Designing for Children
- With focus on 'Play + Learn'

Sustainability in Toy Design through Bamboo

Approaches to integrating the tenants of sustainability through design

Rebecca Reubens, Design for Sustainability, Delft University of Technology, The Netherlands, rreubens@gmail.com

Abstract: There is a growing public and private demand for toys which positively impact sustainability. Bamboo is an alternative that fulfills this criteria, since it is eco friendly, highly renewable, and does not cause deforestation. It is also a viable timber replacement material, and has the potential to create livelihood opportunities for both the rural and urban poor.
Most contemporary bamboo toys are made from industrially processed bamboo. This frees the product from common negative connotations associated with bamboo products such as 'low cost', 'rustic' etc. Actualizing these designs requires industrial production facilities. Consequently, the bamboo producer communities are pushed lower in the production to consumption and value chains of these products. From being final product producers, their role becomes limited to the raw material, and at the most primary processing of bamboo.
This paper looks at exploring bamboo as a sustainable material holistically, rather than simply focusing on its ecological potential.

Key words: sustainability, bamboo, toys, design.

1. Introduction

There is a growing public and private demand in urban and especially developed country markets for environmentally friendly and socially equitable products, systems and lifestyle options. Bamboo is an alternative that fulfills all of these criteria, since it is eco friendly, highly renewable, and does not cause deforestation. It is also a viable timber replacement material, and has the potential to create livelihood opportunities for both the rural and urban poor. Bamboo forests are known to produce 30% more oxygen and greater biomass than hardwood forests of the same size, simultaneously preventing soil erosion and restoring degraded lands. Bamboo also helps mitigate water pollution due to its high nitrogen consumption, which makes it a good solution for wastewater treatment. It is the

fastest growing species on the planet, and regenerates without replanting if harvested and managed properly.

The applications of bamboo for modern lifestyles are not limited using it a timber replacement material. Innovative uses of bamboo range from the Asus Bamboo Eco book computer and the I Pod Bamboo Shuffle case, to bamboo textile products ranging from bed linen to lingerie, to bamboo houses, furniture and lifestyle accessories, to bamboo crash helmets, medical products and cosmetics.

The market for bamboo toys is on the rise, owing to the ever growing demand for eco friendly and sustainable childrens products. Sustainability and children are closely linked since the idea of sustainability is highly relevant for the future generations. Bamboo is now replacing hard wood bit by bit in traditional wooden toys. Companies such as HaPe International, have recognized the 'green' quotient of bamboo, and are advertising their eco friendly philosophies to an eco conscious market. Clearly, contemporary toy and product design, including designers, design research, design institutions, and design driven companies, are attracted by the possibilities bamboo offers.

Workshops and projects such as 'Bamboo boards and Beyond' (Ranjan, NID, 2002) and 'Dutch Design meets Bamboo' (Pablo van der Lugt, Delft, 2007), have successfully explored the possibility to design innovative high quality products made from bamboo. Both the workshops mentioned above subscribed to the 'technology push' approach, whereby the common negative connotations associated with bamboo products, such as 'low cost', 'rustic', 'bad quality', 'handicraft' etc., were addressed by using bamboo in an industrially processed form. Doing this allowed the market to see the product free and apart from these associations and opened up new market opportunities for these products. In the area of bamboo toys as well, a lot of the bamboo toys being developed or available in the market use industrially processed bamboo or bamboo composites as an input material, in line with the 'technology push' approach described above. This approach clearly segments contemporary bamboo toys, separately from traditional bamboo toys in terms of production to consumption systems.

The positive interventions these products, design concepts and explorations of new processing techniques on the commercialization of bamboo as a sustainable material for the future are tremendous. However, actualizing these designs requires industrial production facilities, and this factor limits the involvement of bamboo producer communities in their production cycle. In the case of these 'technology push' products, the bamboo producer communities are pushed back one step lower in the production to consumption and value chains of these products. From being involved in the value chain from growing to production, their role limited to the growing, management, harvesting,

transportation, and at the most primary processing of bamboo. For this reason, more focused thought, and strategy development needs to go into the potential of bamboo as a material which strongly allows for socially equitable production, side by side with exploring the commercial and design potential of bamboo.

Figure.1 'Contina' line by HaPe is said to be the first commercial 100% bamboo toys

Bamboo has the potential to play an important role in generating a renewable and sustainable source of income and employment and providing a viable eco friendly livelihood option to the poor bamboo producers and processors, especially those in Asia, Africa and Latin America. It is easily available to poor communities in their natural environment, and in some cases even their homesteads, and it can easily processed by them including marginalized producer groups such as women. The development of bamboo based enterprises requires low capital, raw material and tools and machinery investments as compared to other micro – small and medium enterprises. This fact is recognized by companies and designers who are looking to find production possibilities in developing and

underdeveloped countries in Asia, Africa and Latin America. The idea behind this is of course that bamboo is easily available here and therefore production here is cost effective; but more importantly the product gains sustainable value if it is produced by local bamboo processors. The linking of the poor producers in the South, to the rich consumers in the North and South enables the dual self reinforcing leveraging of the production opportunities of rural community enterprises, and niche, social, and commercial markets in the North and South.

The need is now for designs which explore bamboos potential contribution to sustainability more holistically, rather than simply focusing on its ecological potential. The onus is on designers, who need to develop design driven bamboo toys for urban markets, which go one step beyond focusing on the eco friendly characteristic of bamboo, and look strongly also at ensuring and cultivating the social, cultural and economic tenants of sustainability.

2. Background/Problem Analysis

In this section, the different reasons for contemporary designed bamboo products including toys, being strongly technology intensive are explored. This takes into account some of the reasons why new industrial processes and technologies, which exploit and bring to the fore previously unknown possibilities with bamboo as a material, are the thrust area for the development of sustainably designed bamboo products.

2.1 Constraints of the natural bamboo culm

The culm is the part of bamboo most used for production irrespective of whether the product is handicraft, handcrafted, or industrial. In the case of toys which are not technology intensive, the nature of the cylindrical culm and what is possible with it production wise in a non industrial set up, is a limiting factor for the designer and manufacturing process. The product innovation process for stem based products is most difficult, because when used in its natural form (stem) there is limited form variety possible for designers that want to work with bamboo (Larasati).

Culm diameter, which can be anywhere from 30 cm to less than 1 cm, is very important when designing a whole or round bamboo product, i.e. when using the bamboo in its natural, cylindrical form, or even when making bamboo boards or when attempting to cover large areas with crushed interlaced bamboo strips, or when making splits (lengthwise sections of culm) or slivers (lengthwise sections of splits. Other characteristics and morphological features of the culm such as culm diameter, culm wall thickness, internodal length, behaviour of culm after drying, shrinkage after drying, warping after

drying, discoloration and culm shape, are all factors that dictate the usage of the material and even the aesthetics of the product in certain cases. (Reubens, 2007)
These are some of the technology oriented reasons that designers and product innovation teams choose to work with processing technologies which are more industrial in nature.

2.2 Constraints of 'craft' production system

Bamboo is usually known in very traditional products using traditional techniques, however many different products, using different technologies, can be created from bamboo delivering a completely new identity and image. (van der Lugt, 2006) Most bamboo products are produced in 'traditional' or 'craft' set ups. This is natural considering that bamboo working is an ancient tradition which has almost always been prevalent in cultures which have had easy access to the raw material of bamboo. Bamboo working in many parts of the world has been traditionally done by certain communities or specific social groups as a trade and passed down from generation to generation. (Reubens, 2007) For this reason, even today, splitting, slivering, bending by heat, flattening, interlacing, and using in the round form are common 'low tech' material manipulation possibilities of bamboo, commonly used for the bulk of production of bamboo products, including toys. Though a wide range of product categories can be produced from bamboo using these few basic techniques, when it comes to modern markets, these products find it difficult to compete in terms of quality, standardization, and aesthetics.
In many cases the accuracy required from a 'designed' product, is very different from a 'crafted' product. It is very difficult to achieve this accuracy given most of the existing setups which employ the above discussed techniques for production.
This is especially relevant when the products are to be exported, and so have to pass stringent standards. Some of the main weaknesses of the commercialisation of bamboo culms over the production chain acknowledged by Flanagan (2004) and CORPEI (2005) are: insufficient drying, inadequate preservation, and damage by insects, cracking, burn marks from sloppy bending, difficulty in joints, problems with shipping & import, and a negative perception by much of the US population. These problems exist less for industrial bamboo products, however chemical additives (adhesives, finishes, preservatives) used during production can damage the sustainable image of bamboo products (Flanagan, 2004).

2.3 Lack of Knowledge about non conventional production set ups

Too few designers are working with bamboo compared to other industrial materials, and this results in too little bamboo toys apt for commercial markets. The lack of involvement of designers also results in a lack of product innovation. More opportunities are expected

to be available once bamboo products are developed based on the specific strengths of bamboo, distinguishing bamboo designs from other materials and not simply copying wood processing techniques. (van der Lugt)

There is a definite gap between markets for bamboo products, and the producers producing the bamboo products. Currently, the rural bamboo producer groups are unable to perceive and cater to these contemporary markets, because there is no direct link between the producer and the buyer, unlike in the traditional market set-up they are used to functioning in, and so these markets are unfamiliar to them. Consequently, though the markets exists on one hand and the skills and infrastructure to cater to these markets exists on the other, the inputs and feedback from the markets do not reach the rural producer groups, and so they are not in sync with urban markets, in terms of market preferences, trends, lifestyle etc. To bridge the infrastructural gap between the rural producer and the urban buyer, there is a need to link the poor producer groups to designers and other technical experts who can identify and elucidate potential markets, and function as support systems towards making the rural communities reliable and dependable producers of quality goods in quantity, in line with markets.(Reubens 2005)

Design has always been positioned to be the link between production and marketing, and so the designer is one of the most important players in the production to consumption cycle. This fact applies to both the familiar industry set ups which designers are trained to function in, as well as to 'development' oriented set ups, (such as where rural bamboo producers form the enterprise), which are largely unfamiliar to designers in terms of structure and working.

Urban designers, tend to apply methodologies which have been developed keeping in mind conventional industries and clients to these rural enterprises and producer communities. The result is often designs which do not succeed, or do not realize their full potential, because of sociological reasons (such as the dynamics of a caste system, or material culture parallels by the producers), organizational reasons (lack access of working capital) or logistical reasons (bad infrastructure and communication, health of workers, transport etc.) These same factors that are so crucial to the success of a product in a 'development' set up are taken for granted in a conventional set up.

For this reason, it is important for designers to be given a checklist of issues or framework of guidelines to look into before venturing to design a product that will be manufactured by BOP producers to enable them to understand better the finer points of development scenarios.

In the absence of this, the designer will not understand clearly why the product is not successful or cannot be manufactured, and will eventually veer towards the familiar

conventional industrialized set up or 'technology push' approach, which is comprehendible and thus manageable by him.

2.4 Associations and perceptions connected with bamboo

Bamboo stem based products in general have a poor image and are perceived by EU consumers as being low quality and non durable (CORPEI, 2005; Held, 2004; Larasati, 1999). One of the reasons for this is that bamboo products are generally produced in rural or peri-urban set ups, and when they are transported to the place of sale, the culms shrink due to changes in moisture and temperature, and consequently crack. These cracks further encourage decay caused by both environmental and climatic factors. This can be prevented to a large extent through good preservation techniques, and also by creating awareness about bamboo's properties, limitations, usage options, etc. among the designers, constructors, fabricators and, of course, users.

Part of the reason for the lack of innovation in the area of bamboo design stems from the fact that a lot of contemporary designers are not very attracted to bamboo as a material. This is because they associate bamboo product development with whole culm usage alone and they do not prefer to work with whole culms because of the limitations from the production point of view and also the 'traditional' or 'craft' connotations attached to this. Such image and perception oriented reasons lead designers and product innovation teams choose to work with processing technologies which are more industrial in nature. For this awareness generation regarding bamboo composites and high-tech applications is necessary as well as information on less industrial technologies, such as those related to bamboo culm usage, such as different culm cross sections through use of moulds, turning the culm on a lathe to achieve perfect dimensions, etc. (Reubens 2007)

3. Methodology and Approaches

The greatest limitation for designers to develop responsible products is lack of knowledge and awareness of the tenants of sustainability and how to actualize designs based on them. Sustainability is based on four tenants i.e. economic, ecological, social and cultural. Given the immediate fragile environmental situation, there is a tremendous impetus to design products based on the ecological tenant. Designers need to be made aware of the need to design a product or system which integrates all the four tenants so as to have a holistic approach to sustainability. Viewing product development through a holistic framework of sustainability would make it possible to develop products that are simultaneously commercially viable, eco friendly, culturally sensitive, and socially equitable. Some methods explored by the author are as under:

3.1 Standardizing culm based products

The inability to standardize bamboo products due to the organic nature of the culm has been discussed earlier. Industrial design philosophies, such as modularity and knock down systems need to be applied to bamboo toy design sensitively, so as to facilitate packaging and production efficiency. One solution explored in this regards is turning the bamboo on a lathe so as to standardize the outside dimension. This is especially viable when solid bamboo species, such as *D. strictus*, are turned on a lathe.

Figure.1 Poorva K. from NID working with craftspersons to turn solid bamboo on a traditional lathe

3.2 Restructuring Bamboo

Many of the limitations of the culm can be resolved by restructuring the culm. Basically, once the culm is broken up and put together again, a new material is created, which has its own properties and characteristics, both in terms of form and function. There are many industrial methods of restructuring the culm, such as bamboo fiber, veneer, board etc. Restructuring the culm through a pro poor technology is a challenge, since adhesives which thermo set are required for production to function in a village set up. The most traditional way of restructuring bamboo is weaving.

Figure.2 Educational toys for hearing impaired children made from interlaced bamboo

3.3 Combination with other materials

Combination of bamboo with other sustainable materials helps often leads to interesting products. The 'sustainability quotient' of the toy is upped if these materials can be disassembled easily, or the combination material is reused, renewable or recycled.

3.4 Adaptation of traditional wood techniques to bamboo

Deforestation is damaging the environment as well as creating a shortage of material for traditional wood workers. Traditional wood craft techniques, such as lathe turning and lacquer work have been adapted by the author to bamboo. Shellac being a natural material is non toxic, and this is ideal for finishing toys. The turned and lacquered bamboo toys integrate the social, cultural and ecological tenants of sustainability, since they are produced by poor producers, rooted in a craft culture, and are eco friendly since shellac is a natural resin.

Figure.3 Turned bamboo toys finished with lac produced by woodworking craftpersons

4. Conclusion

Bamboo has the potential to be a truly sustainable resource, given that it can integrate all the seemingly opposing tenants of sustainability. Beyond policy interventions, responsible and informed design is key to ensure that 'sustainability' is more than a superficial concept used by marketing gurus. Responsible design needs to take into consideration sustainability vis a vis the producers, the craft culture, the material, the value addition chain, transportation, and the impact of the product on our world. Consumers need to be offered a well designed sustainable product to be able to make an informed choice.

References

Ehrenfeld, John R. (2008) Sustainability by Design: A Subversive Strategy for Transforming Our Consumer Culture. Yale University Press.

Liese, Walter. (1998) The Anatomy of Bamboo Culms. International Network for Bamboo and Rattan, Beijing.

Lopez, Oscar Hidalgo. (2003) Bamboo, the Gift on the Gods. D'VINNI, Columbia.

Lugt, Pablo van der. (2007) Dutch Design Meets Bamboo. (Z)oo Producties. Eindhoven.

Reubens, Rebecca. (2002) Cane and Bamboo Lifestyle Accessories. Faculty of Industrial Design, National Institute of Design, Ahmedabad.

Reubens, Rebecca. (2007) Bamboo Products: Design Aspects - Their Relevance . Course 4: Bamboo and Enterprise Development. Block 1: Bamboo Products, Unit 1. Indira Gandhi National Open University, International Network for Bamboo and Rattan, Common Wealth of Learning. 2007. <http://wikieducator.org/Bamboo_and_Rattan/Bamboo/Course-4_Unit-1>

Reubens, Rebecca. (2009) Bamboo in Sustainable Contemporary Design. International Network for Bamboo and Rattan. Beijing.