

# Prefabricated Bamboo Homes for Everyone

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# global challenges, require global solutions

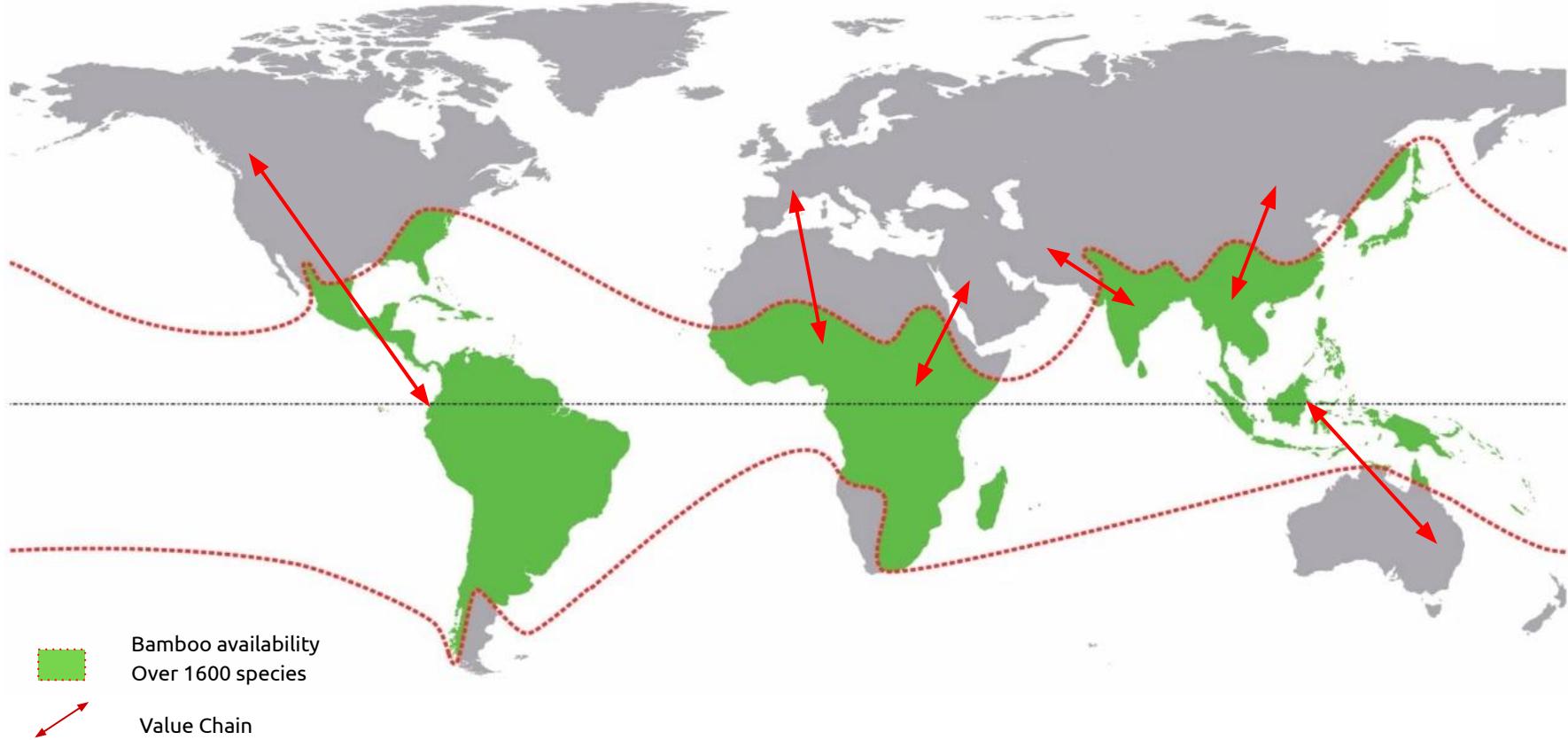


**Earth is collapsing**

**Housing crisis**

**Lack of R&D**

# bamboo, a new global value chain?



# bamboo, gold in the hands of the wise



## Alleviates Deforestation

**Grows 10x faster than wood**

Its four year growth cycle outperforms timber's 40 to 60 yr cycle. .



## Decarbonization

**Up to 300 tonnes / ha**

A hectare of sustainably managed bamboo forests captures between 90 and 300 tCO2/ha.



## Water Cycle

**5000 liters per clump**

Reforestation with bamboo helps absorb 2 million litres of water per hectare per year.



## Renewable

**No clear-cutting**

Bamboo can be harvested continuously once established without replanting. Its extensive root system prevents soil erosion.



## Strong

**3x stronger than wood**

Bamboo can be carbon-negative, structural building material.



## Advanced Manufacturing

**Suitable for prefab mass production**

Bamboo is a fit material for robotic assisted manufacturing and on-demand product delivery.



## Emerging Commodity

**\$80 billion + industry**

R&D in wood science and manufacturing have positioned bamboo as the material of the future.



## UN Global Goals

**Fosters 7 out of 17 goals**

Foster a bamboo regenerative economy contributes to goals 1,7,11,12,13,15,& 17.



# multi-disciplinary training for the #global goals



**Mass timber engineering**  
Aspect Structural Engineers  
@Vancouver, Canada

**Bamboo bio-construction**  
Casa Congo Conservation  
Arquitectura Mixta  
@Latin America & Caribbean

**Academic research**  
Bamboo Applications & Manufacturing Lab  
@University of British Columbia, Canada

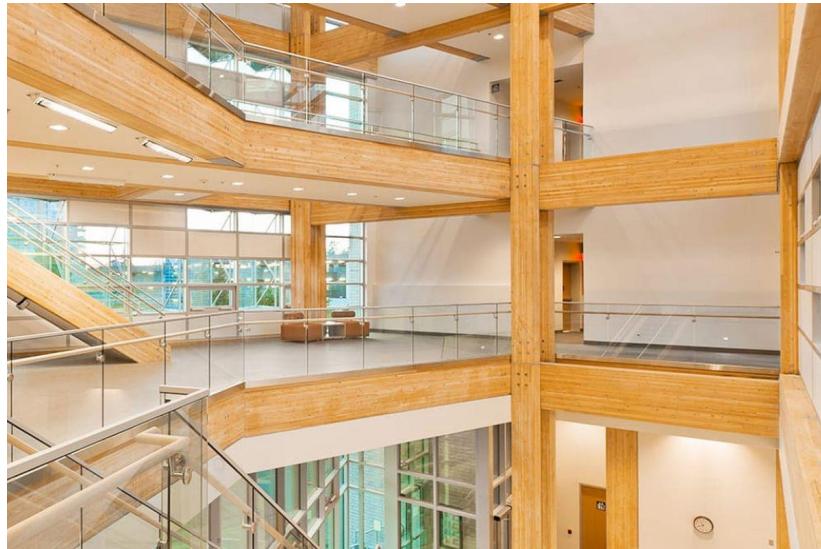
# mass timber 101

Mass timber has enabled a building construction revolution, one that is made from:

- Highly **renewable** building natural fibers
- **Carbon-negative** building materials
- Fast, efficient and cost effective **prefabricated** building solutions

**The key products leading this revolution are:**

1. Glued-laminated timber (glulam)
2. Cross-laminated timber (CLT)
3. Laminated veneer lumber (LVL)



# prefabrication (prefab) 101

Level 1: Components  
Manufactured in Factory

Level 1a: Light Frame (Trusses, Framing Packages)

Level 1b: Heavy Timber (Glulam, NLT, DLT, CLT, ...)

Level 2: Panelized  
Components

Level 2a: One Side Closed Panels

Not finished

1 side finished

Not finished

1 side finished

2 sides finished

Level 3: Volumetric Pre-  
Assembled Pods

Pods: Bathroom, Kitchen,  
Mechanical

Level 4: Volumetric  
Prefabricated Modules

Modular construction

Manufactured Homes

Sources:

Goodier C., Gibb A.: Future opportunities for offsite in the UK. *Construction Management and Economics*, 25(6), 585–595., 2007.  
Goodland H., Lam A., Taylor M., Zadeh P.: Cost Implications of Accelerated Construction Schedules. Vancouver: FP Innovations, 2019.  
Wimmers G: Wood Technology Solutions Report, Quesnel: City of Quesnel, 2020.



**Level 1 - Truss components**



**Level 2 - Panelized wall panel**



**Level 3 - Volumetric bathroom pods**



**Level 4 - Volumetric house modules**

# Kuna, a prefab panelized solution for everyone

Kuna is a housing and sustainable development platform that provides communities with assets to enable **income generation, education and environmental conservation**. Our vision is to solve the global housing crisis, one bamboo pole at a time.

## The Kuna bamboo home overview:

- 50 square meter single family home: 2x beds, 1 bath, 1x living, 1x roofed patio
- Decentralized wastewater treatment & rain-water collection systems
- 3 day prefab + assemble from top of concrete to roof
- Stores 6.7 tCO2e
- Affordable @USD 250/sqm



# Participatory community insights

El Astillero, Nicaragua 09/2020 - 01/2021

## Survey Data Points (October 2020, 190 families)

	<u>Results</u>
Average monthly income	3,400 cordobas (\$115)
Average monthly grocery expense	2,000 cordobas (\$65)
Average monthly electricity and water bills	160 cordobas (\$3.30)
Average monthly mortgage payment capacity	400 cordobas (\$14)
Household that runs a business from the house (pulperia, etc)	52%
Household awareness of bamboo as a construction material	75%
Household willingness to live in a bamboo house	70%
Amount of families with property ownership title	48%
Amount of time families are willing to commit to build their own house	40 hours / week
Amount of families willing to help their neighbour build their house	100%



# the Kuna prefab process

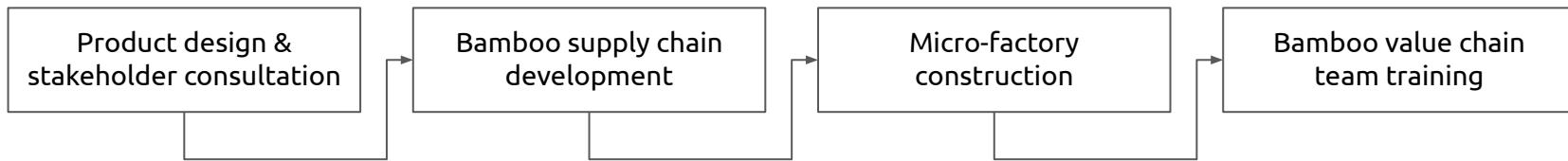
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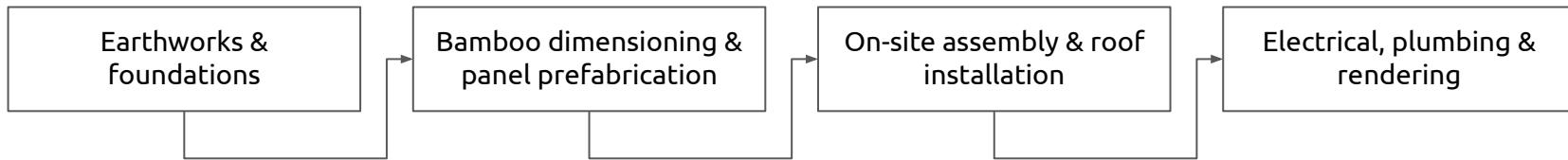
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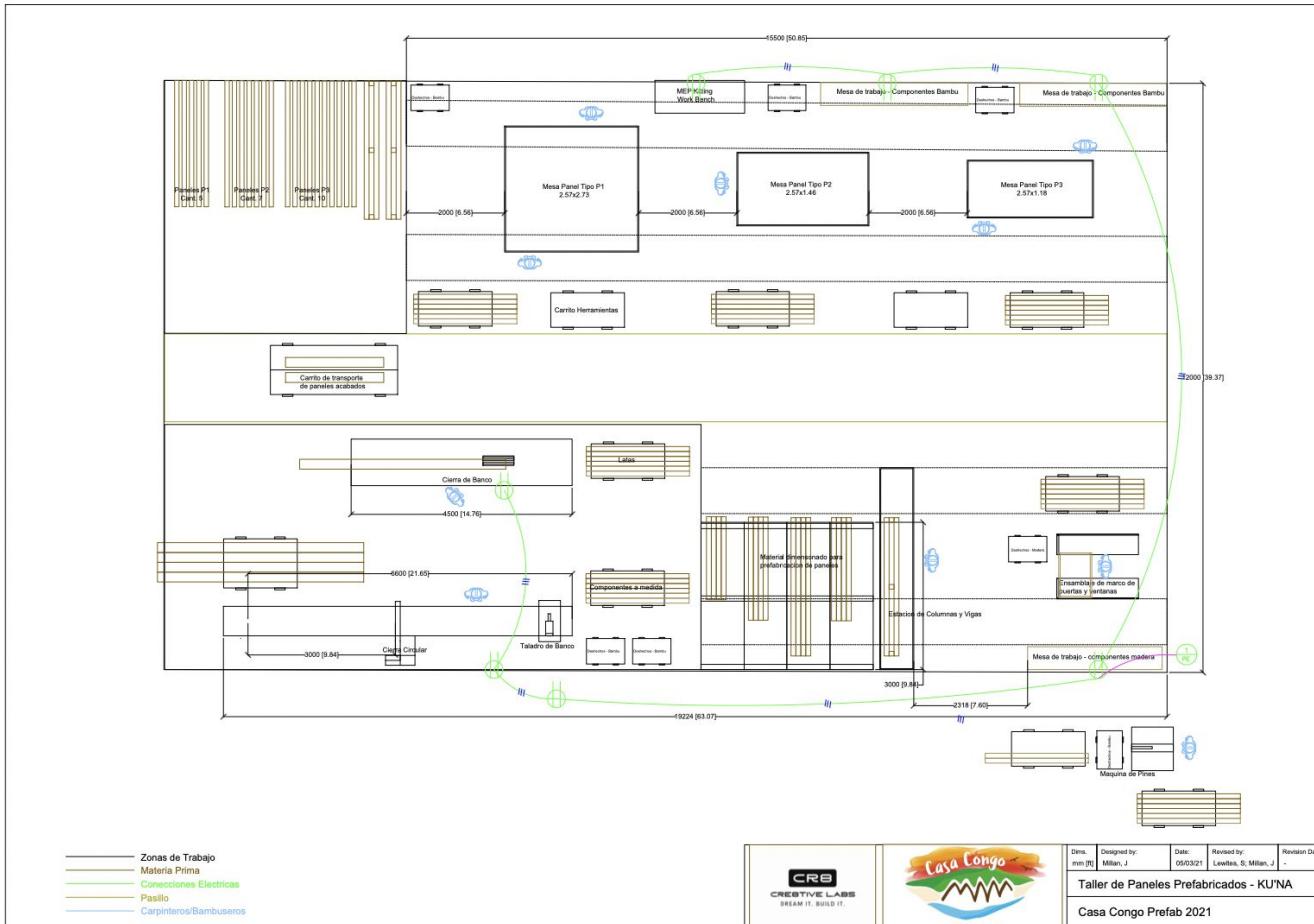
## Pre-project phase: 4-8 months

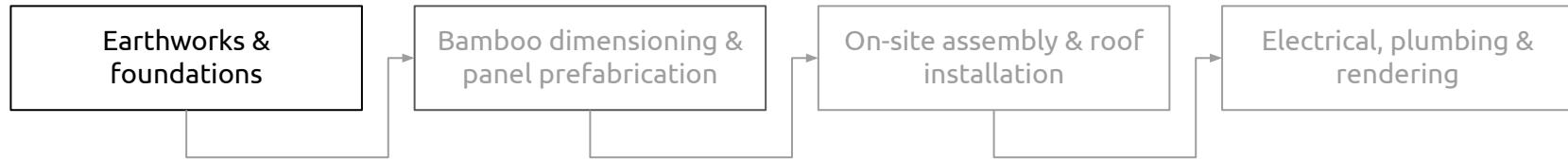


## Project phase: 60 working days x 20 homes



# the Kuna micro-factory & equipment





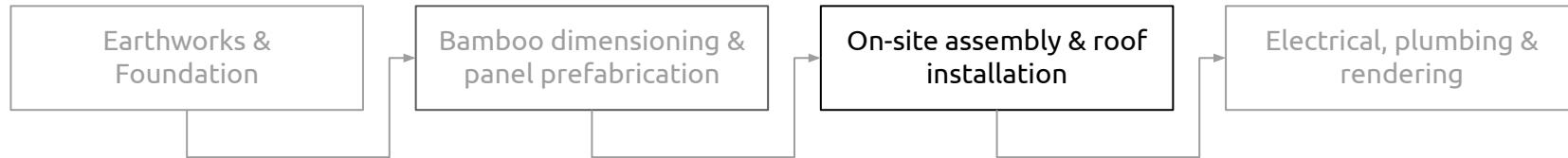
Earthworks &  
Foundation

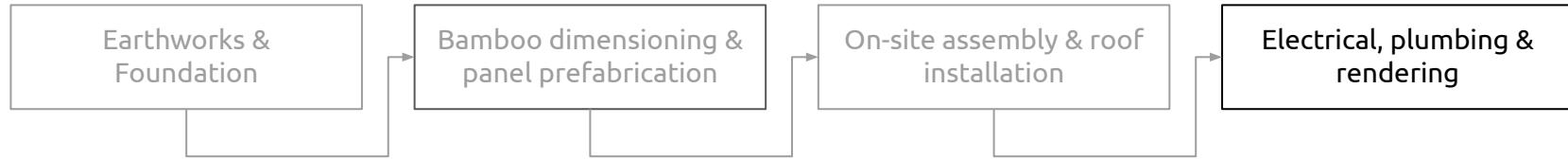
Bamboo dimensioning &  
panel prefabrication

On-site assembly & roof  
installation

Electrical, plumbing &  
rendering







# a bamboo house over a concrete home?

Category	Key performance indicators
Embodied carbon	Equivalent tons of CO2 emitted per primary and secondary structural elements utilized per home
Structural safety	International building code compliance for gravity & lateral load systems
Fire safety	International fire safe code compliance to ensure safe fire rating
Affordability	Final cost per square meter
Speed of construction	Homes built per week
Resilient supply chains	Tons of raw material available per continent Years required to regenerate structural raw material consumed per home Distance of raw material to project location
Equity, diversity & inclusion	Male to female ratio Workers wage as percentage of total cost Certified bamboo carpenters per training course

# Let's build with bamboo.

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**BAM** *Bamboo Applications  
and Manufacturing*

