

The bamboo sector in Colombia and Ecuador: a state of the art analysis of opportunities and constraints

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Abstract—To get a deeper understanding of the factors influencing the bamboo sectors in Ecuador and Colombia with an emphasis on the countries' export potential, an elaborate SWOT analysis was conducted based on interviews with various key stakeholders in the countries' bamboo sectors. The analysis shows that the sector is improving but nevertheless is still hampered by various constraints, mostly based on a lack of commercialisation and marketing skills, which prevent both countries from fully taking advantage of (export) opportunities available.

Key words: Production chain; bamboo sector; Colombia; Ecuador; export potential; business development; SWOT analysis.

ABBREVIATONS

CBI	Centre for the Promotion of Imports from developing countries of The Netherlands
FSC	Forest Steward Councilship
GCI	Global Competitvity Index
GDP PPP	Gross Domestic Product Purchasing Power Parity
GTZ	The Deutsche Gesellschaft für Technische Zusammenarbeit (German Development Organization)
HDI	Human Development Index
HS	Harmonized System
INBAR	International Network of Bamboo and Rattan
NGO	Non-Governmental Organization
SENA	El Servicio Nacional de Aprendizaje (The National Training Service of Colombia)

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SME	Small and Medium-Sized Enterprise
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organization)
UNIDO	United Nations Industrial Development Organization
WCO	World Customs Organization

INTRODUCTION

Bamboo has already a long history in many applications in various mostly Asiatic cultures. However, in Western regions like Europe the market share of bamboo products is still rather small. Besides various factors caused by logistical problems in the production chain of the bamboo producing countries this is expected to be caused by a lack of product development and innovation capacity and skills locally, which is seen as a common factor of failure in companies in developing countries in general [1–5].

In China, the main bamboo exporting country, problems in the production chain are already being addressed and higher quality industrial bamboo products are being produced apt for Western markets. Various other regions are also trying to make this transition. This paper focuses on one of these regions, consisting of Ecuador and Colombia, mostly known for their considerable resources of *Guadua angustifolia* (in this paper referred to as Guadua).

Lately a couple of initiatives have been started to stimulate the development of the bamboo industry in Ecuador and Colombia, since the production and processing chain still has many weaknesses in these countries which prevents the full capture of opportunities for economic development [6–10]. Although because of these initiatives the first part of the production chain (plantation, harvesting, first processing) in the bamboo sector in Colombia and Ecuador has improved there are still very little high quality, value added products manufactured for export markets.

Besides local problems in the production chain it was expected that commercialisation skills (e.g., market knowledge, product design and product development skills), which are necessary to open up new markets, nationally and internationally, are largely lacking in the bamboo sector in Colombia and Ecuador. To evaluate this hypothesis with local stakeholders and to obtain a better understanding of other current problems and factors influencing the bamboo sector in Ecuador and Colombia a field trip to the region was made by the author.

The research objective of the study presented was to gain more insight in (i) constraints and problems hampering bamboos development in Ecuador and Colombia, resulting in small export numbers of bamboo products and (ii) available opportunities and competitive strengths of the bamboo sector in the region.

The focus of the enquiries was especially on commercialisation and product design with the perspective of opening up new markets abroad.

RESEARCH METHODOLOGY

Context analysis

The paper starts with an analysis to get a better understanding of the context in which the research takes place.

First, at a strategic macro-economic level both Colombia's and Ecuador's competitiveness were compared to other countries worldwide using various commonly acknowledged indicators of economic and human development. For this analysis various online databases were examined [11–15].

Secondly a literature study was done on current bamboo trade in the region targeted towards export markets. The literature study showed that quantitative data for bamboo trade worldwide, including Ecuador and Colombia, is hardly available from official sources. For international trade it is possible to retrieve some data, but the data is usually not specific enough because of the absence of specific Harmonized System (HS) codes of the World Customs Organization (WCO) for various bamboo product groups making it very hard to quantitatively assess bamboo trade in a holistic way [16] (Editor's note: these HS codes are available now but they arrived too late for inclusion in this study). The little data available on export numbers from Ecuador and Colombia for certain product groups are presented in this paper and compared to Asian export figures.

Accurate data about bamboo trade within Ecuador and Colombia self is not available at all, only some rough estimations are done in evaluating studies (see, e.g., Ref. [17]). However, the figures presented in these studies are based on assumptions about offer and demand and not on actual trade statistics. Because of the absence of accurate internal trade statistics more qualitative assessments and opinions of the various stakeholders provide a better source of information to assess the dynamics of bamboo trade within these countries.

SWOT assessment

After the context analysis the main part of the paper zooms in onto the level of the various stakeholders in the bamboo sector in Colombia and Ecuador. After conducting a literature study about previous research about specific problems and opportunities of the bamboo sector in Colombia and Ecuador [6–10], the core of the study was based on qualitative research mainly based on open interviews with local stakeholders using a list with appropriate keywords as guideline. In collaboration with INBAR and the Technical University of Pereira (John Jairo Ocampo, personal communication), a selection was made of key persons to approach expected to be representative for the various relevant stakeholder groups (micro-enterprises, SMEs, NGOs, governmental organizations, etcetera). The distribution of the interviewed stakeholders and the level of industrialization and export ambition of the companies involved are given in Tables 1 and 2.

Please note that there is no general accepted definition of SMEs, some definitions are based on quantitative standards (e.g., employee number or capital value), others

Table 1.

Distribution of respondents in stakeholder groups

	Companies			NGO/development cooperation	Academia	Government/ institutional	Consultant/ designer
	Micro	Small	Medium				
Colombia	1	2	1	1	1	1	
Ecuador		2	3	7	1	8	2
International				7	1		3

Note: in some cases more persons of the same organization were interviewed.

Table 2.

Industrialization level of interviewed companies

	Colombia			Ecuador		
	Already exporting	Export ambition	No export ambition	Already exporting	Export ambition	No export ambition
Raw material					1	
Handicraft		1	1			
Semi-industrial	1	1				
Industrial	1				2	

on qualitative aspects (e.g., management style, method of operation). For this paper the definition of the World Bank has been adopted [15]: micro-enterprise, up to 10 employees; small enterprise, up to 50 employees; medium enterprise, up to 300 employees.

The written interviews were analysed and labelled on internal strengths and weaknesses and external opportunities and threats for the various stakeholder groups in general with various Asian countries competing on the global bamboo market as a base of comparison. This SWOT analysis was further supplemented with data and information from previous literature research and observations of the author himself during the field visit. In this paper a selection by the author of the results from the SWOT analysis is presented that applies to both countries (unless stated otherwise), presenting the most important and most referred to aspects during the various interviews. Please note that the results are a generalization of the results of the interviews and represent opinions and observations of the respondents; they show the big picture but do not say it all. For example, there are many bamboo plantations and forests that lack good management but there are also some plantations that are run in a sound way.

The complete SWOT analysis and the list of respondents, including the keyword list used during the interviews, are too elaborate to print in this article. People interested in these documents are requested to get directly into contact with the author. Please note that the analysis is done on a sectoral level and is not a SWOT for individual companies or organizations (as the SWOT methodology is more

often used). Therefore, the results are an average representation for the various stakeholder groups.

CONTEXT

Macro economic analysis

Economic and human development. Looking at important development indicators of Colombia and Ecuador such as GDP Purchasing Power Parity (PPP, best available starting point for comparisons of economic strength and well-being between countries) per capita, the Global Competitiveness Index (GCI) and the Human Development Index (HDI), the indicators reveal similar results [11–13].

In general, the economy and human development (consisting of factors like life expectancy, education and income) and global competitiveness (macro-economic environment, state of countries' public institutions and technological readiness) of Colombia is performing significantly better than that of Ecuador (see Fig. 1). Colombia's purchasing power and competitiveness rankings are average compared to most South American countries. Ecuador is considered one of the poorer countries in South America and its economy still seems to recover from the transition to the dollar in 2000. However, the presence of guerrillas in Colombia is a factor which impedes Colombia's economic stability resulting for example in less foreign

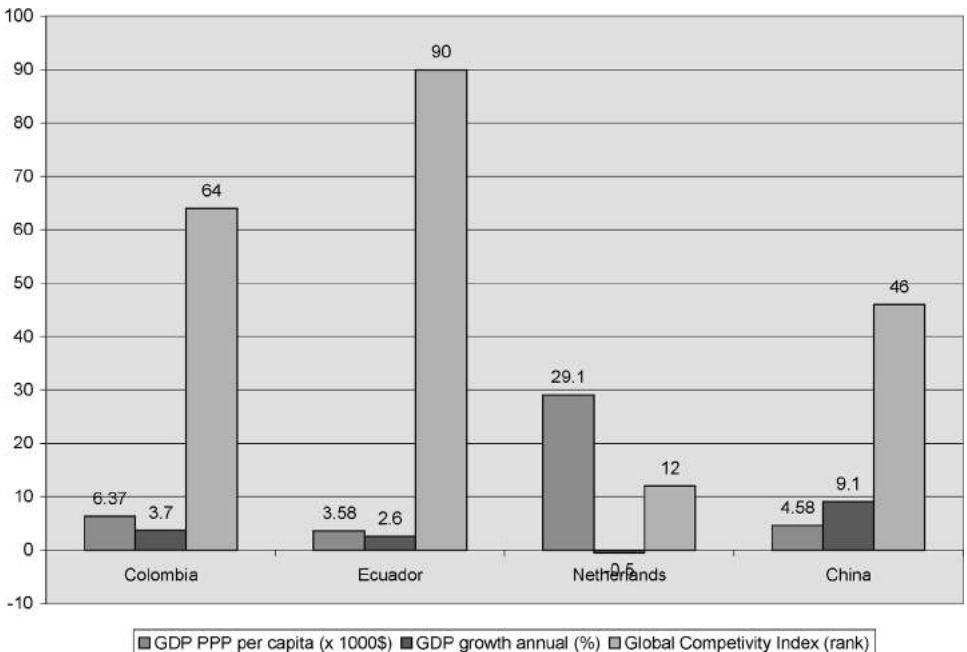


Figure 1. Comparison of GDP and competitiveness indices of Colombia, Ecuador, the Netherlands and China [11–13].

investment. On a global level both countries are situated in the middle group with respect to their competitiveness rankings.

Share of the agricultural, informal and SME sector to GDP. The share of the informal sector is relatively high in both countries (Colombia 53%, Ecuador 58%) compared to developed countries, but average for the South American region. The contribution of the large labour force of the SME sectors (Colombia 67%, Ecuador 55%) to the GDP is relatively low (Colombia 38%, Ecuador 20%) [15].

A problem of Colombia and Ecuador is the relative large workforce in the agricultural sector (Colombia 30%, Ecuador 30%) and the small contribution of this sector to the GDP (Colombia 13,7%, Ecuador 8,7%) [14]. This demonstrates the inefficiency of the agricultural sector. Industrialization of the agricultural sector and increased value addition to the products can help in making the agricultural sector more efficient and profitable.

Import and export. Export is mostly based on commodities with little added value, like petroleum, coffee, coal, apparel, bananas and cut flowers (Colombia) and petroleum, bananas, cut flowers and shrimp (Ecuador), generating less income than possible. Because of increasing competition through globalisation and the relatively high labour costs, Colombia's and Ecuador's main export products coffee, banana and oil face an uncertain future.

For import the most important commodities are industrial equipment, transportation equipment, consumer goods, chemicals, paper products, fuels and electricity (Colombia) and consumer goods, industrial raw materials and capital goods (Ecuador), which are more elaborated and manufactured products with high added value. The focus for Ecuador and Colombia should be on import substitution by self-production of these high-added-value products which at the same time could serve as export products for the future.

This problem of export of commodities with little added value also becomes evident in the bamboo sector (many bamboo products leave the country as bamboo stems with little added value).

For export both countries rely heavily on outlet to the USA, resulting in a large dependency. The European market has been hardly explored thus far and could provide opportunities as a new potential market. Little import and export takes place to and from the European Union (with the exception of Germany). This could have various reasons: the heavier product requirements, especially with respect to certification and sustainability issues in Europe, the larger distance (transportation costs), but also a lack of knowledge of the market, which can also be seen as an opportunity (a new market to produce for).

Bamboo trade from Ecuador and Colombia

Export from Ecuador. Figure 2 shows the export of bamboo from Ecuador in the period 2000–2004 for raw material and furniture [18]. The drop in 2001 can be

Bamboo Exports from Ecuador (x 1000\$)

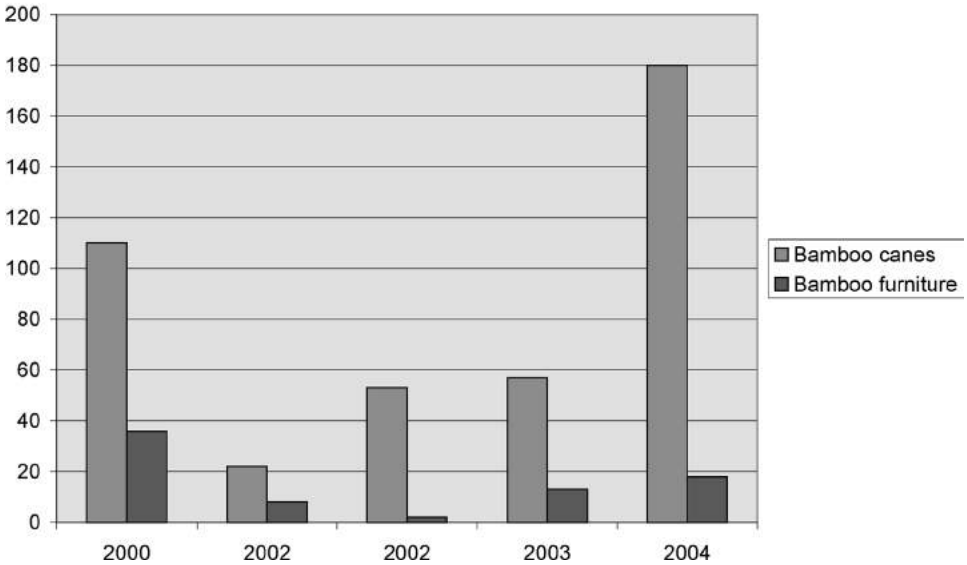


Figure 2. Export figures of bamboo products from Ecuador (adapted from Ref. [18]).

ascribed to the lack of mature raw material because of the high internal demand for bamboo from the social housing program ‘Hogar de Cristo’ [17].

Export from Colombia. Like Ecuador, export volumes and figures for Colombia are scarcely available. Some very rough data have been published by Becker *et al.* [16], who estimate that the export volume of *Guadua* products does not exceed a few hundred tons per year, which represents around 1 or 2% of the total *Guadua* harvest. The main part of the exported products have little added value: poles, followed by furniture and handicraft. These products are mainly exported to countries in the same region, export to Western countries is very small. For example, any peaks in export to Western Europe can be traced back to specific (small) building projects in that region.

Export from Asian countries. To put this data into perspective and show the marginal role Colombia and Ecuador play in the world trade of bamboo it is appropriate to compare data with export numbers from Asian countries. Asian exporters are by far the most important bamboo suppliers to Western Europe [16], but also to the USA [17]. China alone accounts for about 75% of the worldwide bamboo exports, followed by other Asian countries such as Thailand, Indonesia, Malaysia and the Philippines. The annual export value of bamboo products from China is about US\$ 600 million [19], of which US\$ 38 million is export of raw material (compared to Ecuador US\$ 180 000 in 2004) and \$33 million consists of bamboo furniture (compared to Ecuador US\$ 19 000 in 2004) [18].

RESULTS OF THE SWOT ANALYSIS

The summarised results of the SWOT analysis, based on opinions of the respondents, are presented in the sections below and are clustered according to their position and/or role in the production to consumption system:

- Plantation and harvesting.
- Processing.
- Commercialisation.
- Organization of product chain.
- Influencing external conditions/constraints.

These various steps/factors and their relationships are represented in the model in Fig. 3. Finally, a comparison of the strategic differences between Colombia and Ecuador with respect to their bamboo sectors is given.

Plantation and harvesting

Weaknesses in the plantation and harvesting phase of bamboo resources in Colombia and Ecuador, in general, are the lack of knowledge about appropriate bamboo plantation or bamboo forest management, resulting in low quality raw material susceptible to rot and splitting. Additionally, the lack of grading systems results in the harvesting of stems that are too old or too young. This is also caused by a lack of specific norms and regulations available for bamboo plantation management.

Furthermore, a lot of permits and fees are needed for harvesting (especially for sustainable harvesting complying with international certification hallmarks like FSC) and transportation. This might lead to bribing of officials to avoid the bureaucracy but also to the subsequent clear cutting of bamboo resources (threat), resulting in scarcity of bamboo forest.

Another threat is the increasing pressure on bamboo resources because of a rising demand for poles for low value applications (like props in banana plantations, Fig. 4), e.g. because of implementation of EUREGAP norms banana growers are obliged to replace plastic lints for supports from natural material like bamboo,

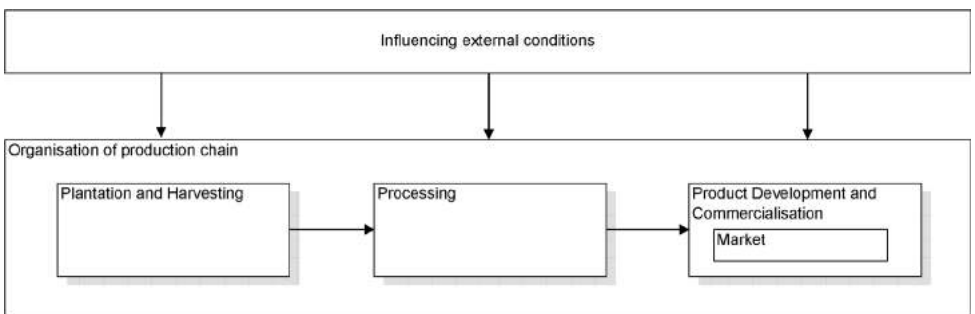


Figure 3. Model for clustering the results of the SWOT analysis.



Figure 4. Bamboo used for banana props in Ecuador.

leading to increased pressure on bamboo resources. This could result in a lack of raw material for applications with more added value. However, if the demand can be met by sustainable harvesting through existing resources this kind of development can also be seen as an opportunity.

One strength is the status of the endemic species *Guadua*, known as one of the strongest bamboos worldwide. However, a corresponding threat is that Asian countries with similar climatic conditions also start planting *Guadua*. On the other hand, there are also opportunities available looking at Asian countries. For example, it is worthwhile to look at the Chinese organization model in which the government facilitates individual entrepreneurship (providing management rights of small bamboo plantations). A whole different opportunity is to take more advantage of other species available in Ecuador and Colombia which are still broadly neglected, like *Dendrocalamus asper* or *Bambusa tulda*.

Processing

In the processing phase, one of the main weaknesses is lack of knowledge about preservation (which method to use, which preservative to use in which concentration, etcetera). Because many growers lack this knowledge the bamboo stems are more susceptible to insects and fungi, leading to lower quality. An environmental hazard is presented by the fact that many growers, when they do preserve their bamboo, dump the leftovers of the preservative directly in the environment (with relative environmental friendly preservatives based on boron this is less of a problem).



Figure 5. Multi-functional bamboo strip making machine suitable for *Guadua* designed by Jorg Stamm.

A promising development is the research about bamboo preservation and reproduction being executed at the Technical University of Pereira, Colombia. If the results could be disseminated in a broad way this could improve the situation. Likewise, there is a lack of knowledge about other important processing techniques like drying or post-harvesting treatment (e.g., leaking of sap from the stems on-site after harvesting).

In the consequent mechanical processing of the bamboo there are also various weaknesses to be considered. The opportunity mentioned in the previous subsection (competitive advantages because of the availability of the strong *Guadua* species in Colombia and Ecuador) is annulled by lack of innovations in processing technologies. There are very few machines available that are especially produced to process *Guadua*. In many cases Chinese machines are imported, that have problems with the strong, more diagonally oriented fibres of *Guadua*.

However, there are some entrepreneurs that are producing multi-functional *Guadua*-processing machines that could play an important role (Fig. 5). Another opportunity lies in transferring wood-processing techniques to bamboo processing, for example, the use of pressing machines used for bending wood to produce curved forms (bamboo is ideal for this because of its high flexibility). Furthermore, in general only a small part of the bamboo culm is used in bamboo processing, this is a missed opportunity since every part of the culm can be used for a whole range of value-added applications.

Finally, many opportunities to link to Western markets, usually requiring certain certifications with respect to quality management and Corporate Social Responsibility, are not grasped because the demands posed by these certification schemes are not met during the processing phase. On a social level the situation in many of the factories is unsafe and labour takes place in circumstances with little protection (danger, dirt, noise, saw dust, etc.). On ecological level there is no priority for use of ecological sound substances (glue, preservation, etc.); therefore, these products are expensive and only very scarcely available in Ecuador and Colombia.

Commercialisation

(Inter)national markets. Bamboo has a distinctive image attached, depending on the level of processing. For some consumers in Western Europe bamboo is associated with pleasant characteristics like exotic, durability, environmental friendly and strong. However, many consumers in Western Europe also see bamboo products as cheap and alternative, especially 'rustic' designs popular in Ecuador and Colombia are considered inappropriate, unless they are targeting for local or tourist markets (e.g., in Florida). In general, if consumers know about bamboo, the species *Guadua* has a better image because of its strength. In Ecuador and, in particular, Colombia, the commonly stigmatised image of bamboo as the poor man's timber is improving after the proven soundness of many bamboo structures during earthquakes in the last decennium.

Weaknesses besides the peculiar image of bamboo are related to lack of marketing knowledge in Colombia and Ecuador with respect to international markets. In general, there is little knowledge about needs, wants and trends in Western markets. Furthermore, there is a lack of knowledge about requirements and demands of international markets (e.g., certification issues, high consistent quality, delivery on time, high volumes), and if this knowledge is present than usually these demands cannot be met because of lack of production capacity. Also few outlets and market channels to Western markets are known.

Still there are opportunities to open up these international markets. For example, many Western bamboo products suppliers (e.g., bamboo parquet) want an alternative for Asian producers in order to decrease their dependency. Also, if companies are able to meet the stringent demands posed by Western suppliers, there are opportunities to establish international alliances/joint ventures with Western companies providing outlet and market knowledge at the same time. However, a lot of time is needed for the successful development of products for the Western market and establishing these market linkages. This requires a long-term vision which, especially through local smaller producers, is not always available.

An important role in opening up new markets is required through product innovation. In some cases this can be done in a very simple way by introducing an existing product in a new market (incremental product innovation). For high quality bamboo poles, for example, there are various small niche markets in the USA and Southern Europe for decorational purposes. Also, through radical innovation

(development of a complete new product often based on new technology) there are opportunities. For example, in the construction sector there are new interesting products developed based on the bamboo stem, like bamboo space-frame systems for temporary structures. But also innovations in packaging using knock-down/flat-pack techniques to lower transport costs could have considerable impact. Green marketing can then play an important role in the introduction of these bamboo products on the Western market as the most ecological sound material around and as an ideal substitute for wood.

In general, there are many opportunities through product innovation in niche market products for Western markets that China does not have interest in (the focus of China for export is on mass-produced standardized bamboo products). A comparative advantage of both countries over China is the small distance to the large Western export markets (USA, Europe), a disadvantage are the relatively high labour costs of Colombia and Ecuador compared to other bamboo-producing countries like China and India. A threat is the imitation of newly developed innovative products by Chinese producers for a lower price. However, by implementing a continuous innovation process there will always be a lead over imitators. By product diversification this risk is reduced even further.

A final threat is posed by the fact that in local market studies for international markets some products are not considered since they do not exist yet or still only have a very small share on the current market. A good example is the case of high-end bamboo furniture, although compared to the import of wooden furniture in the EU (US\$ 17.7 billion in 1999, of which 10% is derived from tropical countries [20]) the share of bamboo furniture is almost negligible (US\$ 5 million, or 0.028% of the wooden furniture market [18]).

However, this does not say anything about the potential market of bamboo furniture. Since almost every form available in wood can also be produced in bamboo through various processing techniques, a big part of the current wooden furniture market can be considered a potential market for bamboo furniture as substitute product. As shown before, the market for wooden furniture is prominent.

Product development. A weakness of many of the bamboo products developed in Colombia and Ecuador is the poor design, usually based on the stem (which has a considerable impact on the image of the product). Many products do not combine materials (mostly 100% bamboo resulting in a 'cheap' look), use little colours, are purely produced for decorating purposes (whereas for example the European market requires more functional products) and are presented in a mediocre way.

As mentioned before product innovation could be important in this context. Nevertheless, almost all entrepreneurs develop similar products based on copying existing products (usually from China) from each other, internet or television. Unsurprisingly, this strategy hardly results in any innovation. However, this strategy is not inappropriate in all cases, in some cases copying of Chinese products for

the local market (e.g., blinds) might be viable because of the large distance of the Chinese producers to Colombia and Ecuador (high transportation costs).

An opportunity to tackle the lack of product design and innovation capacity in Colombia and Ecuador is to integrate Western designers in the design process. This can be done by setting up strategic alliances with Western design schools or multi national companies. Obviously care has to be taken to make sure the design knowledge is transferred to local designers to provide a durable solution and to strengthen the local design capacity. Additionally a base of support for bamboo should be created in the West to get designers interested in the material. A concrete threat that arises is the loss of local cultural skills, customs and form languages if the focus of producers shifts too much to international markets.

Development of industrial bamboo products. As mentioned in the previous sections one of the main weaknesses in Colombia and Ecuador is the lack of product innovation skills and the subsequent copying of already existing products. This is especially true for industrially manufactured products (bamboo boards) in Colombia and Ecuador; they are in general inferior copies of the Chinese product, resulting in a need for product diversification. Other weaknesses of the industrial bamboo products have a more technical nature, like little knowledge and availability of appropriate glues for laminating, and species and age mixing leading to variations in quality of the bamboo boards. For the local market the product is relatively expensive and to really serve international markets a bigger resource base and additional production capacity is needed. Opportunities to provide this capacity can be reached if big players in already existing agro industries get involved or the many smaller companies are organized in such a way that they could provide a platform for the development of strip/board-based products (Fig. 6).

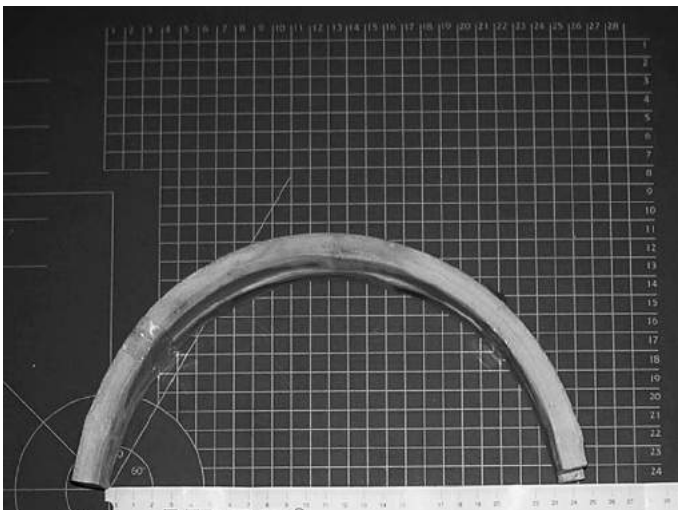


Figure 6. Bamboo strip bent after high temperature steam treatment.



SPRING CHAIR
100% Bamboo 36" H x 19" D x 17" W ©2005 Adapt DESIGN

Figure 7. High-end furniture fully utilising bamboo's strength and flexibility through processing technology innovations (design by Adapt Design, USA).

The boards, when made from endemic species like *Guadua* and *D. asper*, in general are harder and stronger than Asian species (e.g., *Moso*). Also thicker and broader strips can be made from *Guadua* and *D. asper*, which could lead to quality and cost advantages in bamboo boards. On an aesthetic level the visible structure of *Guadua* in, for example, flooring is coarser and less refined than flooring from Asian species. Depending on the taste of the customer this can be seen as either a weakness or a strength.

Finally, product differentiation based on existing technologies (e.g., laminated beams for large spans or bamboo-board-based furniture), but also using new processing technologies to take advantage of bamboos excellent mechanical properties (Fig. 6), can lead to new high-potential designs (Fig. 7).

Development of traditional bamboo products. There is a long tradition, especially in Colombia, of producing very skilfully and manually crafted bamboo products. These, usually stem-based, products are quickly associated with an exotic image and have niche markets in the tourist sector abroad or on the local market. Because of the high handicraft level also women and elderly people can be involved in the production process.

Some of the specific weaknesses of these traditional bamboo products for Western markets are the lack of functionality of the products, the general image of the stem-

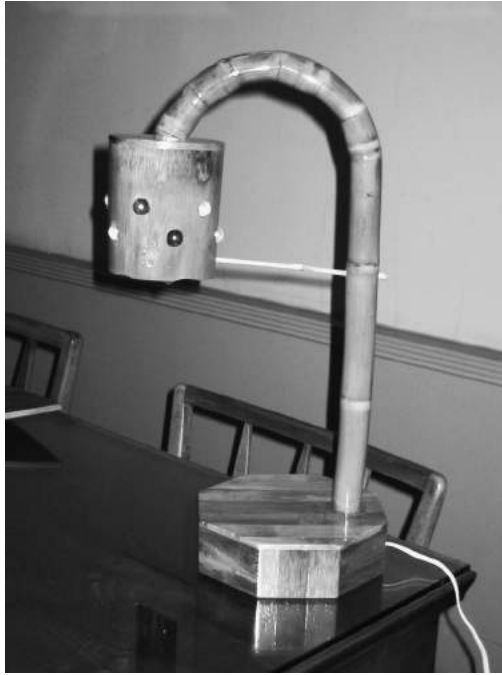


Figure 8. Example of a traditional bamboo product from Ecuador not meeting Western demands with respect to esthetics and safety.

based products and the tendency of these products to split in Western climates. Because of the individualistic attitude of most artisans producing the traditional products it is hard to associate these artisans, resulting in a lack of production capacity to meet big orders from abroad (Fig. 8).

However, opportunities for organizing these small producers are available through the involvement of international NGOs, for example, Fair Trade. If a product line can be set up, synchronizing the labour input of various producers in a modular–serial approach, a leap of efficiency and quality could be achieved. If the NGO also could provide additional market knowledge, even international markets could be targeted with traditional bamboo products that meet Western demands (Fig. 9).

Organization of the production chain

Human resources and capacitating. There are various projects being implemented through NGOs in both countries capacitating local people in various skills in the bamboo production chain, ranging from bamboo propagation to processing techniques and business management and product development skills. However, a weakness related to this strength is the training of the product development and design skills by Chinese trainers, and using Chinese processing and design techniques, resulting in little innovation in developed products. Also, in general there is little



Figure 9. Example of a traditional bamboo product with good quality and finishing produced by INBAR Ecuador.

interest in bamboo as a new resource for economic development in rural areas; a change of culture in local minds is needed first.

If the local people can be brought to understand the purpose and potential of bamboo, then there are various opportunities available. For one, especially in Ecuador the woodcraft guilds in the mountains have an extremely high skill level. If these guilds could be involved in the bamboo sector there are opportunities for new high-quality bamboo products available through them. For Colombia opportunities lie in the recent interest of big institutions, like SENA and Café de Colombia, in economic development through industrialization of Guadua. Especially SENA can potentially serve as a capacity base for local stakeholders in this process. If these local partners get involved also the vulnerability of many projects, now run by various international NGOs with a mandate and corresponding budget for only a limited time, is diminished and prolongation of the projects is assured.

Organization of the bamboo production chain. On paper both the stakeholders in the bamboo production chain of Ecuador and Colombia seem to be imbedded in the institutional sector and seem to be organised well. In Ecuador there exists an advisory organ for the bamboo sector, the ‘Consejo Consultivo del Bambu’, headed by the Ministry of Agriculture. In practice this organ is not functioning properly yet. In Colombia there seems to be a slightly better cooperation in the bamboo sector. There is an agreement for collaboration signed by almost all stakeholders in the Guadua sector (‘Cadena Productiva de la Guadua’) and a trade union has

recently been set up for the Guadua sector ('Fedeguadua'). Also, in both countries, and especially in Ecuador, there is financial and technical support from various international parties for the bamboo sector (e.g., INBAR, GTZ, SNV, CBI).

However, although the institutional framework for the bamboo sector in both countries is in place, there are still many weaknesses in the production chain. There is a lack of management and organization skills of entrepreneurs, resulting in few strategic plans being in place and no long term vision being present. Furthermore, there are too many actors in the production chain harming the small producers at the start of the chain (a lot of revenue goes to middle men), there is a lot of bureaucracy in the production chain, resulting in a long and tiresome process, and there are few trustworthy raw material suppliers providing good quality material of the same species and age. The existence of the institutional framework does not prevent the high level of mistrust and corresponding protectionism of local entrepreneurs in the sector resulting in little cooperation and exchange between stakeholders. Finally there are limited financial resources available to invest and further develop the production chain.

Ideally, there are opportunities available if the stakeholders in the production chain follow an integral approach in which every stakeholder acts as a small part in a big system based on a modular serial approach (e.g., supply of raw material or semi products by small producers, further processing by bigger parties, commercialisation through international organizations, etc.).

However, for such an approach to be only slightly successful facilitation and guidance of experienced international organizations is essential. With professional international help (e.g., through CBI, UNIDO) successful clustering is possible within the sector (see as an example the Ecuadorian flower sector) and potential outlet channels can be reached more easily. Nevertheless, these processes take a long time and require consistent, continuous coordination and guidance over a long period to make the sector eventually self-sustainable.

In such a process also many threats and weaknesses are present, like the fragile interdependency of small producers (not always complying with demands posed by Western parties for certification) and big producers/processors (could continue on their own after the project proves successful). Also, from a purely financial point of view integration of the production chain and compliance with certification policies, like Fair Trade, sounds very promising but make the process more complex, harder to manage and more expensive than when one big producer coordinates the whole chain by itself.

A final opportunity lies in the integration of coffee and banana producers in the bamboo production chain. Coffee grows in the same conditions in general as Guadua, in fact most coffee growers in Colombia have Guadua on their parcels. There lies a strategic opportunity if the bamboo and coffee growers use their channels and infrastructure for the development of the Guadua sector as a by-product. The same applies for the big banana producers in Ecuador.

Influencing external conditions/constraints

There are various studies with respect to bamboo being conducted at respected universities in the region, which can be considered as a strength. However, a lot of key research is also conducted at private companies and therefore not disseminated.

Furthermore, although especially in Ecuador there are opportunities for micro credits available, the demand is far higher than the supply and there are various downsides attached to the micro-credit regime like high interest rates, a long bureaucratic procedure and in some cases criteria for application that are impossible to meet.

Finally, there is little financial support in general from the government in the private sector. Governmental involvement usually only occurs after a project is already successful or when there is a strong international party involved in the project.

Strategic differences between Colombia and Ecuador

Although there are many similarities in both countries there are also various strategic differences which are summarized in Table 3.

CONCLUSIONS

The state-of-the-art analysis of the bamboo sectors in Colombia and Ecuador shows that there are many opportunities for the sector, but that there are also many drawbacks and constraints which impede utilization of these opportunities and hamper the successful development of the sector including the ultimate ambition to open up (inter)national markets.

The last years there is a large input nationally and internationally in Colombia and Ecuador to improve development and organization of the bamboo sector. And although there is still a lot to improve, this input has resulted in improved plantation management, harvesting and first processing, which are seen as important preconditions before even starting to think about commercialisation of developed products.

From various stakeholders in the bamboo sector it is heard that the next step for the near future should be the development and corresponding commercialisation of bamboo products for export markets. However, the skills and knowledge for developing, designing and marketing the right bamboo products, especially for urban and international markets are hardly available in-kind and are strongly required. Note that lack of product development capacity in Colombia and Ecuador does not stand on itself; it is an exemplary problem for bamboo commercialisation in most developing countries worldwide [21].

Meanwhile, with a lot of anxiety China is being observed, producing high quality, high quantity standardised mass products of bamboo. The question of how to compete with China returns again and again.

Table 3.

The biggest differences between the bamboo sectors of Colombia and Ecuador

Factor	Colombia	Ecuador
Amount of bamboo resources	Larger area of <i>Guadua</i> available (36 181 ha) [6]. Plantations: 4820 ha (<i>Guadua</i>)	Smaller amount of bamboo available (<i>ca.</i> 8000 ha, all species) [10]. Plantations <i>ca.</i> 4000 ha in total, 2215 ha with bigger producers
Plantations	There are almost no large plantations available. Most bamboo (<i>Guadua</i>) is a unexploited side-crop at the side of parcels and riverbanks. There are a lot of small producers who lack economy of scale	Various producers with big plantations (>300 ha) available
Dispersion of bamboo	Concentrated in 2 areas: Eje Cafetero and Valle de Cauca	Dispersed all over the country
Bamboo development through existing agricultural sectors	The coffee sector (e.g., Cafe de Colombia) could serve as a infrastructural base for <i>Guadua</i> development, especially since both crops grow in similar conditions	The banana sector uses a lot of bamboo as support poles, for this purpose only the top of the bamboo is used and the rest is still unused. Like the coffee in Colombia, the banana sector could serve as a infrastructural base for the development for the bamboo sector
Intra-sectoral cooperation	The <i>Guadua</i> sector (Institutions, NGO's, companies, government, etc.) in Colombia seems to cooperate better for the common interest of the development of the <i>Guadua</i> sector (Signed agreement of will by all stakeholders, Set up of Fede <i>Guadua</i> , Cadena Productiva, etc.)	The bamboo sector in Ecuador, although formally united in a national advisory board (Consejo Consultivo de Bambu), hardly cooperates, despite effort and support by the institutional sector national (CORPEI) and international (SNV, CBI, Dutch Government)

However, with a keen strategy the bamboo sector in Ecuador and Colombia can potentially distinguish itself from competitors, also from China. The key will be in innovation or differentiation of products and the creation of demand by design based on thorough market knowledge, utilising competitive advantages of both countries but also taking into account the specific qualities of endemic species (e.g., *Guadua*) and utilising the right technologies to take maximum advantage of these competitive advantages.

In order to execute this, an integral value chain approach and external support will be needed, both in coordination, technical know how, formation of strategic alliances and market channels and in integral product development knowledge (market, design, production, marketing, outlet). For the last part designers and product engineers from Western countries can play an important role, especially if

affiliation with contemporary business trends (e.g., Corporate Social Responsibility) can be reached. However, this is only part of the task ahead, which can only be achieved through a multi disciplinary team, including institutional support assisting the development of the complete production to consumption system of the bamboo sectors in Ecuador and Colombia.

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