

# MAINSTREAMING BAMBOO AS A BUILDING MATERIAL IN THE CONSTRUCTION SECTOR GLOBALLY

Supported by WBO

**Ar. Neelam Manjunath, CGBMT, INDIA**

**Ar. Rúben Boas (research associate), Volunteer, CGBMT**

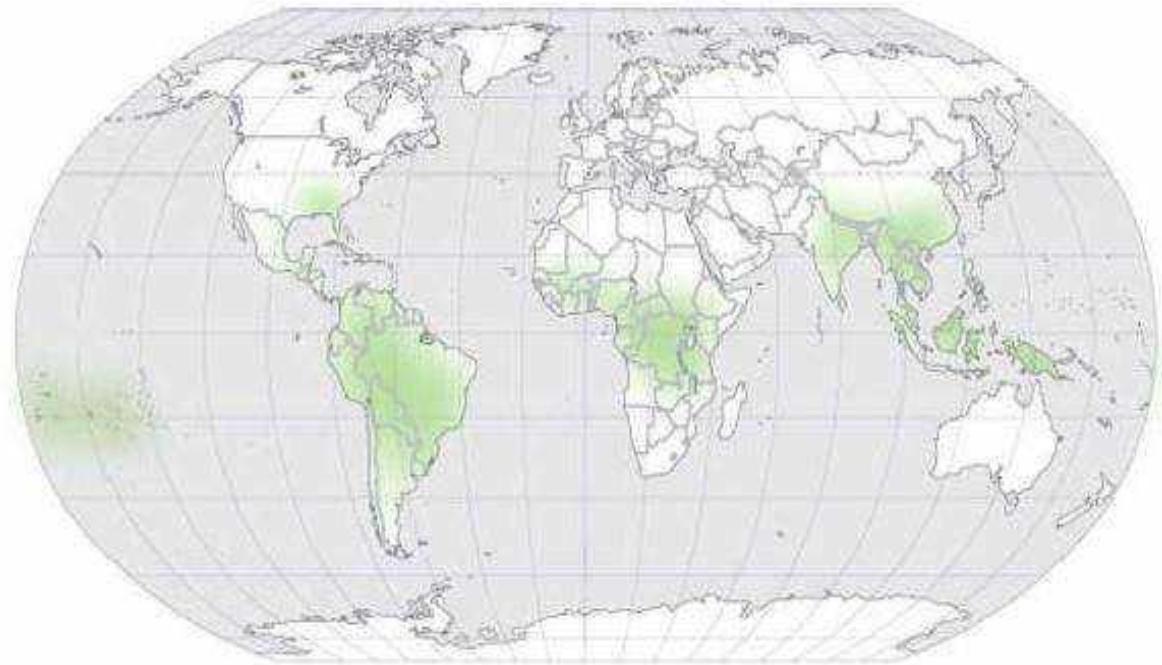
**CGBMT & ArchDaily – survey partners**



# INTRODUCTION

**BAMBOO** holds the potential to create

- Safe
- Economical and
- Eco friendly buildings and Infrastructure



Global distribution of bamboos  
*Lobovokov 2007*



1200 species of bamboo in 70 genera found across the world with its distribution closely resembling the population density distribution

- It could be the vehicle of an integrated development for millions below the poverty line
- an agent of equity of resources to the masses on the planet.

# PROBLEMS FACED

- A majority build construction with Bamboo as more out of **compulsion rather than by choice**
- The **traditional technologies** of construction with Bamboo have **gotten lost**.



<https://pixabay.com/en/hut-bamboo-home-shed-shack-475999/BAMBOO>



<https://www.flickr.com/photos/goimonitor/15533410137>

- **Research on Bamboo** as a building material remains on paper and does not reach the market
- The institutions , organizations and civil societies are plagued with **severe dearth of resources**.



Before proposing solutions to mainstream Bamboo as a building material in the construction sector, the *status quo* with regards to the material had to be undertaken and therefore CGBMT circulated a global survey with the assistance of ArchDaily.

## I - FORMULATION OF GLOBAL SURVEY

## II - RESPONSES RECEIVED

## III - ACTIONS POINTERS BASED ON THE SURVEY

## IV - THE SYSTEMIC ACTION PLAN – STAKEHOLDERSPARTICIPATION GUIDELINES

## V – CONCLUSION

# I - FORMULATION OF GLOBAL SURVEY

- Assessing the status of usage of bamboo as a construction material by building professionals

## CONTENT

- 15 multiple choice questions and an open question in which the participants could add information / suggestions

## SOFTWARE

- Google Forms tool

## TARGETED AUDIENCE

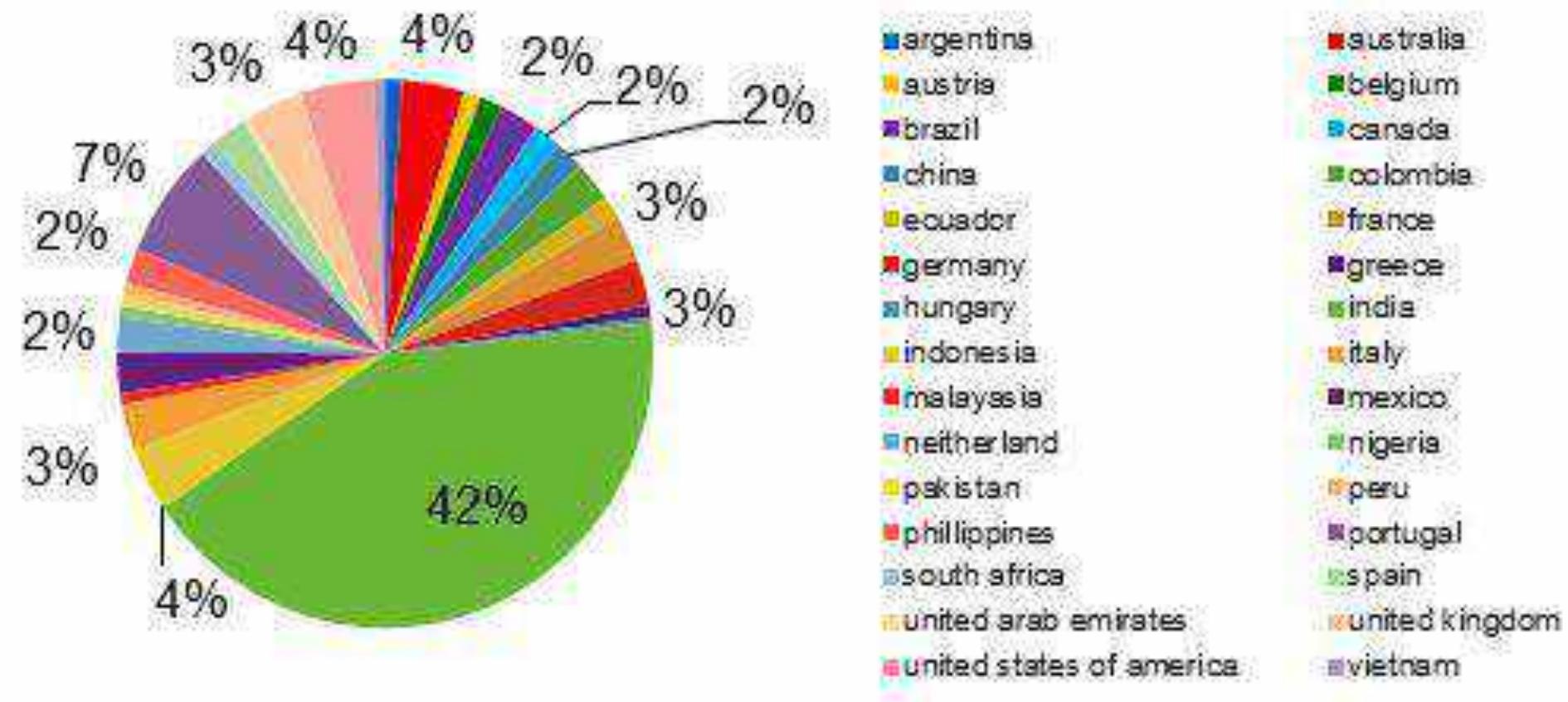
- Arch daily online -<https://www.archdaily.com/886269/is-it-possible-to-massify-the-bamboo-as-a-building-material-in-the-construction-sector>

## II - RESPONSES RECEIVED

- 276 responses were received from more than 30 countries.
- The majority of the respondents were aged 20-39.
- A larger participation was received from India due to the proximity allowed by the social platforms.



Country of Professional Education:



Break-up by continent:

Asia – 61%  
Europe – 20%

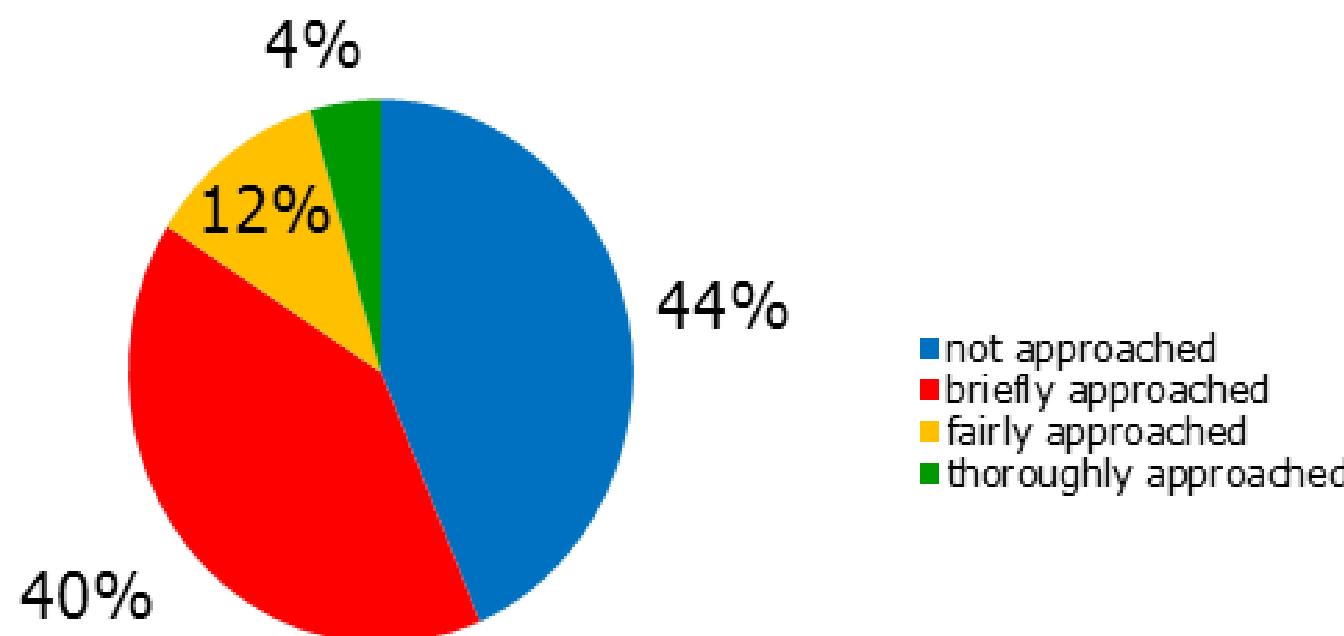
Americas – 17%  
Africa – 2%

Oceania - <1

- Asia contributed with 61 % of the responses.
- Bamboo is not native from Europe, they showed a significant interest on the subject with 20% of the replies.

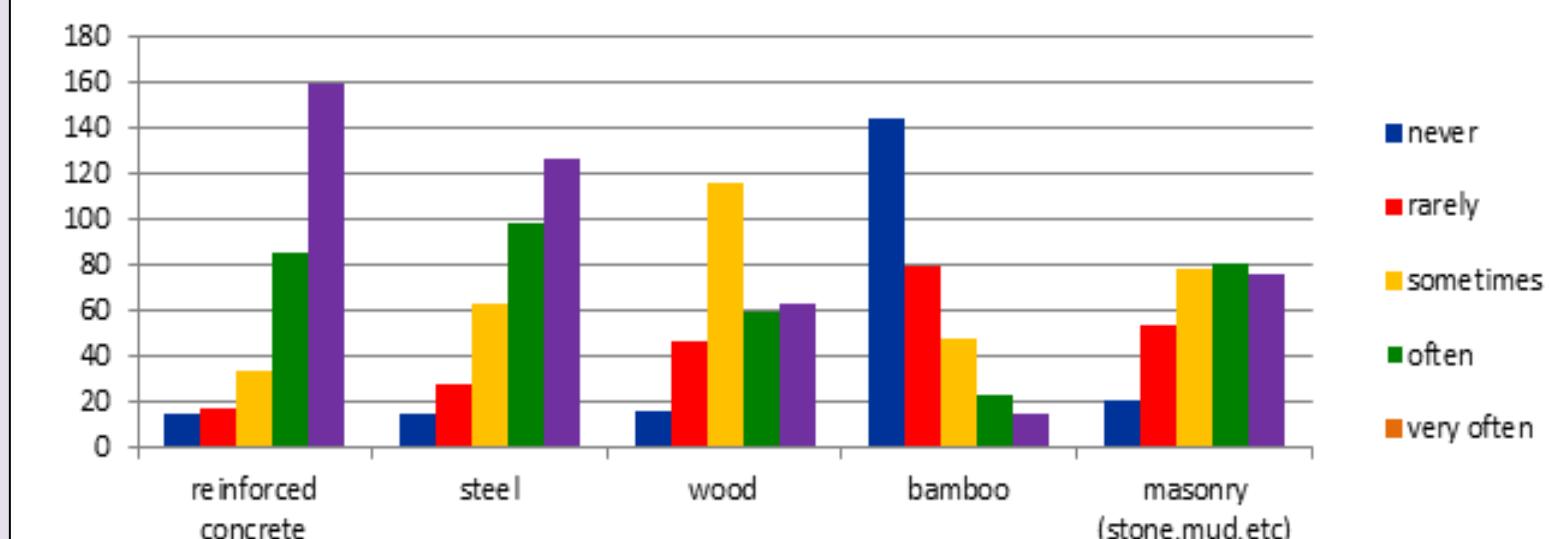
# ACADEMICS

1. During your degree, how thoroughly approached was bamboo as a construction material?



approached or briefly approached as a construction material during their graduation.

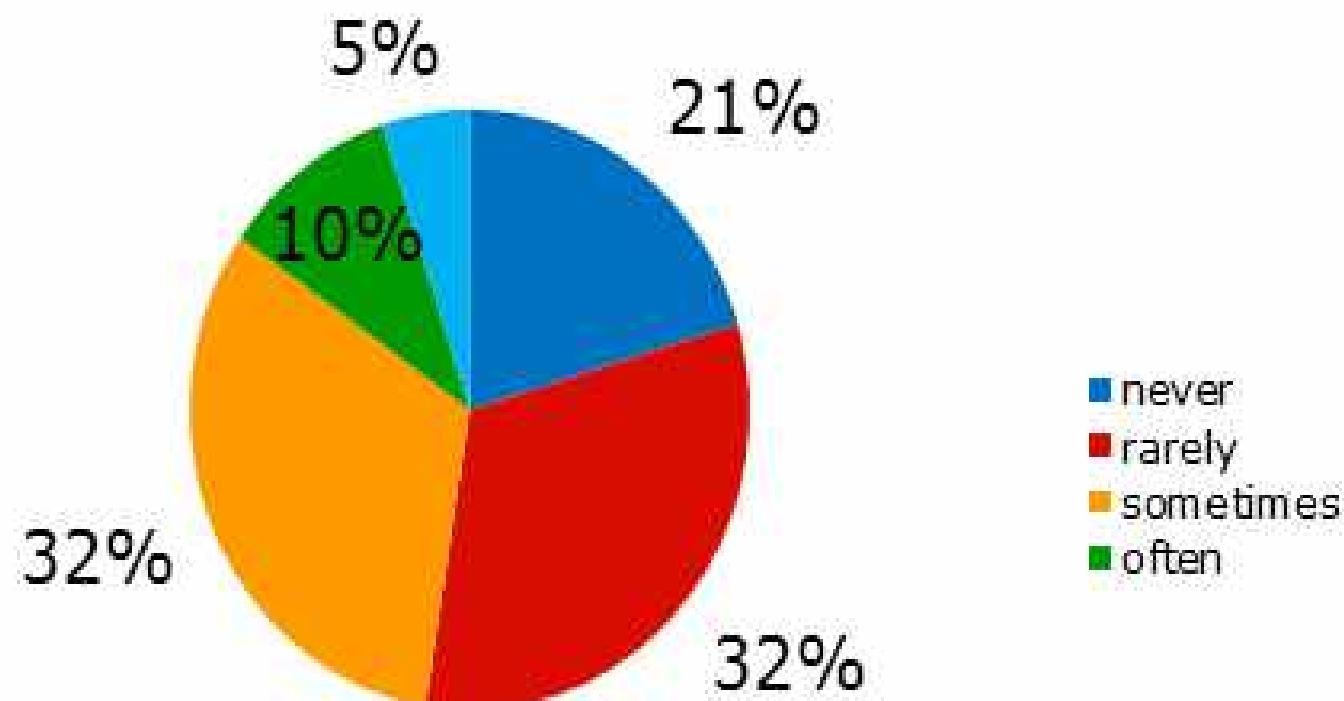
2. How often do you use the following materials as a structural element in your projects?



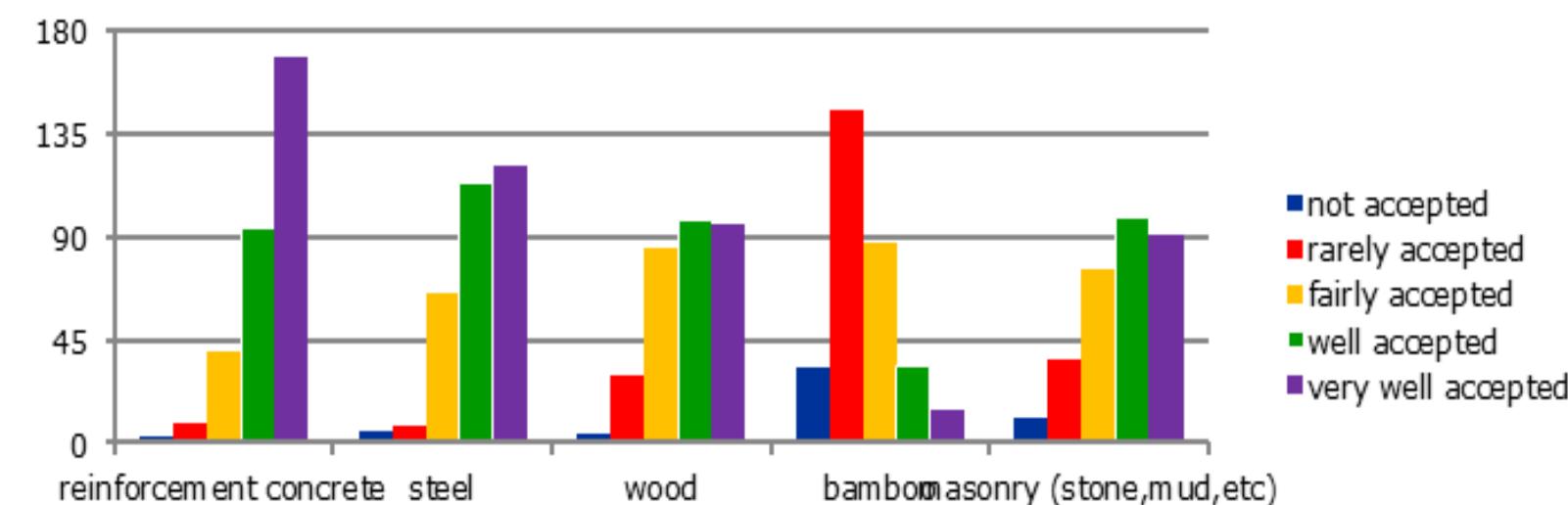
- The majorly used structural elements in buildings were reinforced concrete followed by steel. Bamboo was the least used material even below stone and mud blocks.

# ADVOCACY

3. How often do you use bamboo in your projects in applications like finishes and furniture?



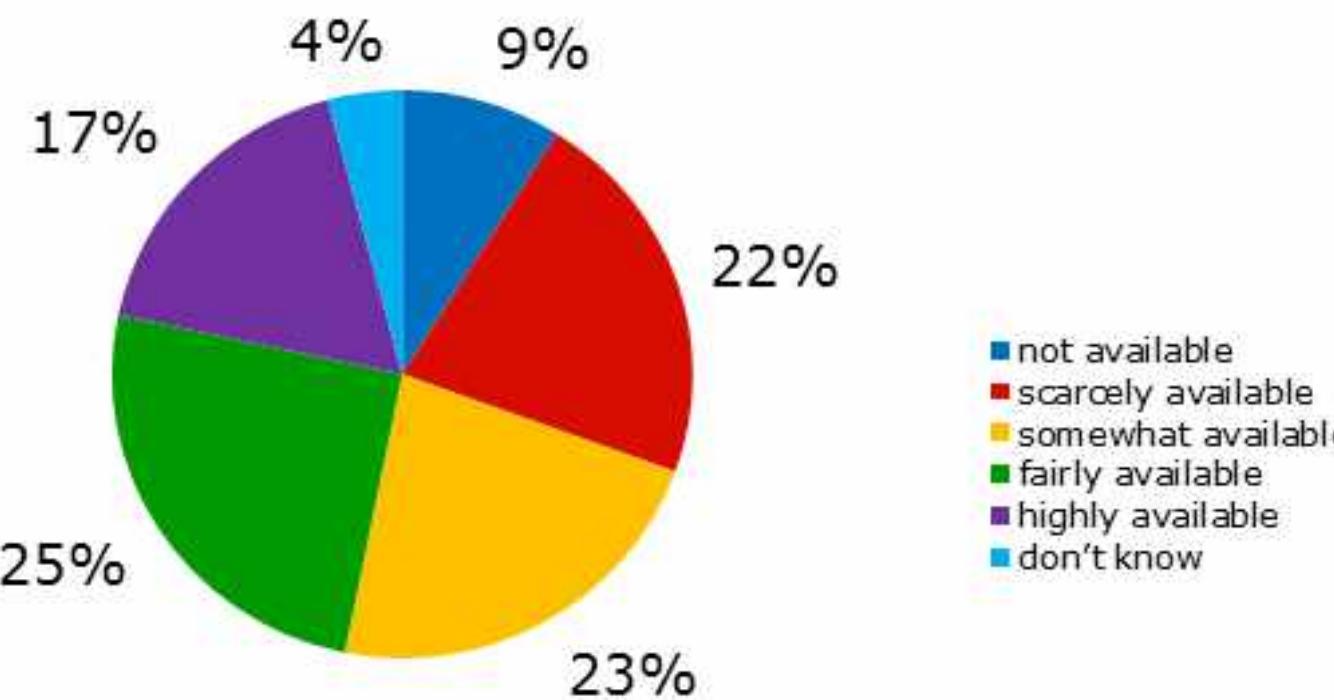
4. How well accepted by the clients do you consider the following materials to be?



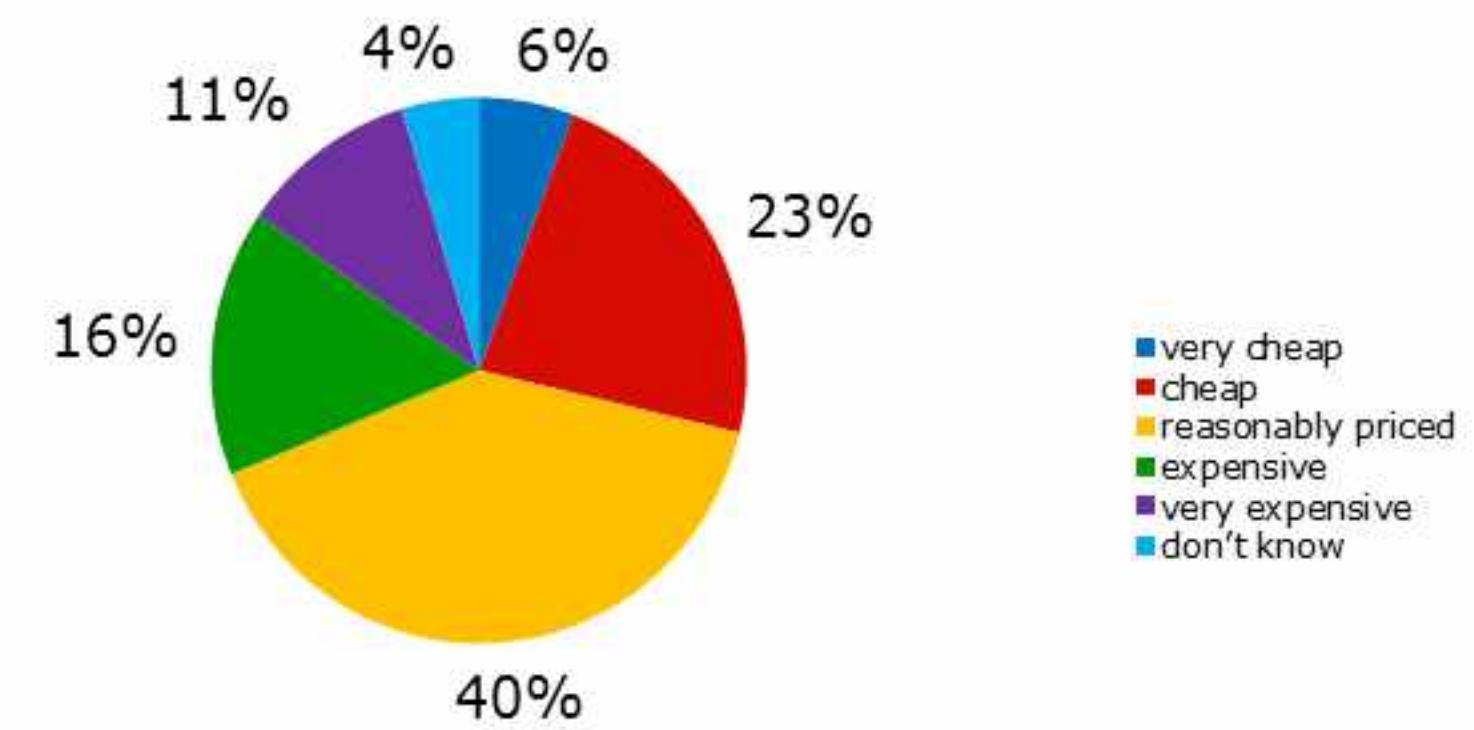
- More than 50% of the time bamboo is never or rarely used as finishes or furniture in projects.

- Bamboo is either not accepted or rarely accepted by more than 70% of the clients.

5. From not available to very much available, how do you consider bamboo where you work?



6. How expensive do you find bamboo in comparison with other construction materials?

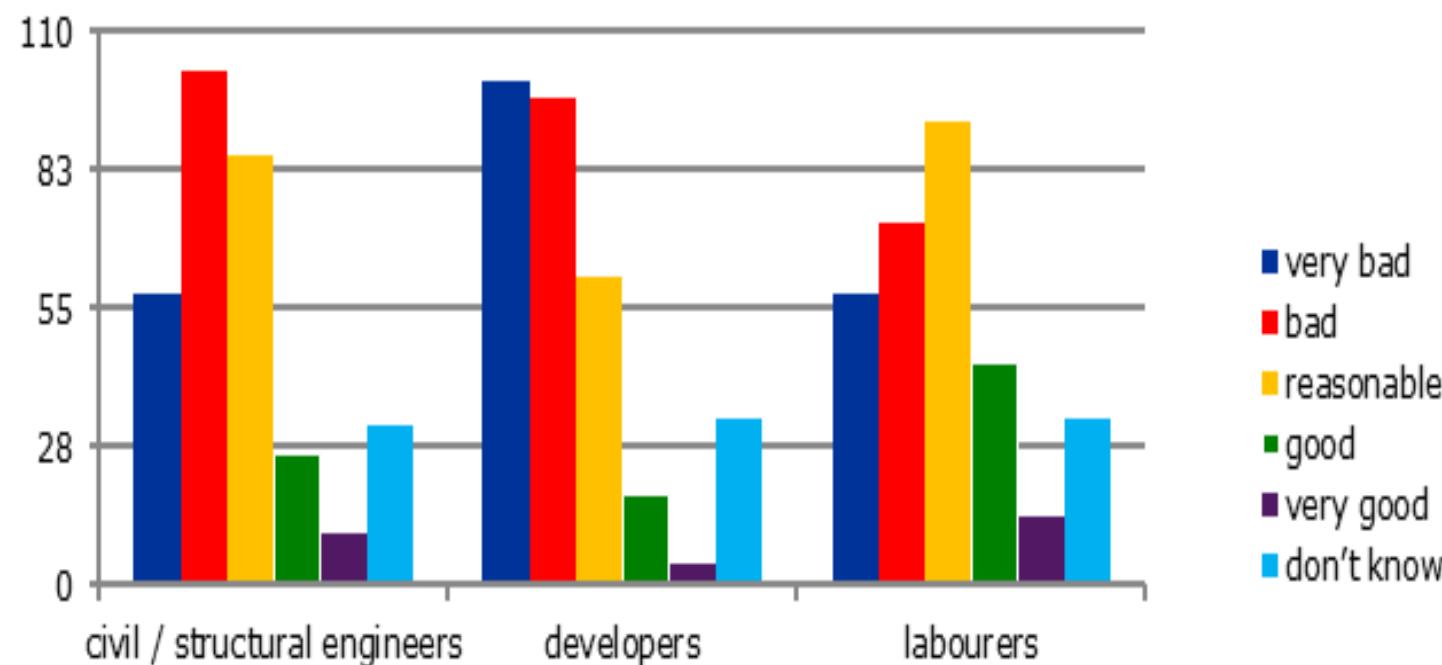


- 31% of the people feel that bamboo is not available or scarcely available. Another 4% of the people are not aware of the availability of bamboo.

- More than 60% feel that bamboo construction is reasonably priced or cheaper than other materials.

## ADVOCACY, SKILL DEVELOPMENT

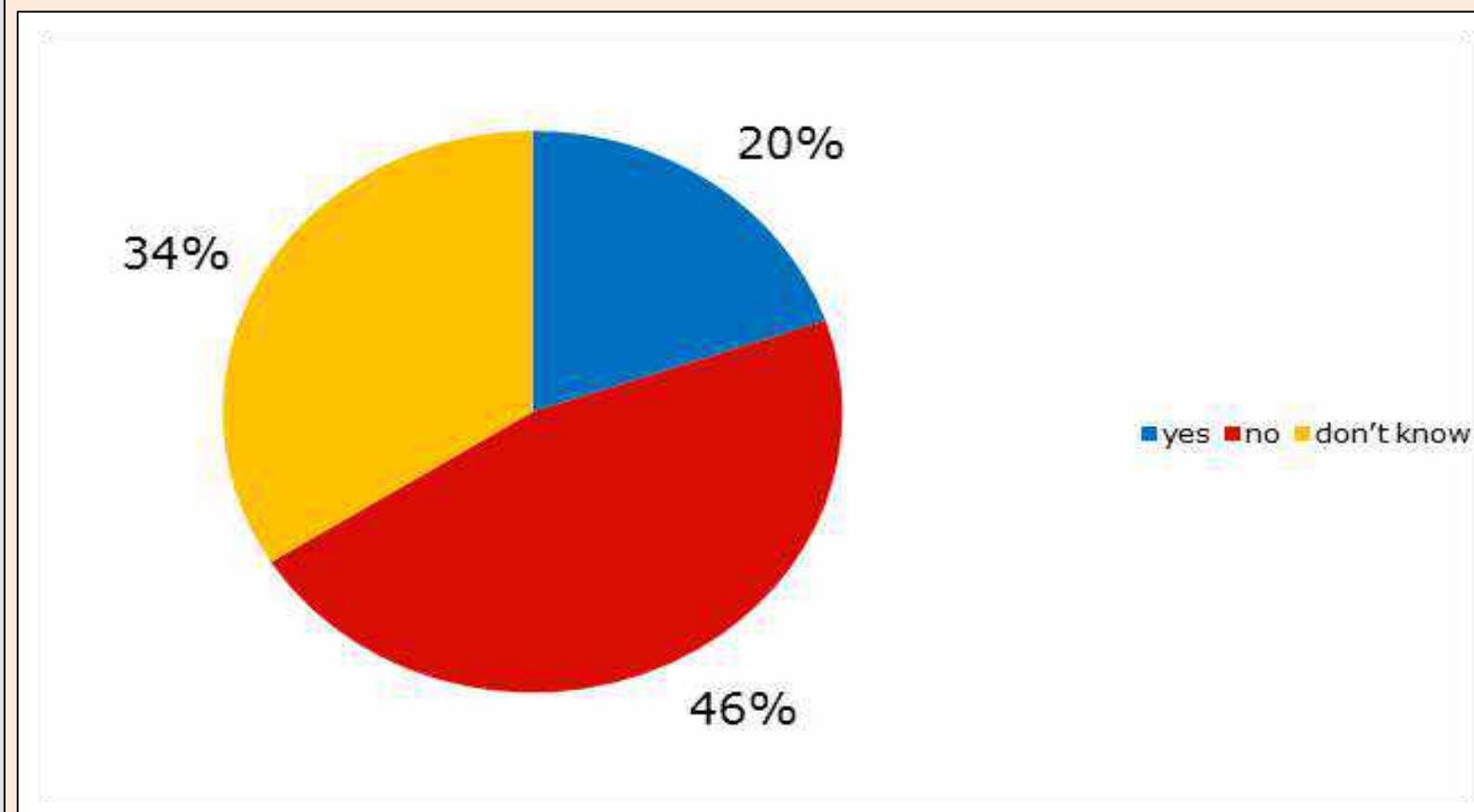
7. How is the situation when it comes to the skills and/or acceptance of the following professionals regarding bamboo?



- Acceptance of bamboo was found very bad among developers followed by civil eng. and labourers.

## LEGAL FRAMEWORK & POLICIES

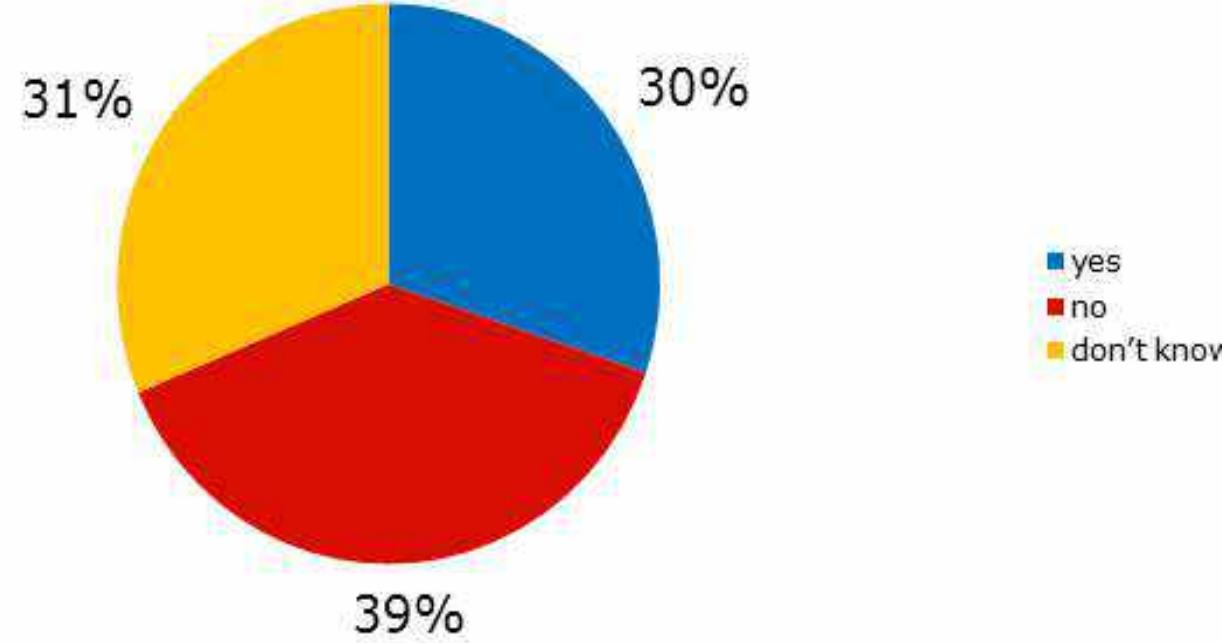
8.1 In the country you practice, in terms of legislation, is bamboo as a construction material, as well regulated as other materials?



- Only 20% globally think that bamboo is well regulated as compared to other construction materials.

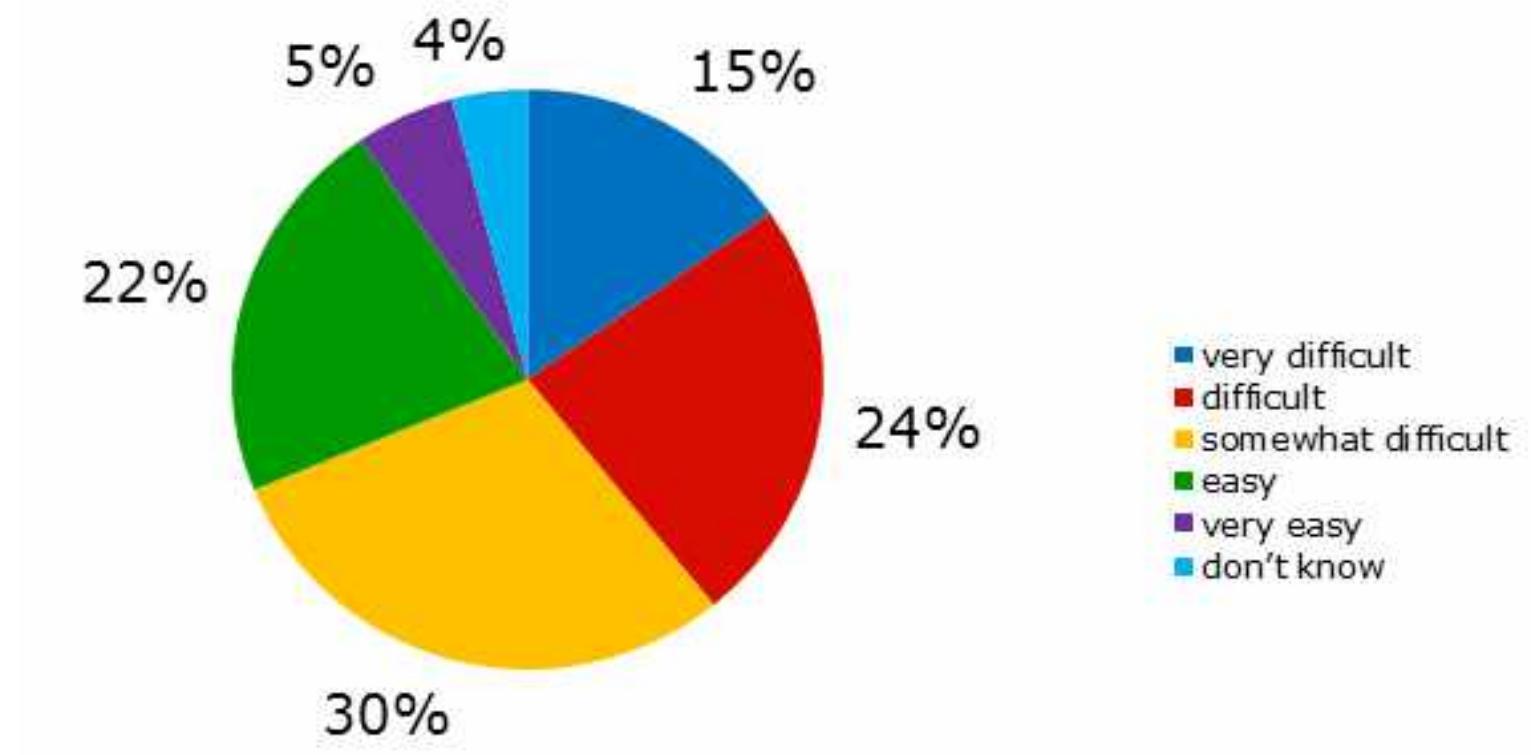
# LEGAL FRAMEWORK & POLICIES

8.2 In case there is lack of regulation on Bamboo, is that a discouragement/obstacle for you to use it?



# SKILL DEVELOPMENT

9. How easy is it to find information about construction with bamboo in your area ?

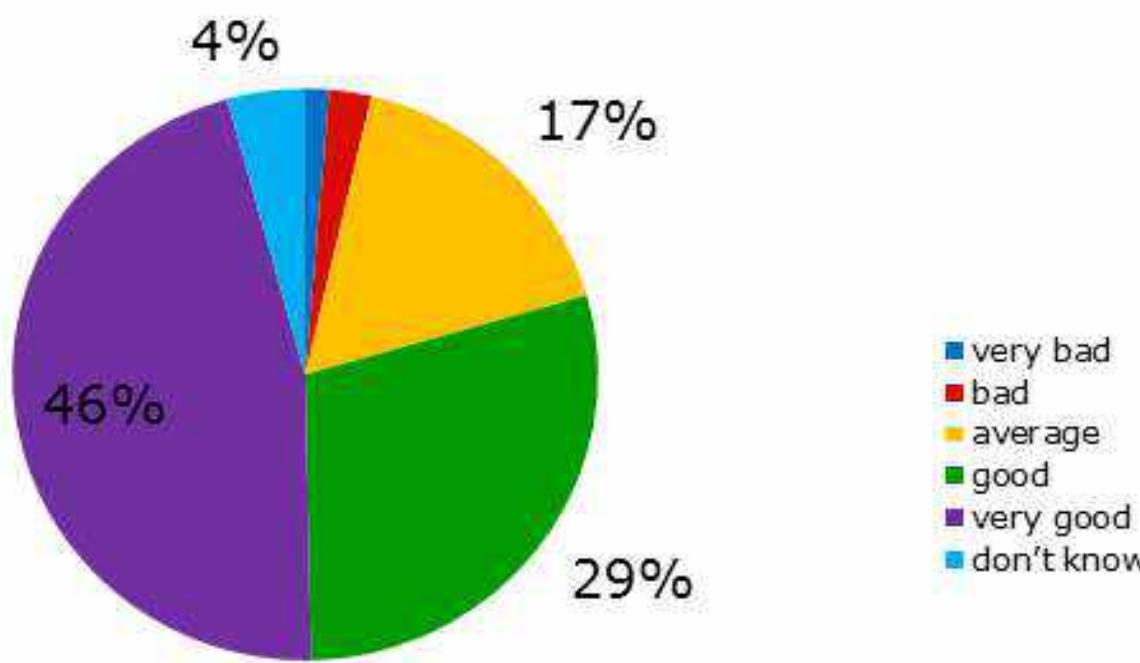


- If Bamboo is regulated, an additional 30% of the professionals could be encouraged to use it.

- Only 27% globally find it easy to access information regarding construction with bamboo.

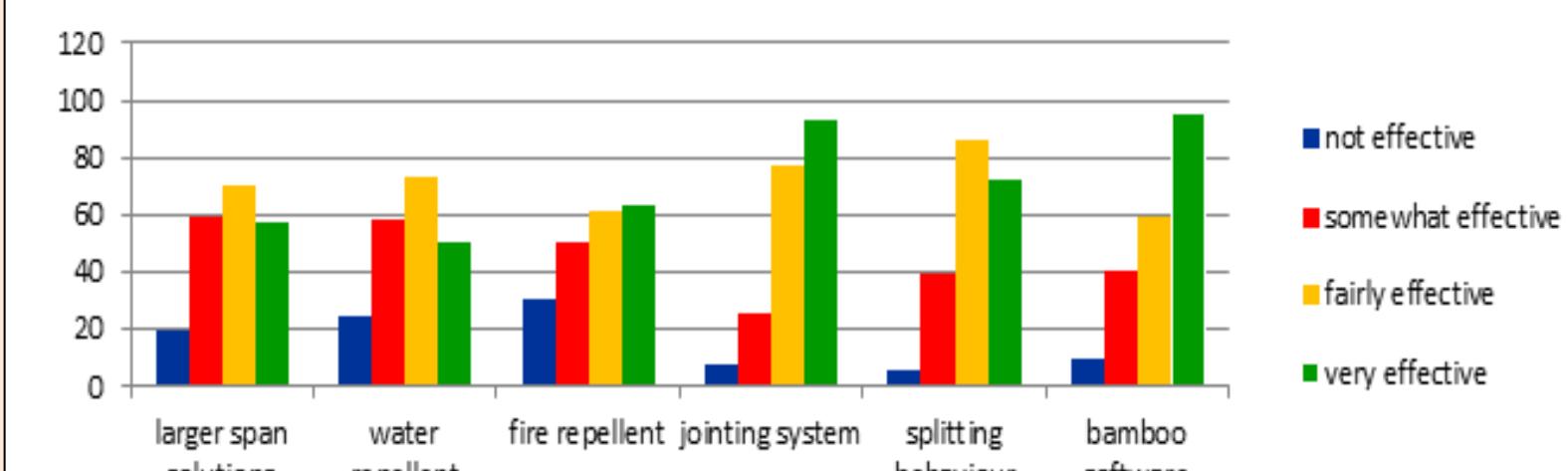
# EXECUTION

10. How good do you consider bamboo as a construction material?



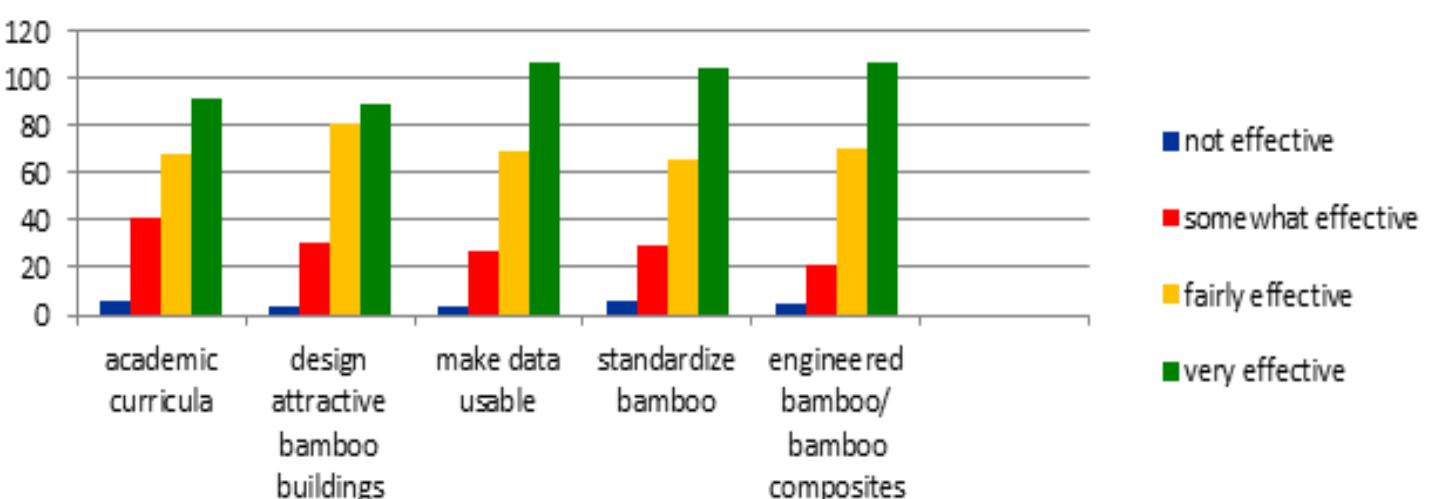
- 75% consider bamboo as a good construction material. It is a very positive indicator and justifies the need to mainstream bamboo.

11. Regarding Material Limitations, how effective would be the following solutions, to mainstream Bamboo, having in mind their ease of implementation?

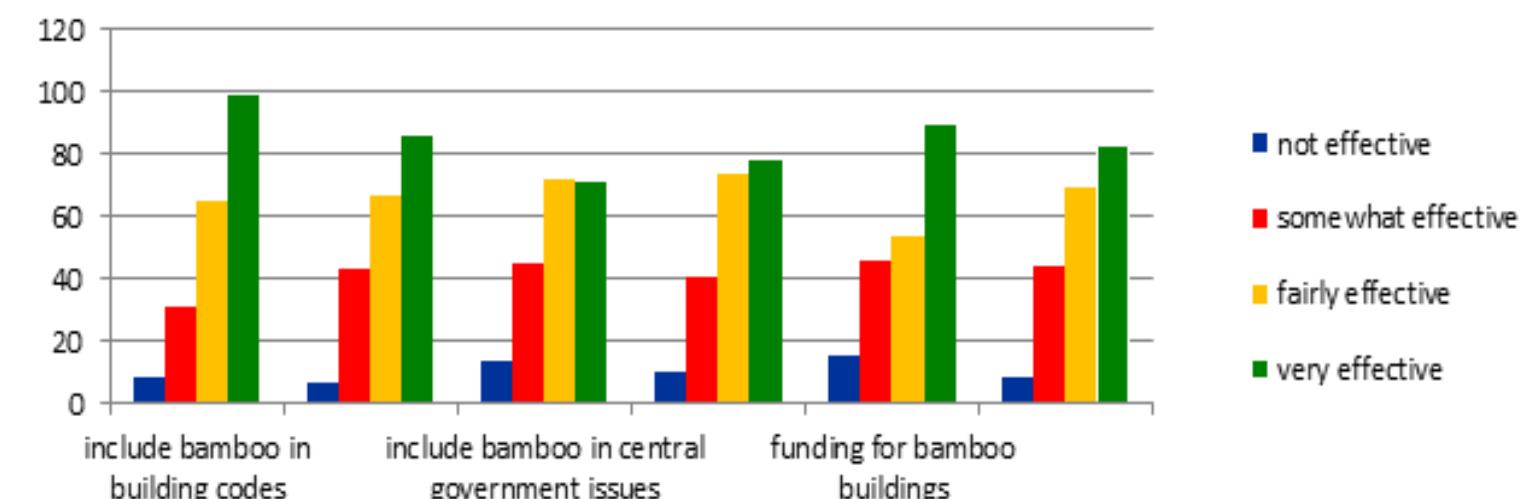


- Bamboo software, jointing systems and splitting behaviour are considered the major material limitations.

12. Regarding Academics and R&D, how effective would be the following solutions, to mainstream Bamboo, having in mind their



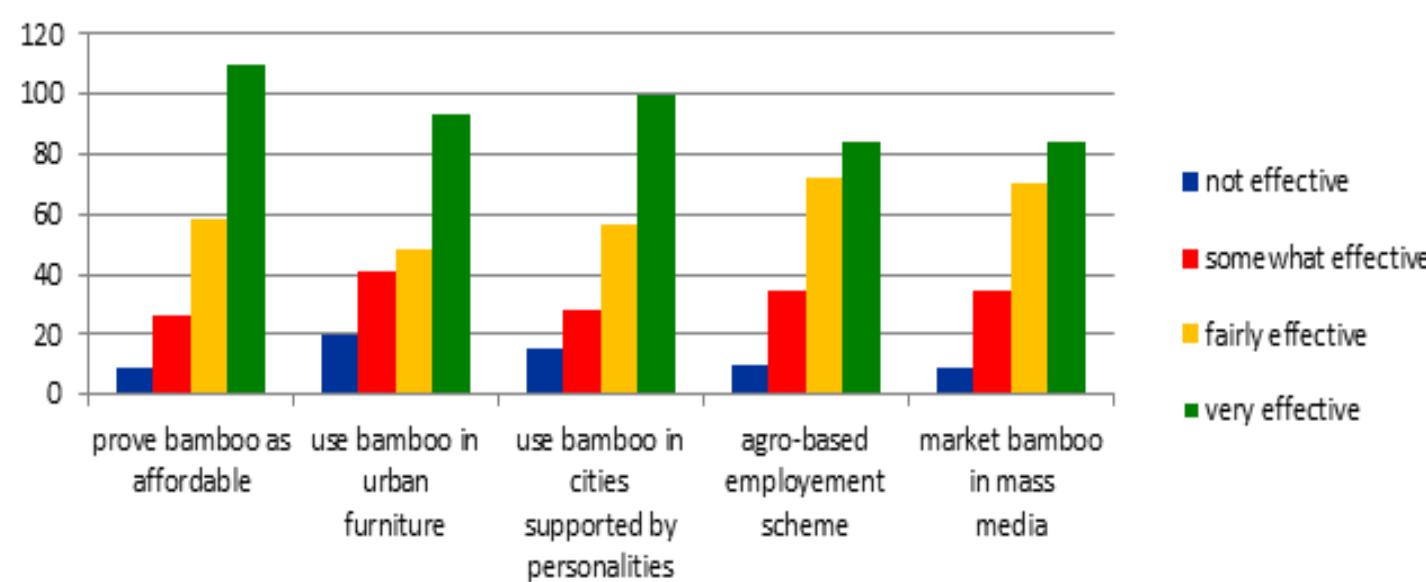
13. Regarding Legal, Financial and Policies, how effective would be the following solutions, to mainstream Bamboo, having in mind their easiness of implementation?



- Making data usable, standardize bamboo and develop engineered bamboo and bamboo composites were considered the most effective solution regarding Academics and R&D to mainstream bamboo.

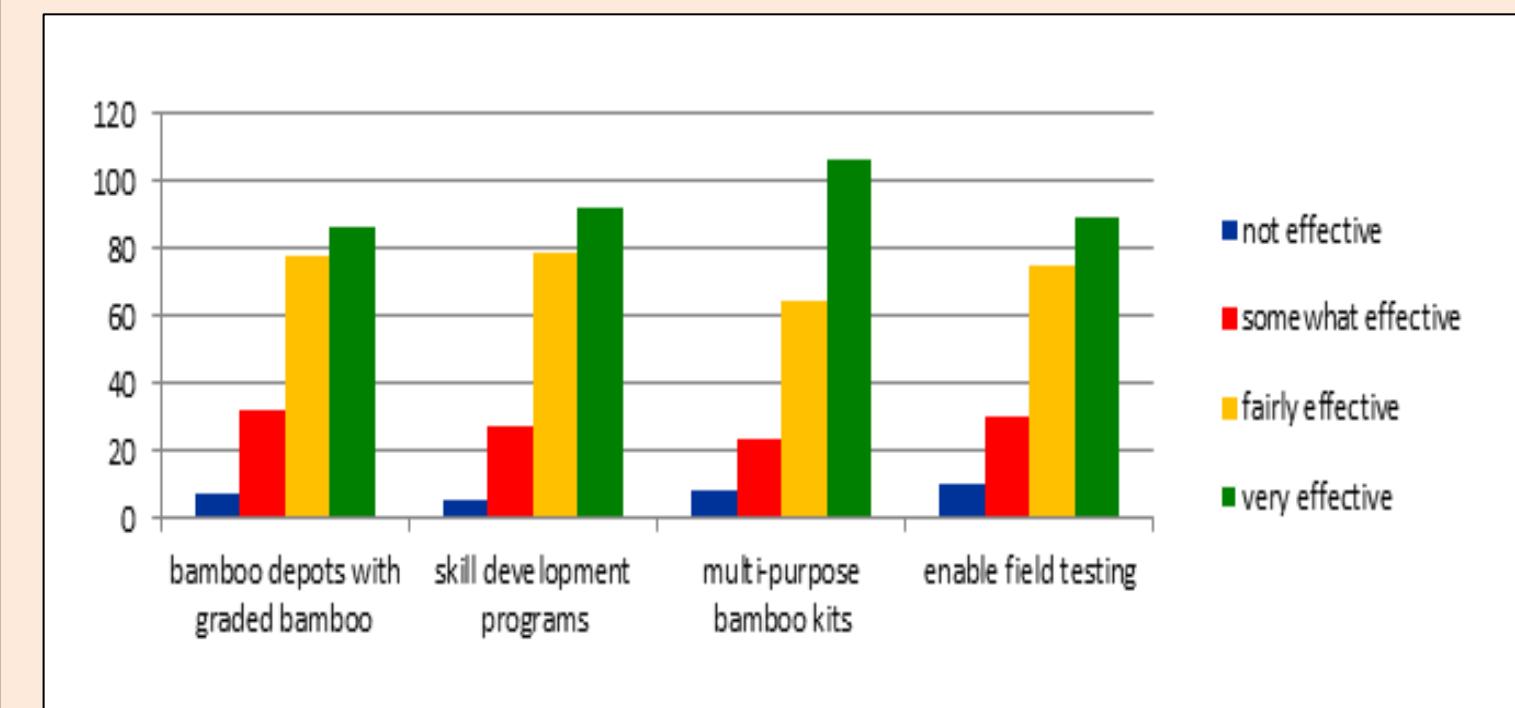
- including bamboo in building codes along with redefining government housing strategies and coordination between agencies/industries are considered effective measures to mainstream bamboo.

14. Regarding Social, how effective would be the following solutions, to mainstream Bamboo, having in mind their easiness of implementation?



- Making bamboo an affordable material and also desirable through support from personalities are regarded as the most efficient strategies for social acceptance of Bamboo.

15. Regarding Execution, how effective would be the following solutions to mainstream Bamboo, having in mind their easiness of implementation?



- Multipurpose bamboo kits along with skill development program and field testing are considered to be effective regarding execution of bamboo.

## MISCELLANEOUS

### **16. Please let us know any other solution that would be effective in mainstreaming Bamboo.**

A summary of the responses is given in detailed response list see Annexure I of the Research Report circulated to you, under the following categories:

- Legal Framework & Policies:
- Advocacy:

Academics & Skill Development:

- R&D and Industry:
- Marketing:

### III - ACTIONS POINTERS BASED ON THE SURVEY

- LEGAL FRAMEWORK & POLICIES

- ADVOCACY

- ACADEMICS

- RESEARCH & DEVELOPMENT

- SKILL DEVELOPMENT

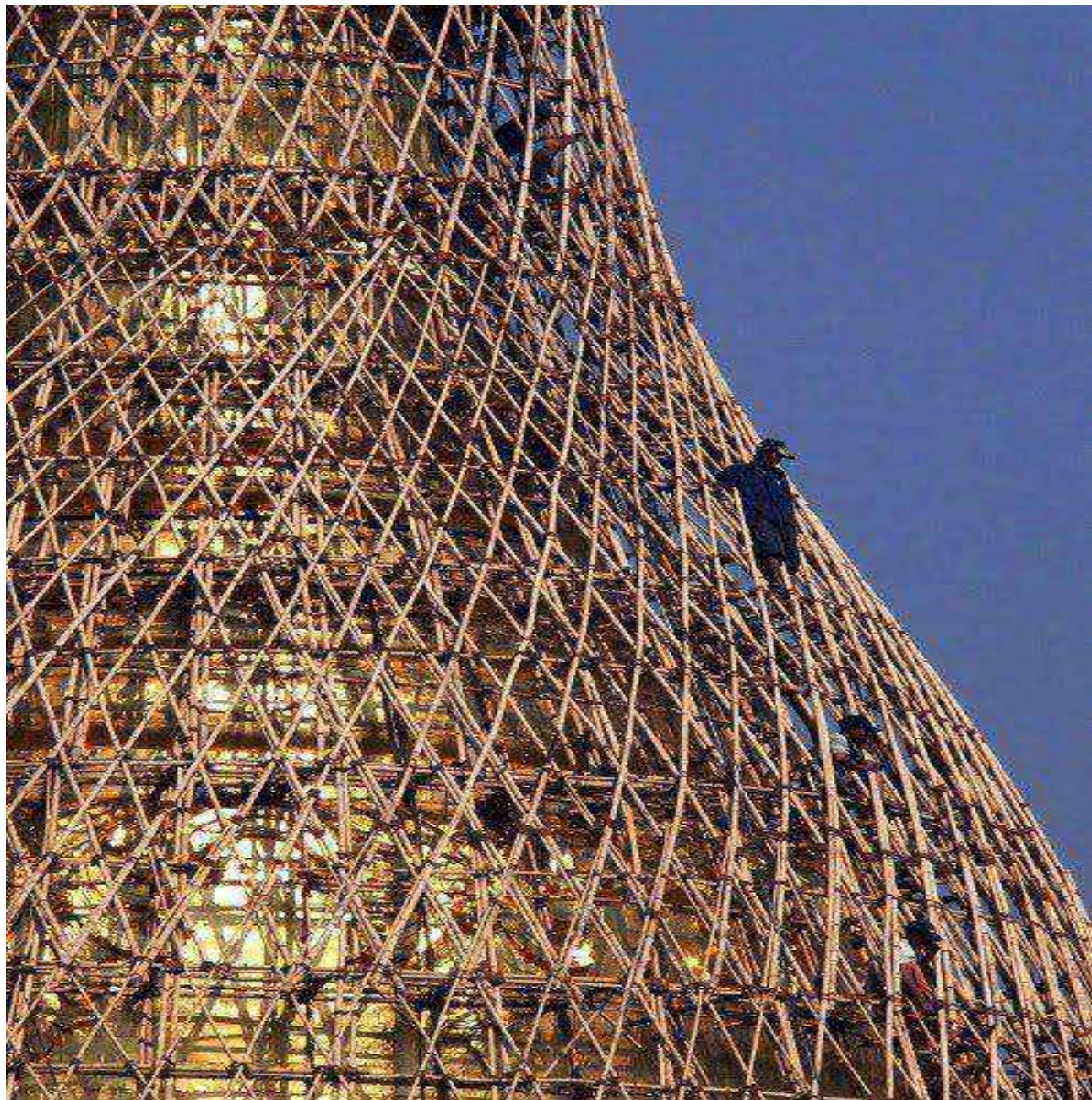
- MARKETING

- INDUSTRY DEVELOPMENT

- HOUSING & INFRASTRUCTURE

## LEGAL FRAMEWORK & POLICIES

- **Redefining governmental housing strategies**, including bamboo in building codes
- **Funding for bamboo buildings**
- Its **crucial to reach the higher bodies of the governments** about the importance of bamboo then laws will change.



<https://www.pinterest.com.au/pin/88946161361156630/>

## ADVOCACY

- **Creating awareness**
- **Showcasing bamboo in key locations**
- No architect mentioned the possible replacement of steel by bamboo in structures which means that there is **a severe dearth of awareness** about the potential of bamboo as a building material



<http://votrongnghia.com/projects/jardines-de-mexico/>

## ACADEMICS

- Including Bamboo in Architecture, Civil Engineering and other related building science **degrees** is very important.
- Among countries where bamboo is a native species, but its inclusion in higher education doesn't match **the material's availability and potential presently**.



<http://dentrodelasala.com/unique-green-school-bali-architecture/>



<http://dentrodelasala.com/unique-green-school-bali-architecture/>

## RESEARCH & DEVELOPMENT

- Make **data usable, develop engineered bamboo and composites, and bamboo specific software** for architects and engineers.
- Allow bamboo **to reach new types and scales of buildings**.
- **Industry specific research** to solve issues
- For example, fire rating of bamboo poles and bamboo composite products. It is a significant obstacle for use in public and large infrastructure projects.

# SKILL DEVELOPMENT



[http://aurovile-learning.net/av\\_opportunity/architect-for-bamboo-constructions](http://aurovile-learning.net/av_opportunity/architect-for-bamboo-constructions)

- **Practical skills** to work with bamboo
- **Trouble to find qualified** labourers and engineers to execute their work.
- **Educational Institutions, Foundations and NGOs** could significantly contribute in this.

# MARKETING

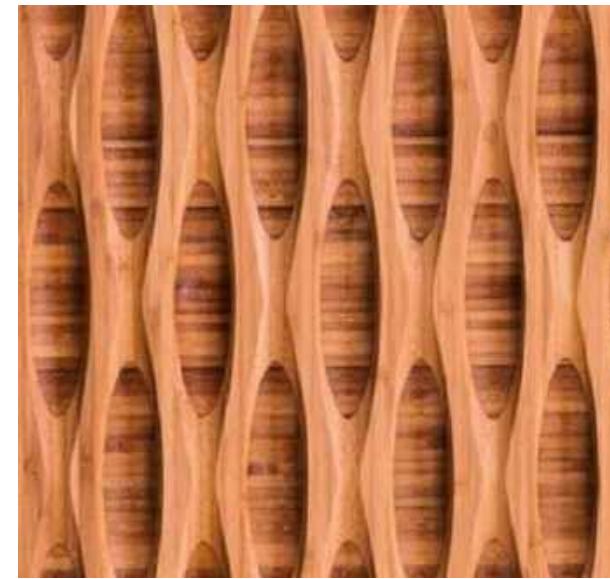
- Advertising it in mass media .
- Appealing for both **low-income** audiences for **its affordability** and also desirable or **high-income** audiences for its **appearance and industrial enhancement**.
- It should be promoted as a **technically sound, eco friendly and aesthetically pleasing material rather** than affordable and cheap material.



<https://www.thedailystar.net/country/bamboo-crafts-decline-1350334>

# INDUSTRY DEVELOPMENT

- Having an agro-based employment scheme and **creating an organised supply chain with better coordination between agencies are indispensable** to serve the construction needs.
- **Standardisation / certification of bamboo** for confident utilisation by professionals and clients.
- Most **professionals prefer off-the-shelf bamboo products and components** for ready usage in their projects.



BAMBOOWOOD

- <https://www.archdaily.com/catalog/us/products/3411/bamboo-wall-panels-plyboos-reveal-line-intect>



BAMBOO WALL PANELS



BAMBOO HOUSING



Tipu Sultan Merkez School

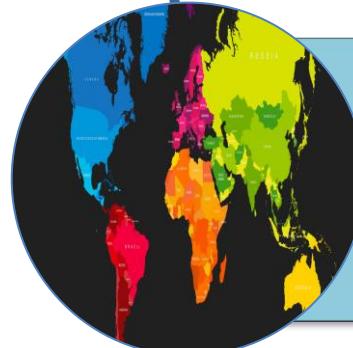


## IV - THE SYSTEMIC ACTION PLAN – STAKEHOLDERS PARTICIPATION GUIDELINES

Stakeholders participation guidelines for each of the necessary action areas have been solved the issues at different levels at :



**GLOBAL**



**NATIONAL**



**STATE/LOCAL**

# LEGAL FRAMEWORK & POLICIES

GLOBAL

UN – Dep. Economic / Social Affairs  
UNDP – UN Development Programme

- funding for bamboo projects

BAMBOO ASSOCIATIONS : - WBO ; INBAR ; TRADA , DFID, etc

- share with governments technical, industry, economical, social information etc. in order to formulate suitable legal framework.

INTERNATIONAL BODIES : BRICS; SAARC ; IMF ; EU, etc

- promote regulations for bamboo  
-facilitate funding for bamboo projects



<https://www.guaduabamboo.com/cultivation/>

NATIONAL

MINISTRIES – Environment / Tribal & Rural Development / Women & Children/Urban Development etc.

-create legal framework and policies for bamboo for its environmental, social and economical advantages

PROFESSIONAL BODIES: Architects/ Engineers, etc.  
BAMBOO SOCIETIES:- Bamboo Soc. of India, etc.

-promote the inclusion of bamboo in building codes with support from research institutes, Standards, Certification etc.



<https://highroadhouse.files.wordpress.com/2013/07/bamboo-truck.jpg>

STATE

MUNICIPAL AUTHORITIES Departments – Town Planning / Social Housing, etc.

- support and implement the measures taken by the ministries

NGOs

- influence authorities at a local level in order to implement changes



<http://bis.org.in/sf/nbc.asp>

# ADVOCACY

GLOBAL

UNEP – UN Environment Programme  
IPCC – UN Intergovernmental Panel on Climate Change

-spread awareness about environmental qualities of bamboo

UNWTO – UN World Tourism Organization

- promote tourism based on bamboo- Cultural ,Heritage and Eco-tourism

BAMBOO ASSOCIATIONS:- WBO , INBAR ,DFID, TRADA etc  
European Bamboo Society, etc.  
INTERNATIONAL ARCHITECTS BODIES  
- UIA, ARCASIA etc.

- promote the use of bamboo in UN programs for Governments, large corporate bodies, International Architectural and design events etc. like Venice Biennale



<http://primaveracity.italpinas.com/category/blog/advocacy/>

MINISTRIES – Culture / Urban Development / Tourism / Environment  
NATIONAL BAMBOO SOCIETIES

- promote bamboo as an important cultural , economical and ecological value addition  
- advertise bamboo on the media both as an affordable material and as a luxury item.



PROFESSIONAL BODIES – Architects / Engineers

- incentivise the use of bamboo in bigger buildings by renowned architects.

MUNICIPAL AUTHORITIES: Departments – Town Planning

- showcase bamboo buildings in key locations  
- use bamboo in urban furniture

NGOs

- promote bamboo to the building industry professionals and population in general, Awareness programs

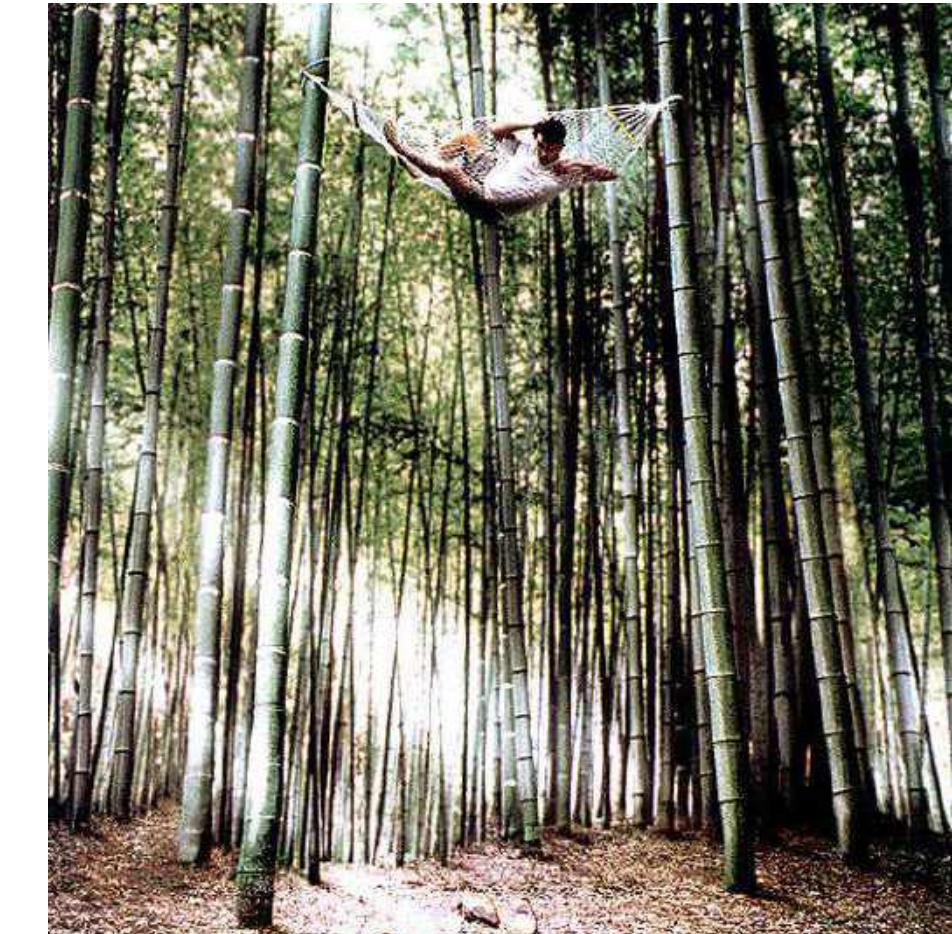
<https://www.arellano.edu.ph/comdev/peace-advocacy-volunteerism>

# MARKETING

GLOBAL

UNDP - UN Development Programme  
BAMBOO ASSOCIATIONS:- WBO ; INBAR ;  
etc  
INTL. BAMBOO SOCIETIES

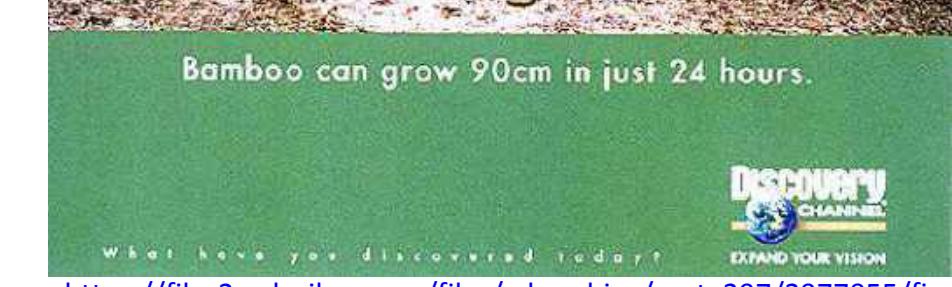
- promote bamboo as affordable and as a means to promote resource equity



NATIONAL

MINISTRIES – Industries / Foreign Affairs / Urban Development / Communication  
NATIONAL BAMBOO SOCIETIES

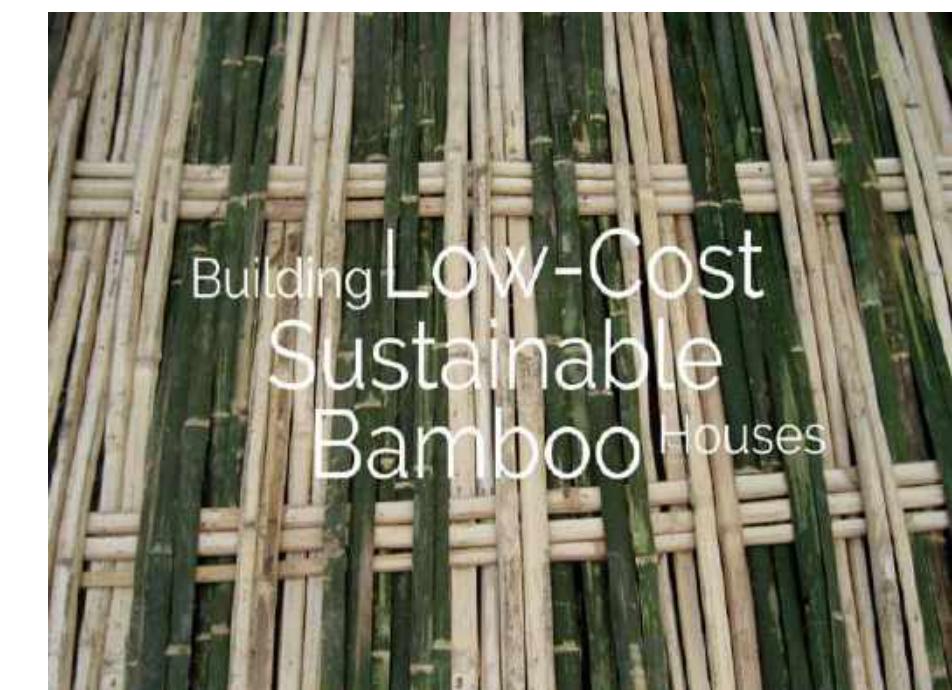
- market bamboo as valuable economical and ecological product and commercialize it.
- Societies can help in networking and knowledge dissemination



STATE

LOCAL INDUSTRY  
NGOs

- develop effective marketing ads.
- Social enterprises for bamboo



Building Low-Cost  
Sustainable  
Bamboo Houses

<https://i0.wp.com/www.yr-architecture.com/wp-content/uploads/Building-Low-Cost-Sustainable-Bamboo-Houses-1.jpg?fit=800%2C533>

# INDUSTRY

UN – Conference on Trade & Development

UNIDO – UN Industrial Development

Organization

UNWTO

BAMBOO ASSOCIATIONS:- WBO ;INBAR;

etcINTL. BAMBOO SOCIETIES

-promote coordination between agencies / industries

INTL. TRADE UNIONS (International Trade Union Confederation, World Federation of Trade Unions)

- organise the global market in order to have an efficient and strong network of bamboo-related industries.



MINISTRIES - Commerce / Industry / Finance / Internal Administration, etc.

-promote coordination between agencies / industries  
- create organised supply chains  
- promote value addition to bamboo

<http://usa.chinadaily.com.cn/attachement/jpg/sit/e1/20130505/d4bed9d4d22012efe08205.jpg>

-promote coordination between agencies / industries  
- create organised supply chains  
- promote value addition to bamboo

- organise / develop bamboo plantation and processing  
- organise demand-supply chain management



NATIONAL TRADE UNIONS

-organise the national market to have a strong network of bamboo-related industries.  
- merge several trade unions

[https://static.dezeen.com/uploads/2015/11/Bamboo-composite-materials\\_dezeen\\_1568\\_12.jpg](https://static.dezeen.com/uploads/2015/11/Bamboo-composite-materials_dezeen_1568_12.jpg)

- State level trade organizations  
- Industries  
-NGOs

- develop market driven industries in association with R&D Organizations  
- commercialise multi-purpose bamboo kits.  
- bamboo based social enterprises with suitable networks

G  
L  
O  
B  
A  
L

N  
A  
T  
I  
O  
N  
A  
L

S  
T  
A  
T  
E

# HOUSING & INFRASTRUCTURE

GLOBAL

UN – Human Settlements Programme

BAMBOO ASSOCIATIONS:

- WBO ; INBAR ; etc

INTL. BAMBOO SOCIETIES

- promote the use of bamboo in housing programmes

UN – High Commissioner for Refugees

- use bamboo as a disaster relief solution

UN – Special Advisor in Africa

- use bamboo for basic housing needs



PROTOTYPE BAMBOO HOUSE FOR TSUNAMI VICTIMS 2005

NATIONAL

MINISTRIES – Housing / Planning /

Infrastructure

NATIONAL BAMBOO SOCIETIES

- redefine strategies, including bamboo



Rohingya refugees build shelter with bamboo at the Jamtoli camp in Cox's Bazar, Bangladesh, January 22, 2018. Photo Reuters

STATE

ARCHITECTS  
NGOs

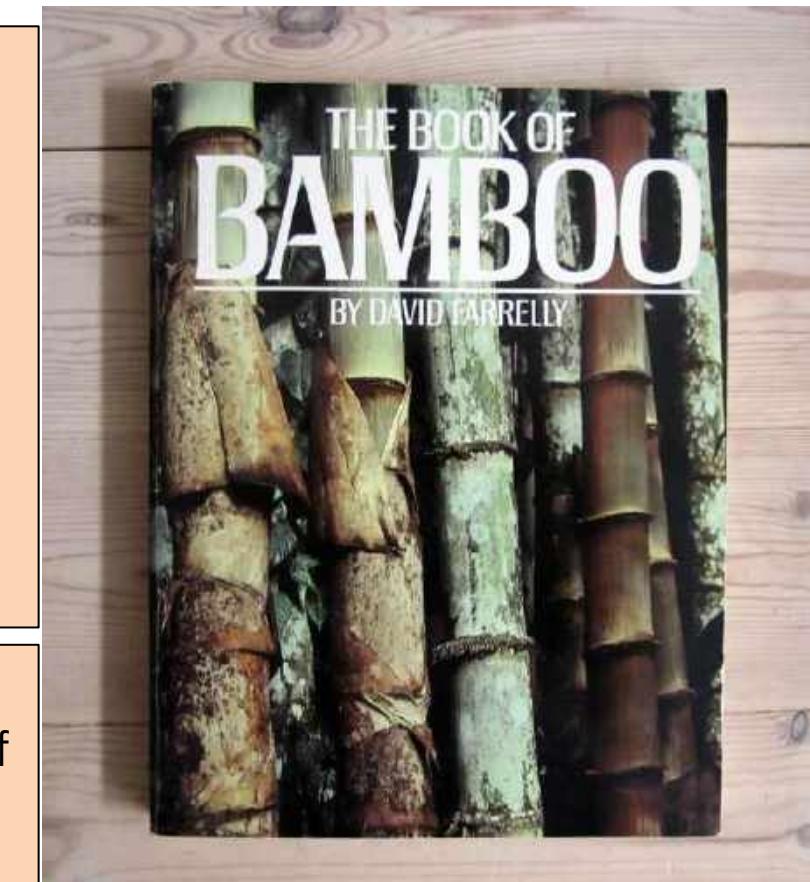
- utilize bamboo in larger scale public buildings / multi-storied housing, infrastructure, etc

# ACADEMICS

G  
L  
O  
B  
A  
L

- UNESCO
- BAMBOO ASSOCIATIONS: - WBO ; INBAR ; etc
- INTL. BAMBOO SOCIETIES

- sensitize governments to include bamboo in education curricula
- promote bamboo focused fellowships programs
- heritage conservation; Funds allocation for documentation of traditional building techniques.

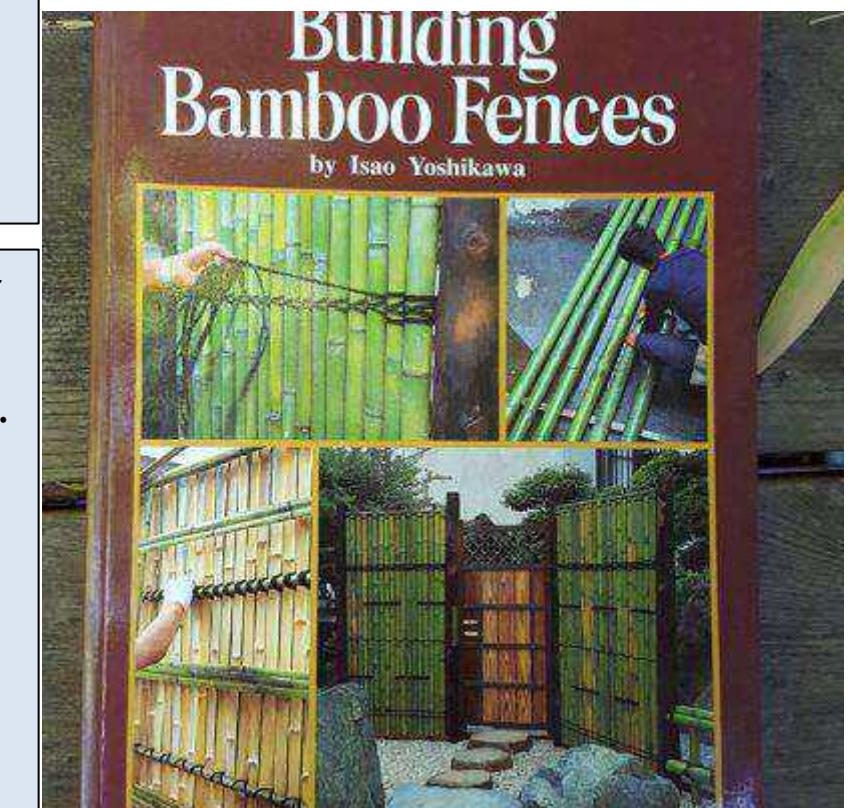


<http://mythologicalquarter.net/2011/08/06/book-review-the-book-of-bamboo/>

N  
A  
T  
I  
O  
N  
A  
L

- MINISTRIES – Education / Culture

- include bamboo in Architecture, Civil Engineering, Interior Design and other practical courses.



<http://bamboosourcery.com/2017/09/02/books/>

S  
T  
A  
T  
E

- UNIVERSITIES
- NGOs

- give bamboo the due importance as a major building material and provide specific information and training programs for teachers.
- include industry interface as an essential part of the programmes.
- awareness programs and workshops to be conducted

# RESEARCH & DEVELOPMENT

GLOBAL

UNDP – UN Development Programme

- allocate and ensure funds availability for R & D

BAMBOO ASSOCIATIONS:  
- WBO ; INBAR ; etc  
- INTL. BAMBOO SOCIETIES

- facilitate / promote collaboration and cooperation among Universities and Research Centres and bodies across the world

MINISTRIES – Science / Technology / Environment  
NATIONAL BAMBOO SOCIETIES

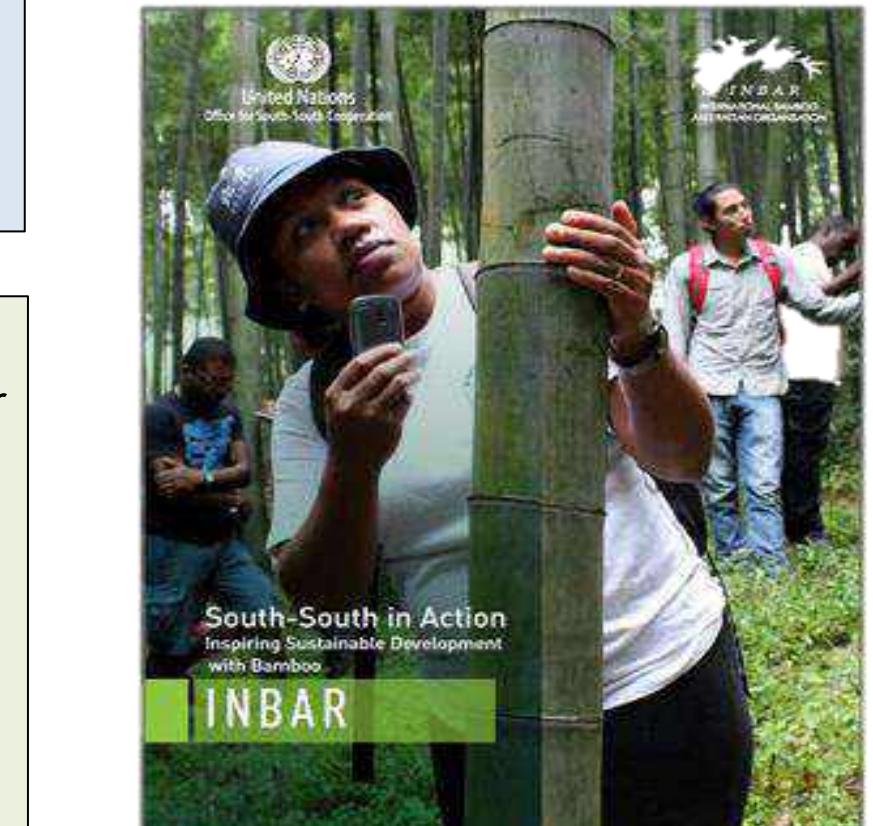
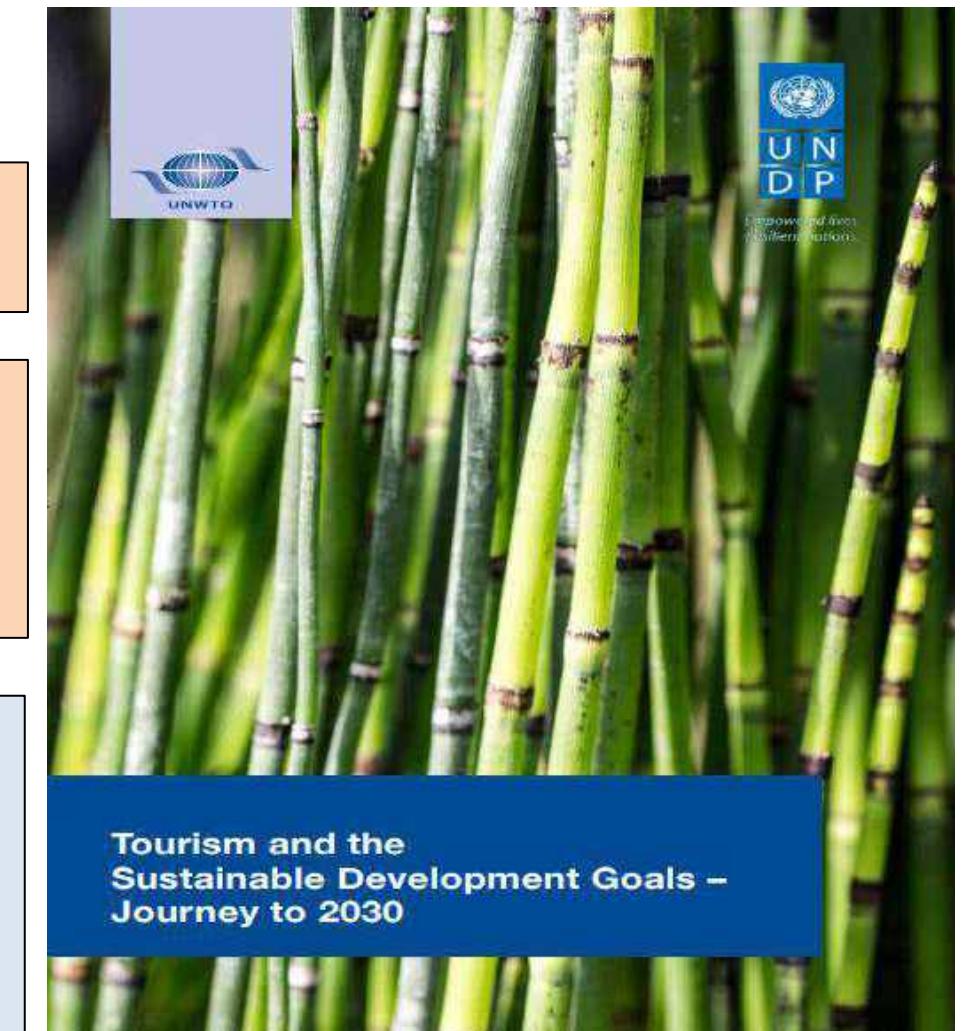
- include bamboo in national building codes and schedule of rates.
- promote standardization / certification of bamboo with support from Research Institutes

UNIVERSITIES

- tie up with Research Institutes to spread updated and usable database for ready usage by the architects, engineers and other building professionals.

PUBLIC/PRIVATE Research Organisations  
NGOs

- develop engineered bamboo and composites and other products as per industry requirements
- make data usable
- develop suitable fire rating, treatment and other solutions critical to widespread usage of Bamboo
- bamboo specific joineries and designing software, etc.



# SKILL DEVELOPMENT

GLOBAL

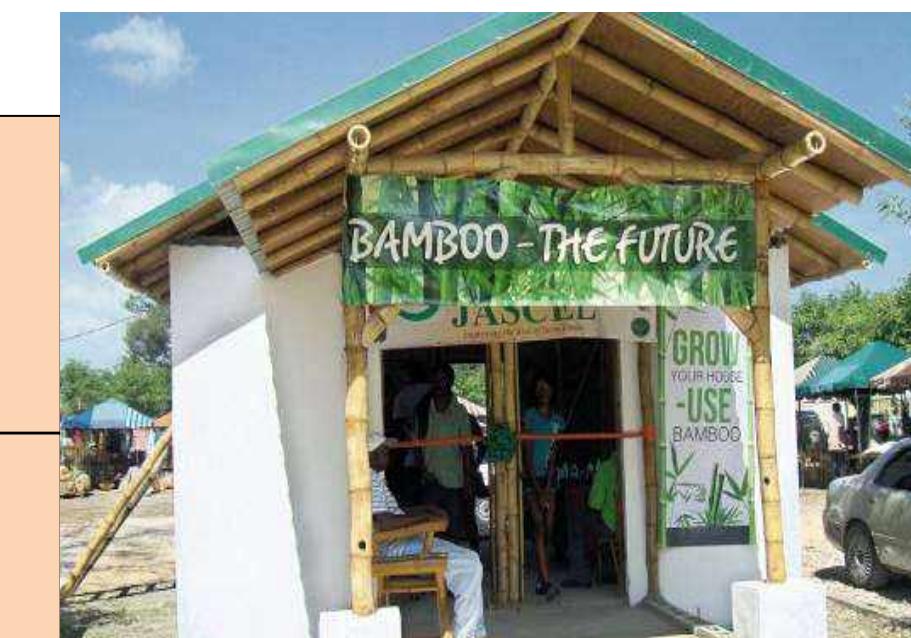
UN – High Representative for least developed countries, landlocked, small island developing states

ILO – UN International Labour Organization

BAMBOO ASSOCIATIONS:

- WBO ; INBAR ; etc
- INTL. BAMBOO SOCIETIES

- funds availability
- promote bamboo related skill training as a vehicle for development and raising of HDI



<http://www.jamaicaobserver.com/apps/pbcsidli/storyimage/JO/20140903/ARTICLE/30903890/AR/0/AR-309039890.jpg>

NATIONAL

MINISTRIES – Labour / Employment  
NATIONAL BAMBOO SOCIETIES

- create suitable and necessary mechanism for implementation of skill development programs



[http://shivamfoundation.com/wp-content/uploads/2016/12/RKU\\_9291.jpg](http://shivamfoundation.com/wp-content/uploads/2016/12/RKU_9291.jpg)

STATE

EDUCATIONAL INSTITUTES

- provide local skill development programs.
- integrate vocational training and general education programs



CGBMT WORKSHOP

NGOs

- execution of skill development programs on a larger scale with networking from international level to the last beneficiary

# IMMEDIATE ACTIONS

## LEGAL FRAMEWORK & POLICIES

## ADVOCACY

## MARKETING

## INDUSTRY

UN-Habitat: National Urban Policies - <https://unhabitat.org/>

UNEP: Beat Plastic Pollution  
<https://www.unenvironment.org>

- INBAR: Goal 1 – Promoting Bamboo and Rattan in Socio-economic environmental development policies at National, Regional and International levels.

- IMF – Legislative Frameworks - [http://www.imf.org/external/np/ins/english/capacity\\_wwd.htm#sub](http://www.imf.org/external/np/ins/english/capacity_wwd.htm#sub)

- UNCTAD: Investment Policy Framework for Sustainable Development - <http://unctad.org/en/Pages/themes.aspx>

UN-Habitat: Cities and climate change Initiative

- UNFPA: Climate Change Topic - <https://www.unfpa.org/>

- UNDP, SDG 12: Responsible Consumption and Production - Using local and eco-friendly materials like bamboo, their production methods and waste management will help achieve this goal. -

<http://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

- IPCC: Working Group II - [http://www.ipcc.ch/working\\_group\\_ii/working\\_groups.shtml](http://www.ipcc.ch/working_group_ii/working_groups.shtml)

- UNWTO: Sustainable Development of Tourism - <http://www2.unwto.org/>

- UNWTO: Tourism & Development

- UNDP, SDG 7: Affordable and Clean Energy – energy from bamboo by gasification, ethanol, charcoal, etc. An affordable, non-polluting bio energy fuel that uses waste from the bamboo sector.

- UNDP, SDG 16: Peace, Justice and Strong Institutions - Bamboo based industries can provide economic stability to the most marginalised sections of the society, thereby ensuring peace and justice.

- UNIDO: Inclusive and Sustainable Industrial Development - <https://www.unido.org/inclusive-and-sustainable-industrial-development>

## HOUSING & INFRASTRUCTURE

## ACADEMICS

## RESEARCH & DEVELOPMENT

## SKILL DEVELOPMENT

- 

UN-Habitat: Participatory Slum Upgrading Programme

• UN-Habitat: Human Settlements Management  
• UNDP, SDG 11: Sustainable Cities and Communities - The target for 2030 is to ensure access to safe and affordable housing. Construction with Bamboo with other local and eco-friendly materials could provide localised solutions easy to implement and achievable.

• UNHCR: Shelter -  
<http://www.unhcr.org/uk/shelter.html>

- TRADA: Learning Resources -  
<https://www.trada.co.uk/Academic/>
- ARCASIA: Student Competitions -  
<http://www.arcasia.org/events/student-competition>

- Trada: research -  
<https://www.Trada.Co.Uk/publications/research-summaries/>
- IPCC: task force on national greenhouse gas inventories
- UNWTO: fostering knowledge
- UNCTAD: science and technology for development -  
<http://unctad.Org/en/pages/themes.Aspx>
- UNESCO: building knowledge societies -  
<https://en.Unesco.Org/themes/building-knowledge-societies>
- UNESCO: Science for a sustainable future

- UNEP: Education and Training Topic
- INBAR: Goal 3 – Sharing Knowledge and communicating lessons learned, providing training and raising awareness of the relevance of bamboos and rattans as plant commodities.
- UNESCO – Education transforms lives
- ILO – Indigenous and Tribal People -  
<https://www.ilo.org/global/about-the-ilo/lang--en/index.htm>
- ILO – Skills, Knowledge and employability

## V – CONCLUSION

As per the survey it was found that the issues

- Need to be tackled from various fronts in a systemic manner
- They are inextricably linked to each other.
- Highest authorities to the lowest bodies to make it successful.

The programs will also need to vertically connected with all persons working on it

**As per no. 17 of the UN's Sustainable Development Goals, we have to "Strengthen the means of implementation and revitalise the global partnership for sustainable development"**



**CGBMT and MANASARAM ARCHITECTS** are committed to work with the **WORLD BAMBOO ORGANISATION and other organisations** as envisaged in the Stakeholders participation table (table 3), to take this project to implementation through further detailed action plans with practical timelines to Mainstream Bamboo in the building and related **sectors to address the three bottom-lines of Sustainable Development-**

**Economic prudence,  
Environmental protection  
and Social justice globally.**



**“In a gentle way,  
You can shake the world”**

**- Mahatma Gandhi**

**Thanks for this journey-  
Let's get down to work together towards...  
newer beginnings!**