communities. The summary indicator used is the percentage of jobs with potential to go to rural communities which is assumed to equal employment creation among farmers, traders and primary processing workers.

Each of these measures is expressed in two forms:

- **Efficiency of impact:** measures the rate of employment creation and financial impact (pro-poor and total) created throughout the sector per hectare of land committed to bamboo production. This measure permits very clear policy and strategic decision-making, and permits a comparison of benefits with competing options for land use.
- **Scale of impact:** measures the overall scale of impact indicators above.
Environmental Impacts

There are two main environmental considerations from the supply side:

- **Raw material production**: Does the cultivation and harvesting of bamboo have discernable positive or negative environmental impacts?
- **Processing**: What are the main environmental impacts of the different processing industries?

Pro-poor financial impacts

The feasibility study methodology sought to determine how much created value is captured by poor communities, compared with those being captured as profits by larger businesses, imported items costs (fuel), interest payments, or other expenditures that do not attribute value to the local rural economy.

We have used the term “pro-poor financial impact” to describe this local component of total revenue that is captured by poor communities. Part of the study fieldwork included surveys of business cost bases. The data allows the calculation of the proportion of total costs spent on the main “local” costs, such as labor and bamboo processing inputs and provides estimates of profit margins and other main costs.

Bamboo resources and labor together typically represented approximately 80% of the total cost of production for most bamboo processing industries with profit margins of approximately 7% (ranging typically from 0 to 12%). At the processor level, approximately 75% of revenue is captured by local costs compared to approximately 7% taken as profits. The notable exception is paper where we measure that only 33% of revenue is captured locally.

These estimates reflect the “factory gate” price paid for bamboo. Factory gate pricing includes the total local value-added and profit captured by farmers, traders and transporters along the local value chain. It includes local costs such as raw material, labor, local fees and profits of farmers and local traders but also transport costs. When bamboo businesses are sourcing bamboo from poor rural communities, this is a useful approximation of the value captured by poor communities.

However, these estimates are only proxy measures. The main limitations are that they might be subject to include:

- Under-estimating the total pro-poor impacts as they do not reflect the wider impacts of reinvestment of profits and surplus capital by farmers and local traders back into the local economy.
- Over-estimating the direct “pro-poor” impacts as they also include transportation fuel costs and do not differentiate between the benefits captured by non-poor farmers and traders and those actually classified as poor. For example, the study found that when transported up to 20km fuel costs may represent around 10% of the factory gate price.

Subsequent stages of work will look more precisely at attribution of value at various points in the market chain, and wider secondary impacts of supply chains. For the purposes of a feasibility study, the assumptions above are regarded as reliable in indicating the pro-poor nature of the supply chains.

Efficiency of impact

“Efficiency of impact” is a measure of total supply chain impact arising at all points along a domestic
value chain expressed per hectare of source bamboo production. It is determined for each of the individual industry supply chains for the five socio-economic measures outlined above (Table 5). The analysis is based on data obtained by the feasibility study from farmers, traders and businesses operating in each industry.

Table 5: Efficiency of impact of bamboo industry supply chains.

<table>
<thead>
<tr>
<th>Industry segment</th>
<th>Overall financial output</th>
<th>Pro-poor financial impact</th>
<th>Job creation</th>
<th>Total beneficiaries</th>
<th>Local Costs</th>
<th>% women in supply chain</th>
<th>% jobs in rural communities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$ per ha</td>
<td>US$ per ha</td>
<td>FTE per ha</td>
<td>farmers+ workers per ha</td>
<td>% of total costs</td>
<td>% FTEs</td>
<td>% FTEs</td>
</tr>
<tr>
<td>Handicrafts (VN)</td>
<td>14,300</td>
<td>11,300</td>
<td>39</td>
<td>40</td>
<td>85%</td>
<td>60%</td>
<td>95%</td>
</tr>
<tr>
<td>Bamboo Shoots (China)</td>
<td>3,800</td>
<td>3,100</td>
<td>0.4</td>
<td>1.1</td>
<td>90%</td>
<td>31%</td>
<td>100%</td>
</tr>
<tr>
<td>Flooring (VN)</td>
<td>3,100</td>
<td>2,400</td>
<td>1.2</td>
<td>1.9</td>
<td>85%</td>
<td>49%</td>
<td>35%</td>
</tr>
<tr>
<td>Chopsticks (VN)</td>
<td>1,600</td>
<td>1,300</td>
<td>1.1</td>
<td>1.8</td>
<td>85%</td>
<td>49%</td>
<td>46%</td>
</tr>
<tr>
<td>Woven mat (VN)</td>
<td>1,100</td>
<td>1,000</td>
<td>0.9</td>
<td>1.5</td>
<td>100%</td>
<td>42%</td>
<td>100%</td>
</tr>
<tr>
<td>Mat board (VN, panels)</td>
<td>1,300</td>
<td>810</td>
<td>0.8</td>
<td>1.5</td>
<td>70%</td>
<td>46%</td>
<td>98%</td>
</tr>
<tr>
<td>Charcoal (briquettes, China)</td>
<td>600</td>
<td>420</td>
<td>0.2</td>
<td>0.9</td>
<td>75%</td>
<td>37%</td>
<td>95%</td>
</tr>
<tr>
<td>Charcoal (briquettes, Lao PDR)</td>
<td>320</td>
<td>180</td>
<td>0.3</td>
<td>1.0</td>
<td>60%</td>
<td>38%</td>
<td>79%</td>
</tr>
<tr>
<td>Paper + pulp (VN)</td>
<td>1,500</td>
<td>490</td>
<td>0.3</td>
<td>1.0</td>
<td>35%</td>
<td>38%</td>
<td>66%</td>
</tr>
<tr>
<td>Raw culms (VN)</td>
<td>360</td>
<td>360</td>
<td>0.1</td>
<td>0.8</td>
<td>100%</td>
<td>31%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The most critical measures from a pro-poor perspective are the rates of pro-poor financial impact and employment creation. Against these two measures, the analysis in Table 5 confirms important differences between and within the different sub-sectors.

- **Handicrafts**: Very high rates of pro-poor financial impact and employment creation per hectare of bamboo are seen due to the highly manual processing of relatively small volumes of bamboo, with most benefit gained by small-scale processors and factory workers. This supports the argument that handicrafts are a distinct sub-sector, based on the sale of skilled craft labor rather than of large volumes of bamboo material.

- **Bamboo shoots**: Deliver high levels of pro-poor financial impact per ha due to the higher prices and yields of shoots compared to culms. In this sense, shoots are a high value agricultural crop. However, shoot farming creates relatively little employment. Most of the financial benefits are retained by farmers themselves and not distributed along the supply chain.

- **Industrial processing**: From a pro-poor perspective, 3 distinct industry groups emerge within the industrial processing sub-sector: Low-value and bulk; medium-value; and, premium processing.
In line with experience from China, the analysis allows for a further 10% employment creation in related activities such as handling, transportation, trading and wholesaling.

Low-value and bulk processing industries, such as charcoal, paper and pulp, have low rates of both pro-poor financial impact and employment creation. They achieve only marginally higher levels than selling unprocessed raw bamboo culms to the construction industry. This lower impact is partially offset by the fact that the industry can utilize low quality bamboo, leftovers and processing waste from other industries and various species.

Medium-value processing industries, such as chopsticks and mat boards (panels), create similar levels of employment as the premium processing industries but only half the pro-poor financial impact per hectare of bamboo. However, they are able to use lower grades of bamboo than premium processors.

Premium processing industries, such as flooring, have the highest rates of pro-poor financial impact and employment creation of the industrial processing industries, but require premium quality bamboo. Their rate of economic impact is twice the level of the medium-value processors and five times the level of the low-value and bulk processors. Similar results are demonstrated in China for laminated furniture industries.

Table 5 indicates this differentiation across products. Premium products require high value raw bamboo (species, culm size and quality) creating farmer income. They also create more jobs in the supply chain. But only certain parts of the culm can be used for premium products, so the value from premium products can only be realized through the development of an efficient mixed industry which is maximizing the utility of all parts of the plant. The critical factor to establishing a mixed industrial sub-sector is the presence of near-source pre-processing workshops which process bamboo culms into various parts (including waste), which are then transported to other factories for secondary processing (into paper, blinds, flooring etc). This innovation in the supply chain structure enabled China to reduce prices and enter a range of new product markets. It shifts material utilization rates from the current levels of sometime less than 30% in Mekong to upwards of 95% in China, increasing overall industrial sub-sector efficiency. Sector ‘industrial mix’ options for a bamboo industrial sub-sector based on 50,000 ha of bamboo for Vietnam or Lao PDR are shown in Figure 1. Thanh Hoa Province, Vietnam is the most advanced in its supply chain and approaches the ‘Medium Mix’ scenario.
Scale of impacts

The previously developed Mekong 2017 scenario of a US$ 1.2 billion bamboo sector (Table 4) combined with the rate data from the feasibility study and Table 5 provides an overall scale of impact across the various indicators (Table 6).

Table 6: Potential scale of impact of the bamboo sector by industry segment

<table>
<thead>
<tr>
<th>Industry Segment</th>
<th>Pro-poor financial impact</th>
<th>Financial output</th>
<th>Employment creation</th>
<th>Total direct beneficiaries</th>
<th>Area of bamboo</th>
<th>World bamboo market</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$ millions</td>
<td>US$ millions</td>
<td>FTE</td>
<td>People</td>
<td>ha</td>
<td>US$ millions</td>
</tr>
<tr>
<td>Handicrafts</td>
<td>266</td>
<td>336</td>
<td>920,000</td>
<td>936,000</td>
<td>24,000</td>
<td>4,200</td>
</tr>
<tr>
<td>Bamboo shoots</td>
<td>111</td>
<td>136</td>
<td>16,000</td>
<td>41,000</td>
<td>36,000</td>
<td>1,700</td>
</tr>
<tr>
<td>Wood furniture</td>
<td>217</td>
<td>280</td>
<td>106,000</td>
<td>170,000</td>
<td>90,000</td>
<td>5,600</td>
</tr>
<tr>
<td>Wood flooring</td>
<td>46</td>
<td>60</td>
<td>23,000</td>
<td>36,000</td>
<td>19,000</td>
<td>1,200</td>
</tr>
<tr>
<td>Wood panels</td>
<td>100</td>
<td>110</td>
<td>68,000</td>
<td>127,000</td>
<td>85,000</td>
<td>2,200</td>
</tr>
<tr>
<td>Blinds</td>
<td>47</td>
<td>60</td>
<td>41,000</td>
<td>44,000</td>
<td>4,000</td>
<td>1,200</td>
</tr>
<tr>
<td>Chopsticks</td>
<td>16</td>
<td>20</td>
<td>14,000</td>
<td>23,000</td>
<td>12,000</td>
<td>400</td>
</tr>
<tr>
<td>Charcoal</td>
<td>5</td>
<td>7</td>
<td>1,000</td>
<td>2,000</td>
<td>11,000</td>
<td>130</td>
</tr>
<tr>
<td>Activated carbon</td>
<td>6</td>
<td>9</td>
<td>1,000</td>
<td>3,100</td>
<td>18,000</td>
<td>170</td>
</tr>
<tr>
<td>Paper/pulp</td>
<td>35</td>
<td>110</td>
<td>18,000</td>
<td>69,000</td>
<td>72,000</td>
<td>n/a</td>
</tr>
<tr>
<td>Raw bamboo</td>
<td>60</td>
<td>60</td>
<td>24,000</td>
<td>141,000</td>
<td>167,000</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>909</td>
<td>1,185</td>
<td>1,232,000</td>
<td>1,592,000</td>
<td>538,000</td>
<td>16,830</td>
</tr>
</tbody>
</table>

The industry is separated into three independent sub-sectors: handicrafts, bamboo shoots and industrial processing. At a sub-sector level, the analysis leads to the following conclusions:

- **Handicrafts** are the most important source of employment creation, accounting for more than 75% of all employment in the sector under both scenarios. The pro-poor financial impact of handicrafts is substantial though they deliver relatively minimal benefits to farmers.
- **Bamboo shoots** represents the smallest of the three sub-sectors, but its high financial impact rate means that it provides 10%-20% of the pro-poor financial impact from employment rates of just 1% - 2%.
- **Industrial processing** emerges as the largest sub-sector in terms of pro-poor financial impact, accounting for up to 60% of the total pro-poor financial impacts of the sector. The sub-sector also consumes by far the largest share of bamboo (over 85%) and so is the most important sector for delivering large-scale benefits to poor farmers.
Environmental impact

**Cultivation and harvesting:** Bamboo has a number of environmental benefits as compared to industrial economic development options. The main environmental benefits of bamboo include:

- Bamboo is a sustainable cropping system for sloping lands, reducing soil erosion, and delivering sustainable farming systems;
- Bamboo is suitable for the recovery of degraded lands;
- Bamboo reduces rain run-off and downstream flooding and retains water within the watershed;
- Bamboo’s rapid growth rate and selective harvesting sequesters up to 12 tons of CO\textsubscript{2} per hectare. It releases 35\% more oxygen than equivalent areas of trees; and
- Bamboo may be produced with comparatively low inputs of fertilizer and pesticides (proposed models in this analysis have zero inputs assumed).

However, one main drawback is the biodiversity risk from the development of bamboo monocultures, but this risk needs to be considered in relation to the costs of alternative land use options.

The wider environmental impacts are primarily driven by the extent to which bamboo products are used as a substitute for hardwood and slow-growing timber. Greater use of bamboo as an alternative to hardwoods should contribute to a slowing in the depletion of tropical forests, with corresponding benefits for bio-diversity, conservation and carbon sequestration.

**Processing industries:** The main industries of concern from an environment perspective include paper/pulp and fiberboard production. The use of large quantities of chemicals and the production of significant volumes of wastewater pose serious environmental concerns to the local environment.

In other industries, the main potential environmental impact is from processing wastes, such as chips and sawdust, but also the chemicals used in the treatment of bamboo (e.g. hydrogen peroxide and borax). The volume of bamboo waste would be reduced in the proposed industrial models.

**Summary of impacts**

Each of the sub-sectors can make an important contribution to rural development and poverty reduction. However, as shown in Table 7, there are important differences in the nature of their impacts. The stars in the table show levels of impact, with one star representing low impact and five stars representing high impact.

<table>
<thead>
<tr>
<th>Sub-sector</th>
<th>Overall impact</th>
<th>Impact scale</th>
<th>Impact efficiency</th>
<th>Gender bias of impact</th>
<th>Rural bias of impact</th>
<th>Environmental Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pro-poor financial impact</td>
<td>Pro-poor financial impact</td>
<td>% of FTEs to women</td>
<td>% of rural FTEs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>US$ millions</td>
<td>US$ millions</td>
<td>FTE (000's)</td>
<td>US$ per ha</td>
<td>US$ per ha</td>
</tr>
<tr>
<td>Handicrafts</td>
<td>*****</td>
<td>***</td>
<td>***</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
</tr>
</tbody>
</table>
### Bamboo Shoots

<table>
<thead>
<tr>
<th></th>
<th>266</th>
<th>336</th>
<th>920</th>
<th>11,300</th>
<th>14,300</th>
<th>39.2</th>
<th>60%</th>
<th>95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo shoots</td>
<td>**</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>111</td>
<td>136</td>
<td>16</td>
<td>3,100</td>
<td>3,800</td>
<td>0.4</td>
<td>30%</td>
<td>100%</td>
</tr>
<tr>
<td>Industrial</td>
<td>*****</td>
<td>*****</td>
<td>****</td>
<td>**</td>
<td>**</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Processing</td>
<td>532</td>
<td>716</td>
<td>296</td>
<td>1,113</td>
<td>1,498</td>
<td>0.6</td>
<td>45%</td>
<td>62%</td>
</tr>
<tr>
<td>Total</td>
<td>909</td>
<td>1,185</td>
<td>1,232</td>
<td>1,690</td>
<td>2,203</td>
<td>2.3</td>
<td>56%</td>
<td>87%</td>
</tr>
</tbody>
</table>

### Handicrafts

- Handicrafts: are most important for employment creation and have the highest impact efficiencies although delivery of benefits to farmers is relatively minimal.

### Bamboo Shoot Production

- Bamboo shoot production: is a high impact niche that primarily delivers high levels of benefits to a relatively small group of farmers.

### Industrial Processing

- Industrial processing: is most important for overall pro-poor financial impact and is the only sub-sector capable of delivering widespread benefits to farmers.

  Premium processing has a high rate of financial impact efficiency, comparable to bamboo shoots, but on more than double the scale. It also creates more employment than all other areas, with the exception of handicrafts. The scale of the industry should be maximized to take full advantage of available premium grade bamboo.

  - Medium value processing creates substantial employment and pro-poor financial impacts. It has impact rates typical of the industrial processing sub-sector as a whole and should be expanded as part of a diversified industrial processing sector.

  - Low value and bulk processing have impact rates of only 1/5 premium processing industries, and correspondingly low total pro-poor impacts. However, the industry has an important role within a diversified industrial processing industry as a value-added user of low grade bamboo, leftovers and processor of waste from other industries.

  - Supply of raw culms has the lowest rate of pro-poor impact, but is an unavoidable part of the sector due to bamboo’s great versatility.

### Conclusion

Clear market growth opportunities coupled with appropriate conditions in the Mekong countries offer opportunities to access to growing global bamboo markets. The experience from China shows that under the right conditions, bamboo can be a lead sector for rural industrialization and large-scale poverty reduction.

Bamboo industries have been a key driving force in rural industrialization and widespread poverty reduction in Anji county, Zhejiang province, one of China’s 10 “bamboo homelands”. The benefit has been distributed across the whole population, with average household incomes for the population increasing by 220% in the first ten years of the bamboo boom.

Some researchers have suggested that the greatest impact was the catalyzing effect that bamboo had on the diversification of income opportunities (Ruiz-Pérez and Belcher 2001).

### Features for success

Several features were crucial to the dynamic growth of the sector in Anji:

- Strong demand and favorable market conditions:
Located in the heart of the Yangtze Delta region, close to the major Yangtze Metropolis around Shanghai and Hangzhou, Anji is ideally located to meet market demand.

- China’s logging ban in the 1990’s created additional demand for timber substitutes and led to a 10%-15% jump in bamboo prices over a single year;
- Consistent, sustained leadership from the Chinese Government targeted the development of the bamboo sector as part of economic development planning;
- Parallel development of processing industries and bamboo resources created a “virtuous circle” of demand for farmers products, increasing value-addition and capital in the local economy, as well as reinvestment and diversification of income opportunities;
- Local development of specialist processing technologies and equipment ensured appropriate, affordable equipment was available;
- Minimum scales of production suited to the resources of farmers, SME’s and local enterprises [e.g. typical area of bamboo in Anji was 0.6 ha per household (Ruiz Pérez, et al., 2004)];
- Lower perceived market risks due to diversity of uses of culms and shoots, leading to greater attractiveness of bamboo for farmers and processors; and,
- A readily available existing bamboo resource and a tradition of growing bamboo enabled exploitation of emerging market opportunities.

In addition, there were three pre-requisite policy reforms that paved the way for the rapid development of the bamboo sector in China, and will also be an important consideration for the Mekong countries.

- Land tenure systems: Clear land ownership and usage rights, characterized by 30-50 year land leases that allows for the transfer of rights to family and others.
- Supportive business environment: creating the conditions for a vibrant private (and collective) sector, especially small and medium enterprises.
- Market liberalization: Opening up of the economy to allow access to international markets and investors.

At the local level, several further points are worth noting:

- Heavy public investment in the development and dissemination of local processing technologies greatly increased their affordability and accessibility to local enterprises.
- Intensification of raw material production was critical to output growth with yields rising to 8.9 ton per ha from 4.9 ton per ha between 1978 and 1998. The area of bamboo cultivation increased by 16% while production of culms increased by 98%.
- Bamboo shoot production generated sufficient value for farmers to be a standalone industry driving poverty reduction, as happened in Li’nan County, but it also provided opportunities for diversification for bamboo farmers.

Recent developments and emerging lessons

Recent developments that have contributed to the growth of the industry, while also presenting new challenges, include:

- Emergence of a pre-processing industry, which greatly assists in achieving very high “added value” utilization rates of the bamboo harvested;
- “Nieyou” a traceability system in Anji allows for easy identification of the age and source of culms and is linked to harvest quotas and regulated by the Forestry Bureau. It has the potential to form the
basis of an effective “Certification” or “Chain of Custody” system;
- Quality is becoming an increasingly important requirement in the global market. Anji, and China as a whole, have not yet established a reputation for providing this;
- Raw material shortages and rising bamboo prices (US$85 per ton for “moso” culms in early 2006) are squeezing profit margins and limiting the output of individual businesses that are unable to secure enough raw material;
- Decreasing profit margins and excessive competition in several markets have driven increasing commoditization of some products; and
- Bamboo demand is driving an increasing risk of monoculture development and adverse biodiversity impacts, and requires attention to land use management policy.

The Mekong Countries’ Potential

Both Vietnam and Lao PDR have extensive bamboo resources. With comparative advantages in both raw material and labor costs, as well as an ability to develop competitive economies of scale (Vietnam, in particular), the prospects for the Mekong countries look strong. The scale of the opportunity for Lao PDR is more modest and will be maximized by linking with cross border supply chains (Vietnam, Thailand, and China).

The opportunity for Cambodia will also be modest, but is still considerable compared to the current size of its market. There remain business environment challenges in attracting investment into the large scale businesses required to achieve volumes in new bamboo supply chains. Compared to Cambodia and Lao PDR, Vietnam stands poised to develop a large bamboo sector in the Mekong, and can work as an engine for linked market opportunities for its Mekong neighbours.

The Mekong bamboo sector is poised for significant growth and widespread pro-poor impact. The feasibility study demonstrates that with appropriate support, it can grow from a US$ 250 million industry to a US$ 1 billion-plus industry by 2017, an industry with around 1 million jobs and a supply chain structured so that 75% of the financial impacts are pro-poor. The associated supply chain pilot in Thanh Hoa, Vietnam has shown early signs of this potential with recently introduced supply chain innovations resulting in a dramatic increase in near-source value addition and job creation. The details of this impact will be presented in subsequent reports from MPDF. Preliminary analysis shows that there are now a total of 10 new or converted pre-processing workshops creating 539 new jobs. Annual salaries from these are US$ 294,000 (US$ 550 per annum per worker) in an area where average incomes are less than US$ 100 per annum. Workshop sales of slats (pre-processed inputs to secondary processors to make high-value laminated products) have gone from zero to US$ 26,000 per quarter over a period of 6 months, a result of introducing the pre-processing supply chain innovation from China. On the production side, 533 ha of bamboo have been planted with direct support, and on the basis of current prices, will generate US$ 159,000 per annum starting from 2010. Raw material demand is increasing, and prices have increased 20% to the benefit of farmers.

Transferring resource development, industrial supply chain development, and technological and management experiences from the global market leader (China) is necessary and achievable as an important driver of the bamboo sector in the Mekong. Appropriate, targeted support is needed to create progressive farming and business environments and to ensure financial viability and good returns on investment for farmers, processors and others in the supply chain. This will help expand the success of the supply chain pilot, and enable an impact of the scale indicated in the feasibility study, thereby creating substantial pro-poor income into the future and potentially creating hundreds of thousands of new jobs in
the Mekong region.

References
