Mitigating the impact of Natural Risks in Africa

The important role of architecture for climate change mitigation and adaptation

A holistic approach towards International Disaster Resilient Architecture by learning from vernacular construction

UNESCO

United Nations
Educational, Scientific and
Cultural Organization


CULTURAL
ECONOMIC
SOCIAL
ENVIRONMENTAL
TECHNICAL
HOLISTIC APPROACH

Lilongwe, Malawi
Kafinja School
Feeding shelter
and kitchen

INternational
Disaster
Resilient
Architecture

Natural hazards

Non-engineered construction

Vernacular architecture

Challenges – needs

INDRA

Policy opportunities

International DRR Policy

Contemporary vernacular

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Educational, Scientific and
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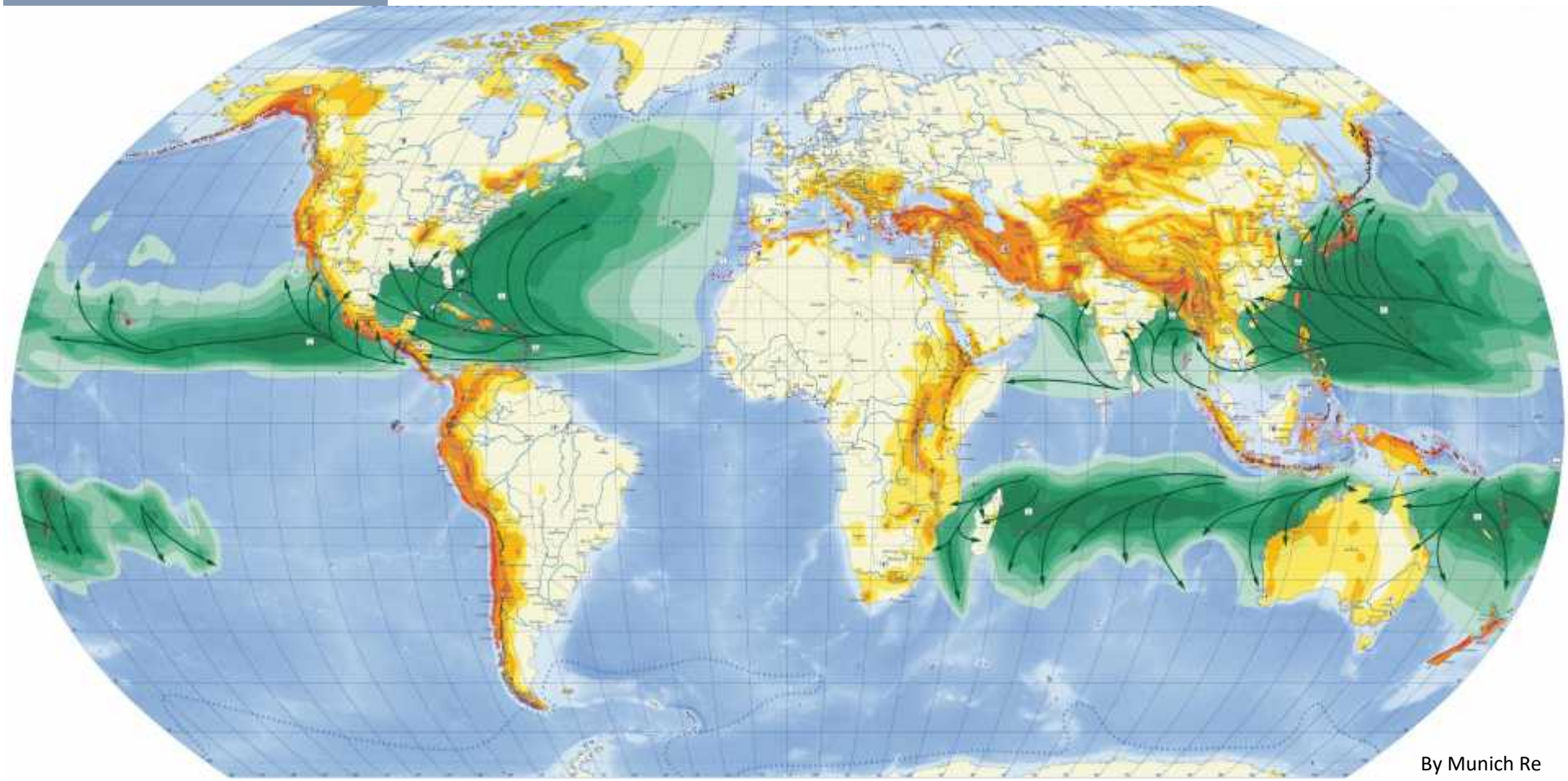
Natural hazards

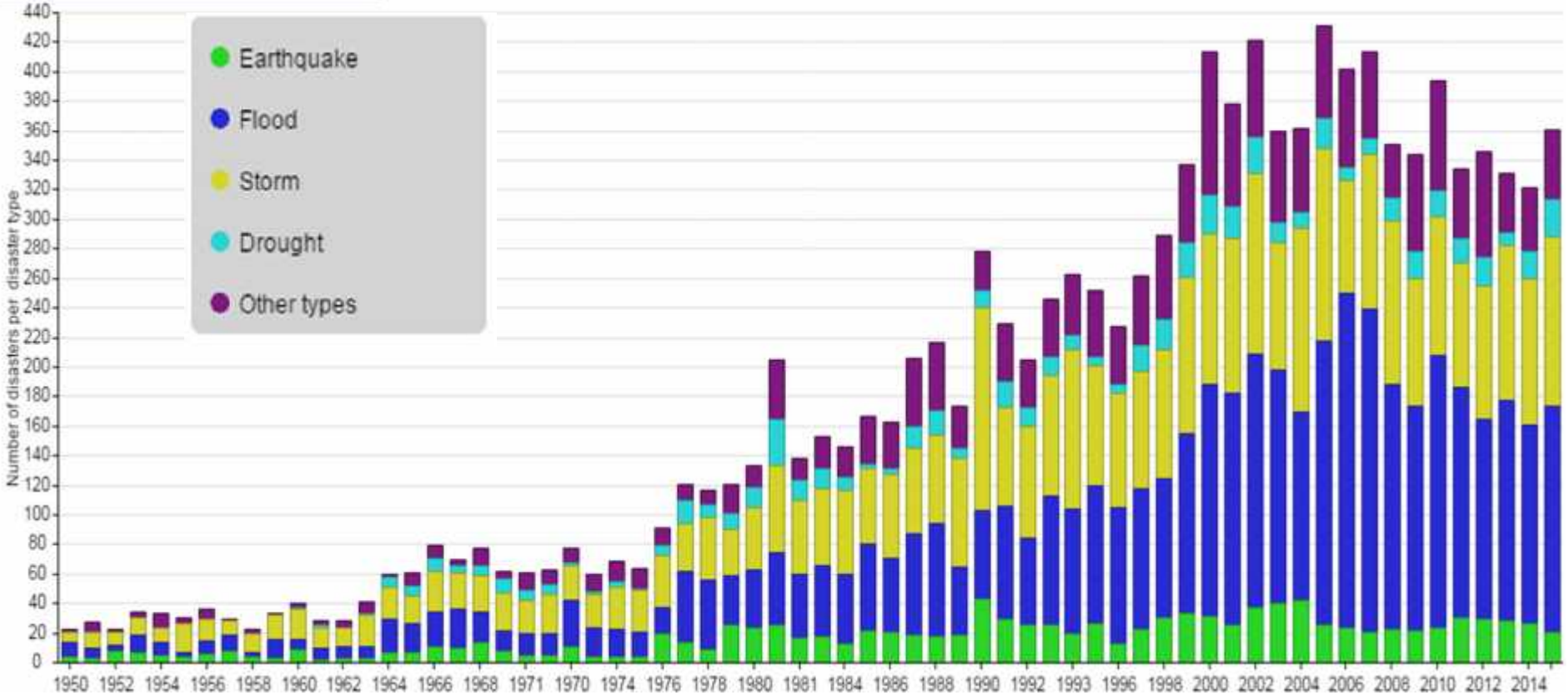
EARTHQUAKES
TROPICAL CYCLONES
VOLCANOES
TSUNAMIS AND STORMS



By Munich Re

Natural hazards

Number of disasters per type and per year



Natural hazards

2000 - 2016

> 1/3 of the world population heavily affected

~ 30 million homeless

836 620 people died

Each year

250 – 300 billion USD

Natural hazards

95% deaths
in developing countries

325 million people
exposed
by 2030

60% extra buildings
of the area
expected to be urbanized
by 2030

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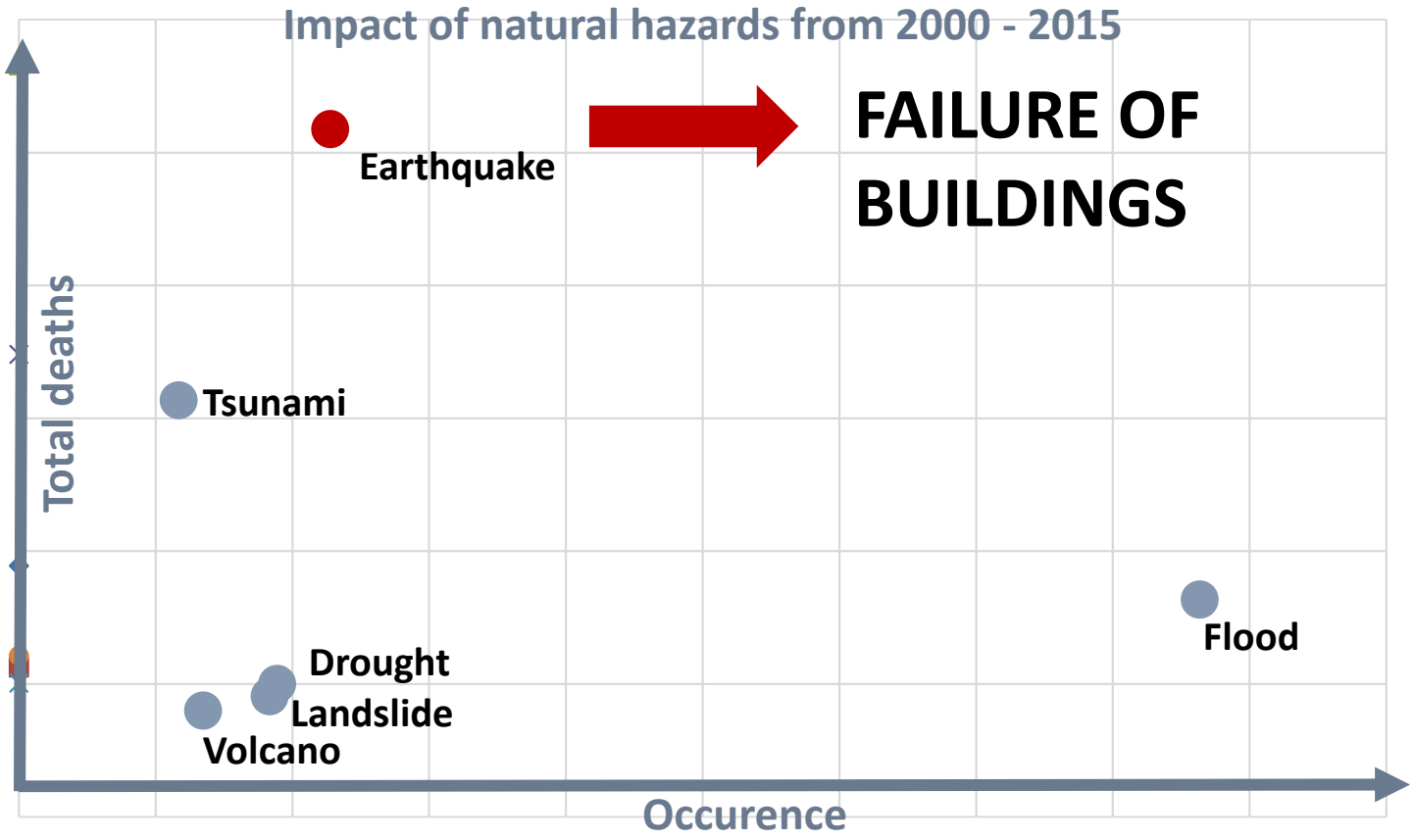
Non-engineered construction



Non-engineered construction

+- **80%** of people at risk today live in

reinforced concrete frame infill-masonry buildings

dixit Fouad Bendimerad at 13th World Conference on Earthquake Engineering, 2004

Reinforced concrete frame building with brick infill walls under construction, Kathmandu, Nepal (© J. Bothara)

Non-engineered construction

Major losses in non-engineered construction

Floods in the outskirts of Islamabad, Pakistan, 2014
© Photo by AP

A slum in Haiti damaged by the 2010 earthquake.
© UN Photo/Logan Abassi United Nations Development Programme

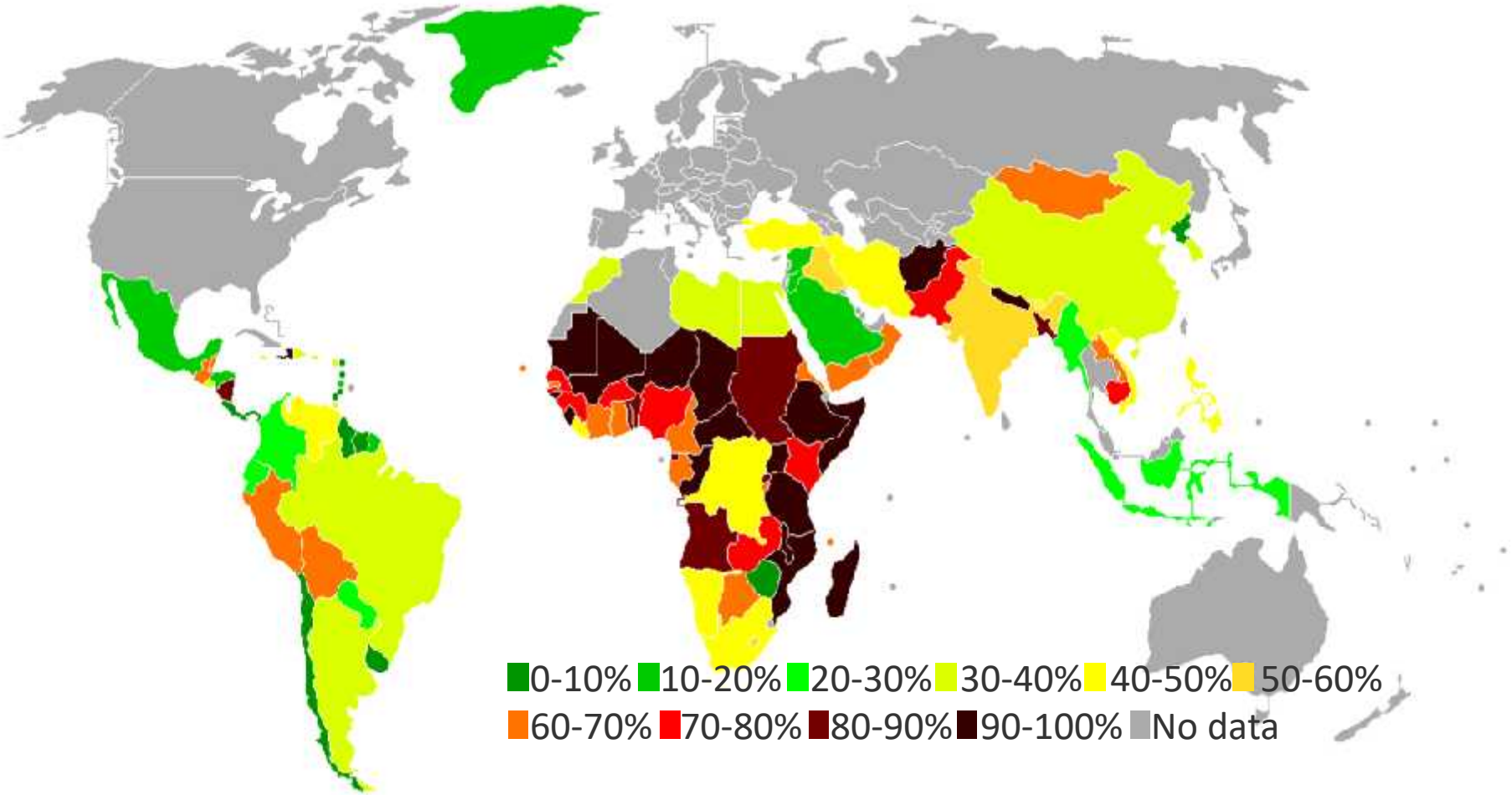
Non-engineered slums

828 million people live in slums today

and the number keeps rising

Proportion of each country's urban population living in slums

(2001, according to UN-Habitat definition)



Non-engineered construction

= Informally constructed,
without any or little intervention by qualified architects and engineers

-Often copied from other countries

-(partly) imported materials

-‘foreign’ techniques, lack of technical know-how

-Highly vulnerable to natural hazards

Failure of buildings
Mostly non-engineered construction

These hazards are within our power to respond to!

Retrofitting
Build back better
New construction

'Africa does little to pollute our world,

but will pay the highest price.'

Kofi Annan

2015, CNN

Construction sector

↓

Climate Change mitigation and adaptation

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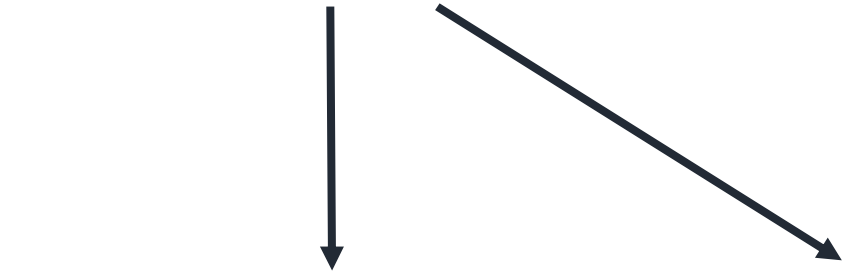
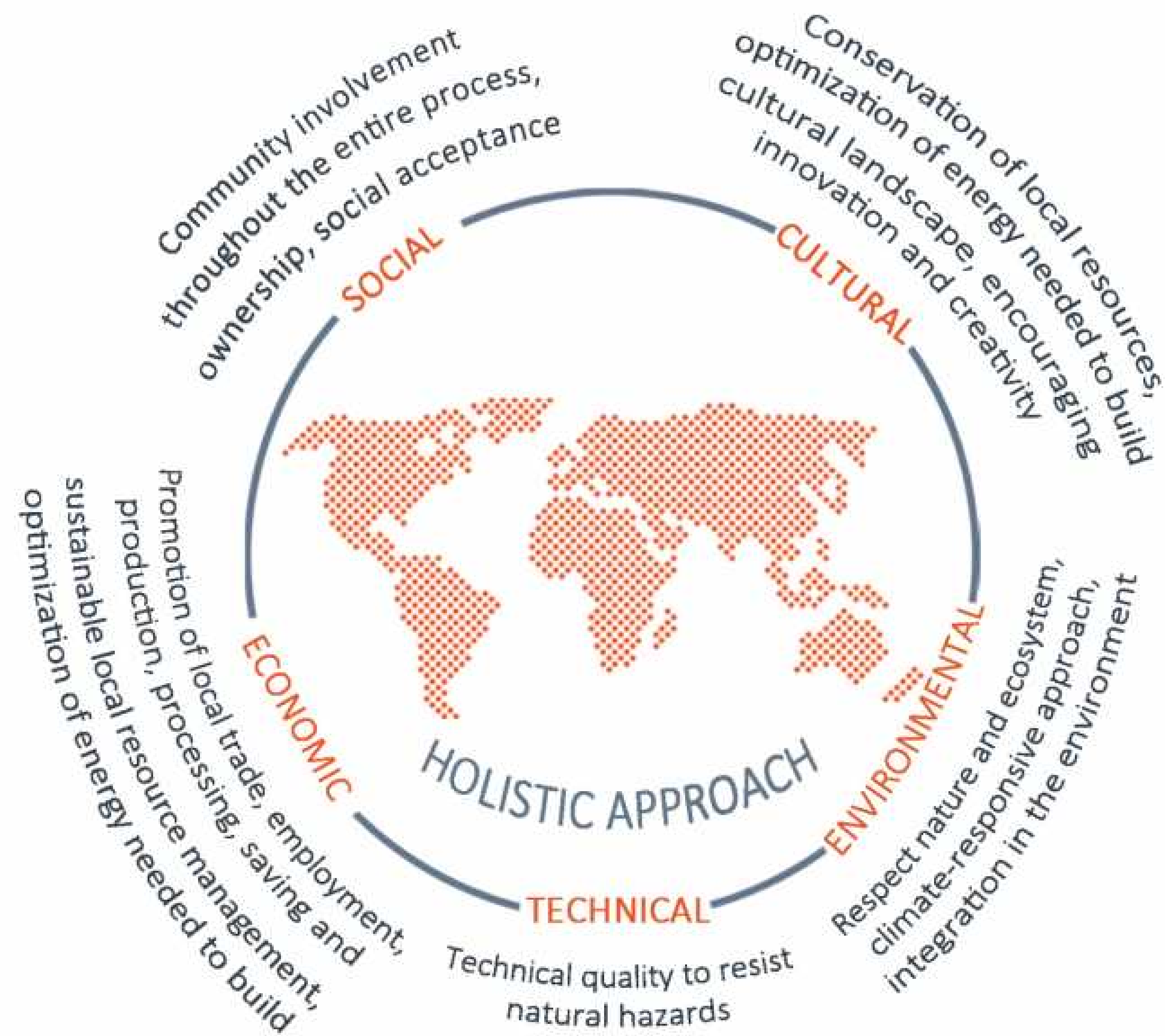


	Vernacular architecture
-Often copied from other countries	-Adapted to local context
-(Partly) imported materials	-Local materials
-'Foreign' techniques, lack of technical know-how	-Accumulated knowledge
-Highly vulnerable to natural hazards	-(Was) mostly resilient to natural hazards

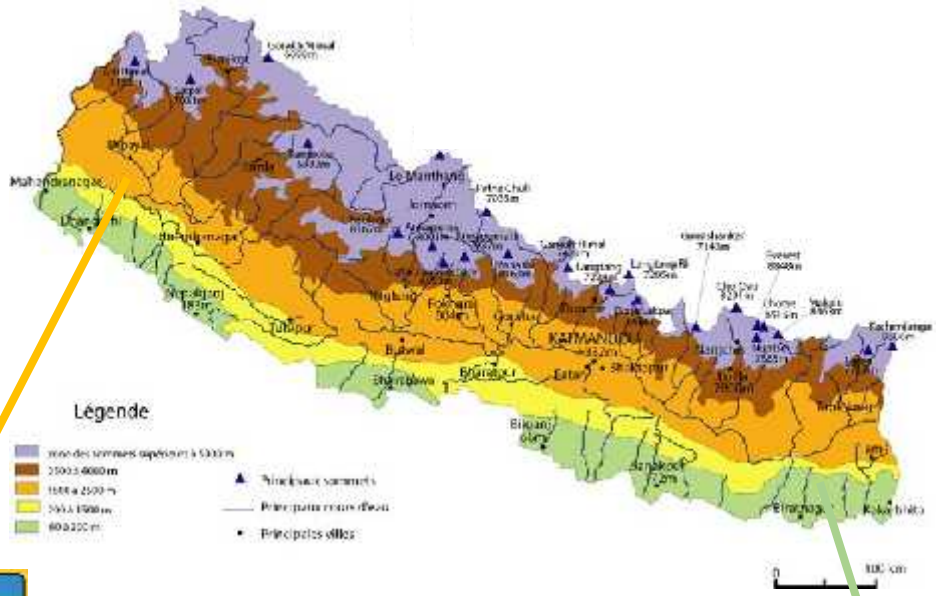

Community involvement throughout the entire process, ownership, social acceptance
SOCIAL
Conservation of local resources, optimization of energy needed to build cultural landscape, encouraging innovation and creativity
CULTURAL
ECONOMIC
Promotion of local trade, employment, production, processing, saving and sustainable local resource management, optimization of energy needed to build
HOLISTIC APPROACH
ENVIRONMENTAL
Respect nature and ecosystem, climate-responsive approach, integration in the environment
TECHNICAL
Technical quality to resist natural hazards

Vernacular architecture

CASES

Nepal

Rajbanshi and Gurung construction
Resilient to earthquakes and/or floods



Gurung houses

Gurung houses in western mid-hill:
resilient to earthquakes

A stilt-house constructed
of sal wood and
stuccoed bamboo weaving
Shani-Arjun, Jhapa

Rajbanshi construction in eastern Nepal:
resilient to earthquakes + floods

Vernacular architecture

CASES

Haiti

Gingerbread houses
Resilient to earthquakes

1912 Peabody House in Pacot
survived the 2010 earthquake almost undamaged

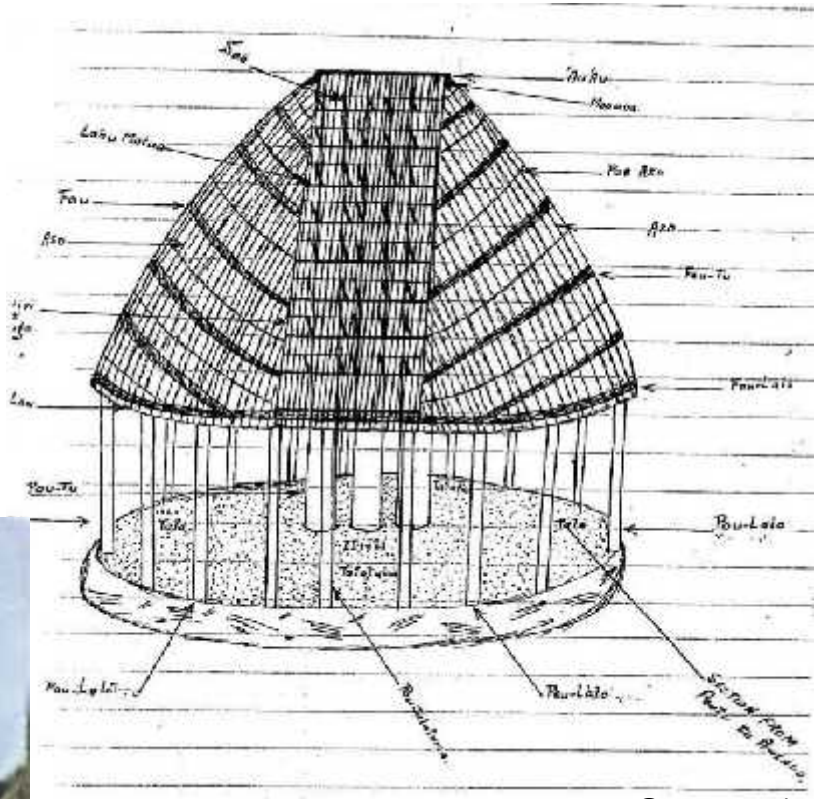
Vernacular architecture

CASES

Samoa

Fale tele construction

Resilient to floods, storms, cyclones



© Teo Tuvale

© Charles S. Greene

Vernacular architecture

CASES

Borneo

Longhouse construction
Resilient to floods

Iban longhouses

Vernacular architecture

Chile

Chiloé Island

Resilient to floods and earthquakes

Vernacular architecture

CASES

Turkey

Traditional ‘himis’ construction, Safranbolu
Resilient to earthquakes

Vernacular architecture

CASES

Turkey

Traditional ‘himis’ construction, Safranbolu
Resilient to earthquakes

Himis construction didn’t collapse after earthquake in 1999, modern structure collapsed.

Vernacular architecture

CASES

Indonesia

Traditional construction in Nias
Resilient to earthquakes and floods

Yemen

Reconstruction after Dhamar earthquake in 1982

Reinforced concrete prototype house

Cultural dimension of reconstruction overlooked

Rejection of the new settlements by locals

Houses altered, extended or changed by locals

Most additions not earthquake-safe because of inability to follow the introduced technology.

Dhamar earthquake in Yemen in 1982

Image source: Snipview

Natural hazards

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- Limited research about vernacular architecture
- Limited improvement of local techniques
- Low recognition of vernacular architecture

- Gap between local construction practices on site and engineering studies from developed countries

- Lack of framework for non-engineered construction (non-engineered construction not always included in building codes)

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INDRA

A holistic approach towards
international disaster resilient and sustainable construction
by learning from vernacular architecture.

INDRA

STRATEGY

1 Research and analysis of indigenous and current construction techniques

2 Develop sustainable solutions through science, technology and innovation

3 Disseminate and implement sustainable solutions through different activities

➡ Workshops, guidelines, training, education…

INDRA

IMPACT

– climate change mitigation and adaptation
– business continuity
– improve the overall economy
– reduce greenhouse gas emissions

SUSTAINABILITY

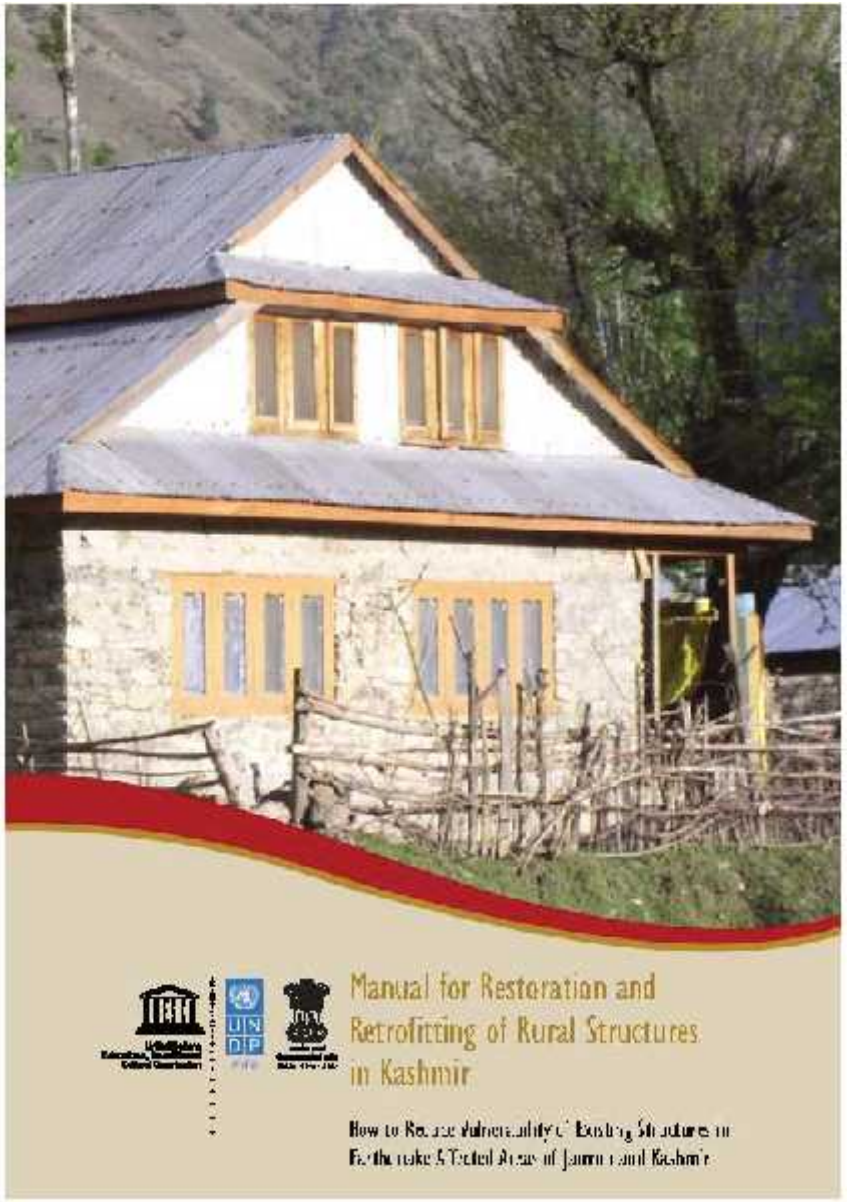
– replicable by locals thanks to local materials, techniques and trainings for local builders

– build back better

INDRA

Northern Pakistan – Kashmir

Dhajji dewari and taq construction
Resilient to earthquakes



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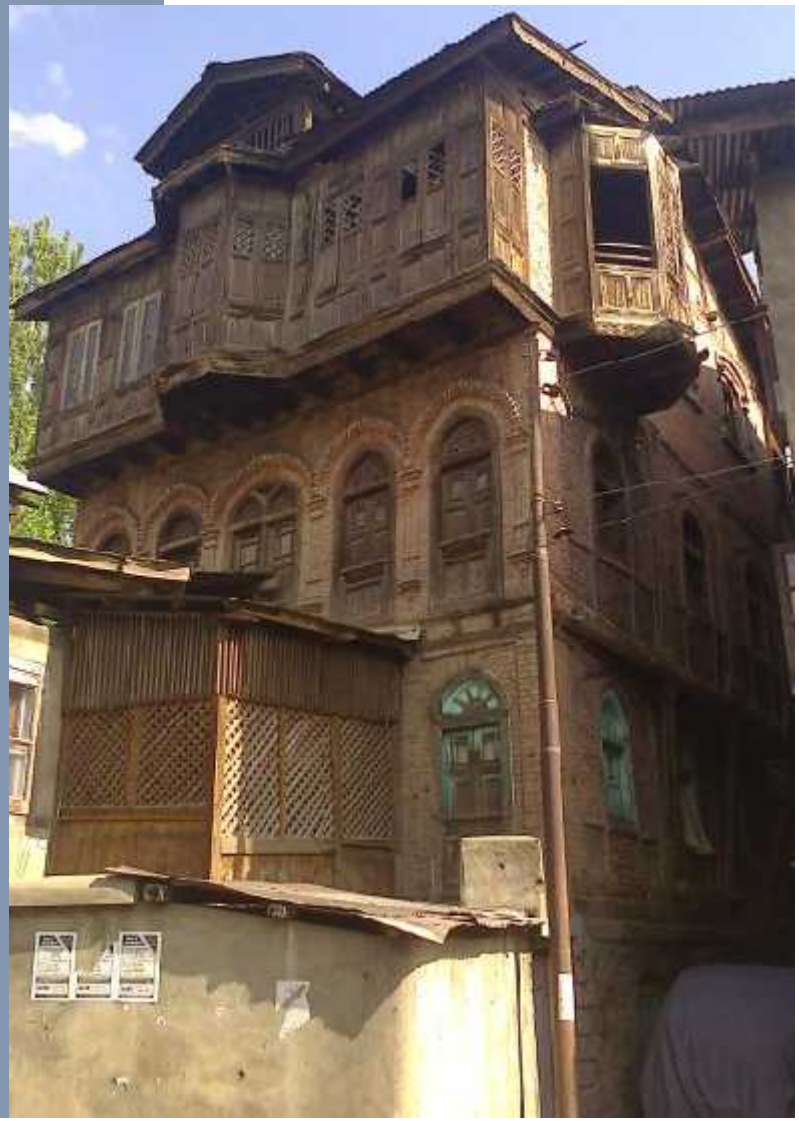
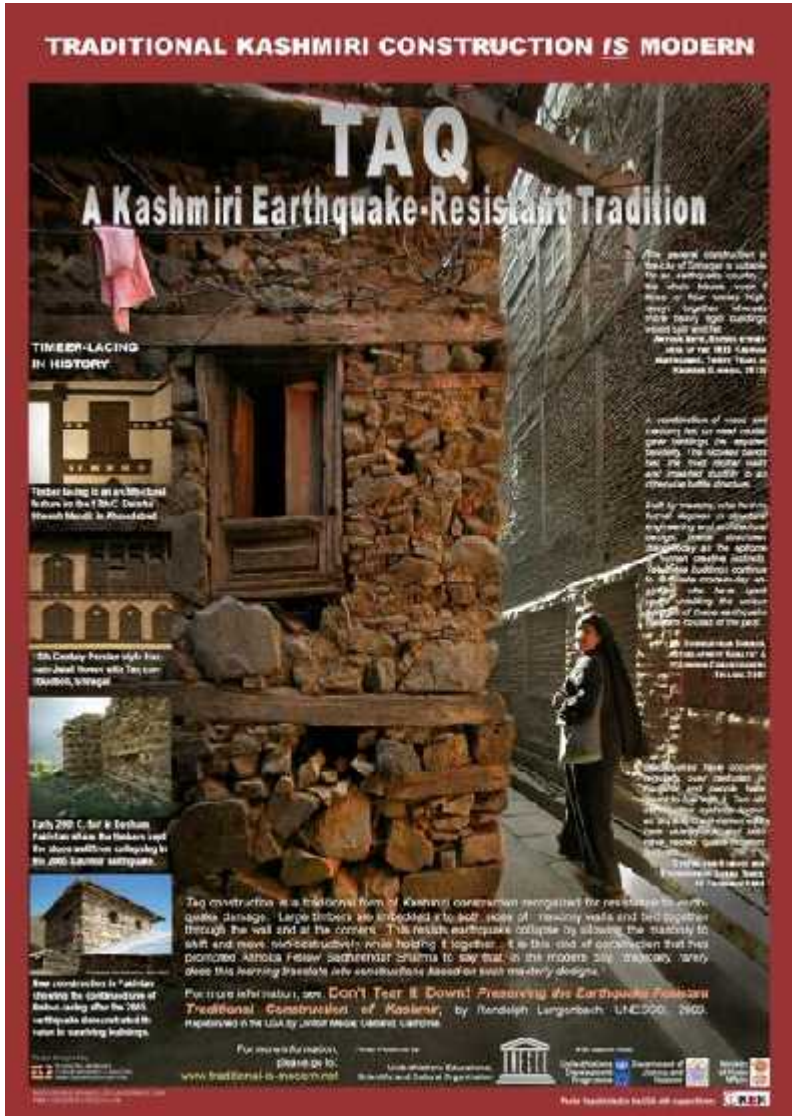


UNESCO 2007 poster



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Indonesia

Traditional construction in Nias
Resilient to earthquakes and floods

Mereka Yang Siaga
(The Prepared Ones)
(2007 UNESCO)

INDRA

Housing reconstruction after tsunami

Deforestation

Flash floods & landslides

Awareness raising and education

Construction sector

Indonesia

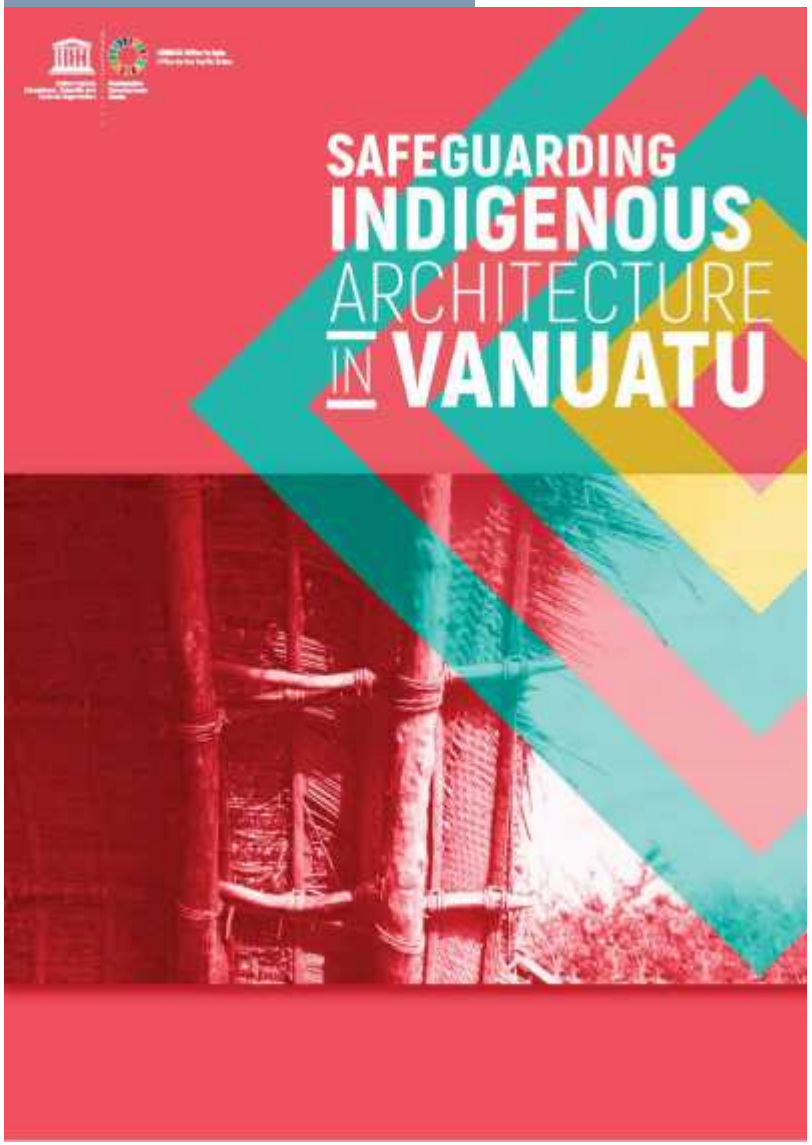
Tropical Rainforest of Sumatra

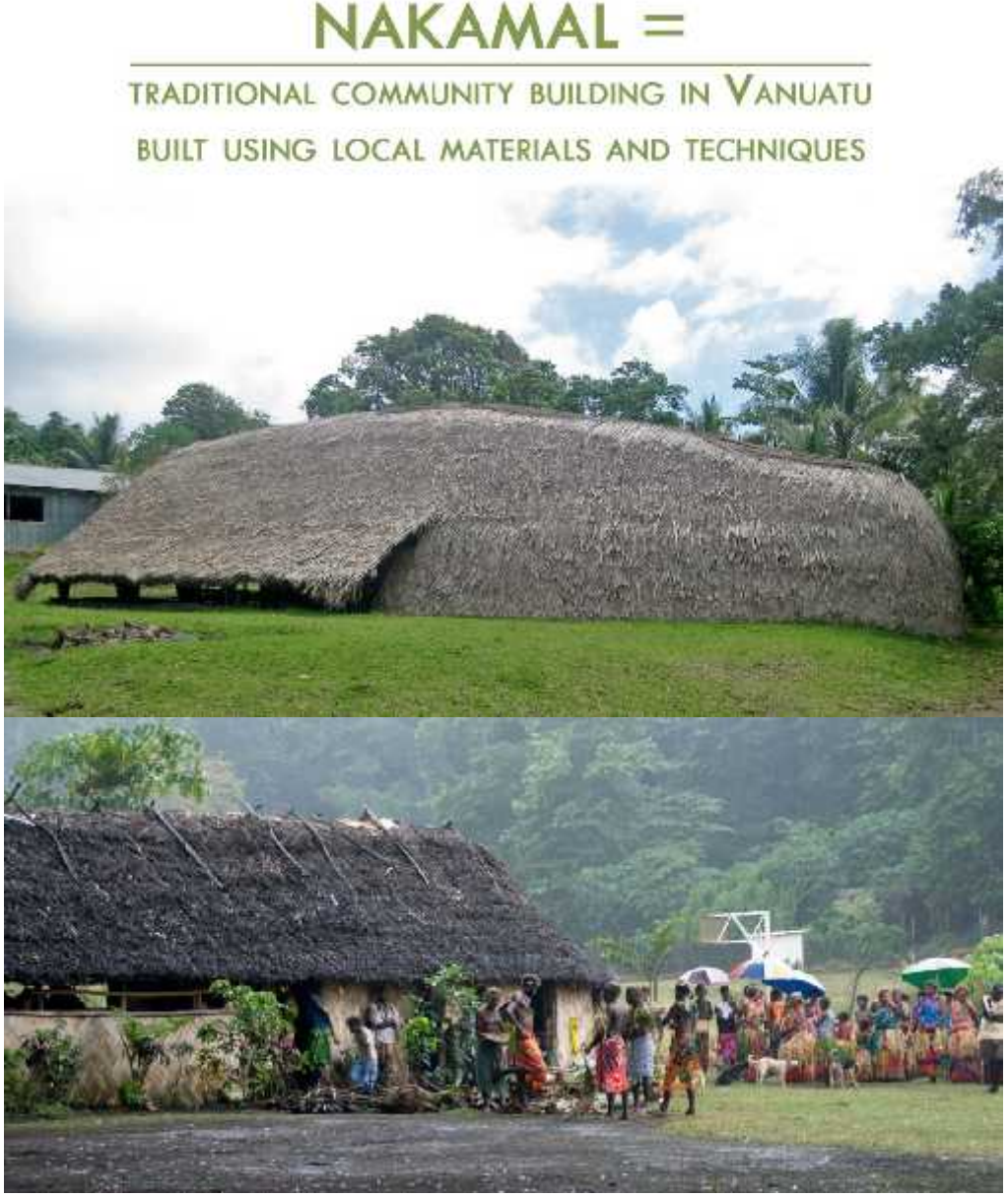
INDRA

Vanuatu

Traditional Nakamal construction

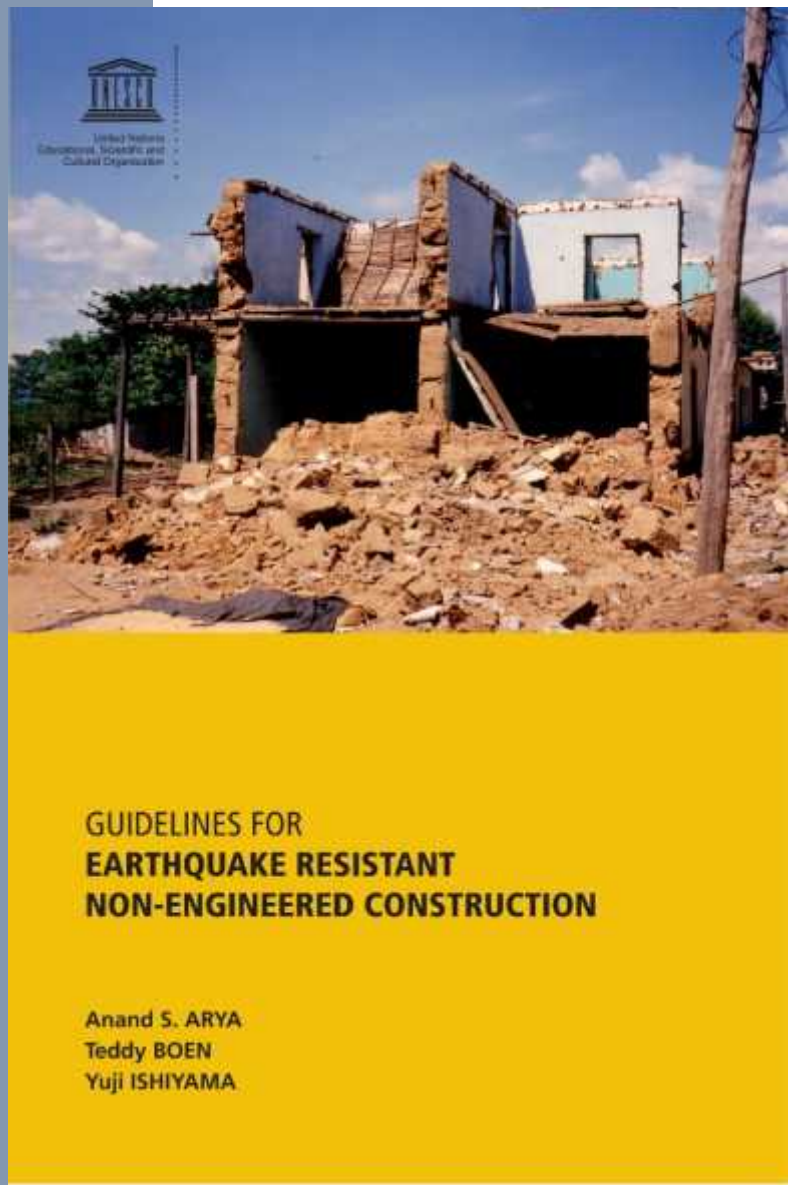
Protecting community against cyclones





INDRA

UNESCO Guidelines



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Support

Improve holistic approach by

building codes,

enforcement mechanisms for BC,

tax/subsidy systems

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International DRR policy

Sendai Framework
for Disaster Risk Reduction
2015 - 2030

SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY

11 SUSTAINABLE CITIES AND COMMUNITIES

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

TOGETHER IN ACTION
H III
NEW URBAN AGENDA

United Nations Plan of Action on
Disaster Risk Reduction for Resilience

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Contemporary vernacular

Nepal

Emergency shelter by arch. Shigeru Ban (Japan)
Resilient to earthquakes

‘Pombalino ‘gaiola’ construction in Portugal.

Emergency shelter to be built from rubble, 2015

Contemporary vernacular

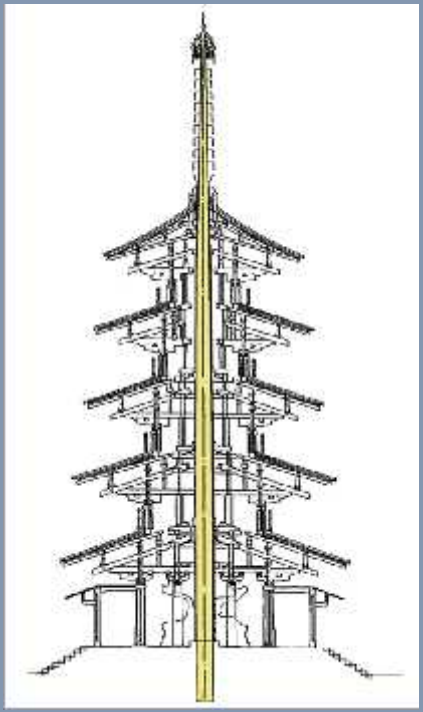
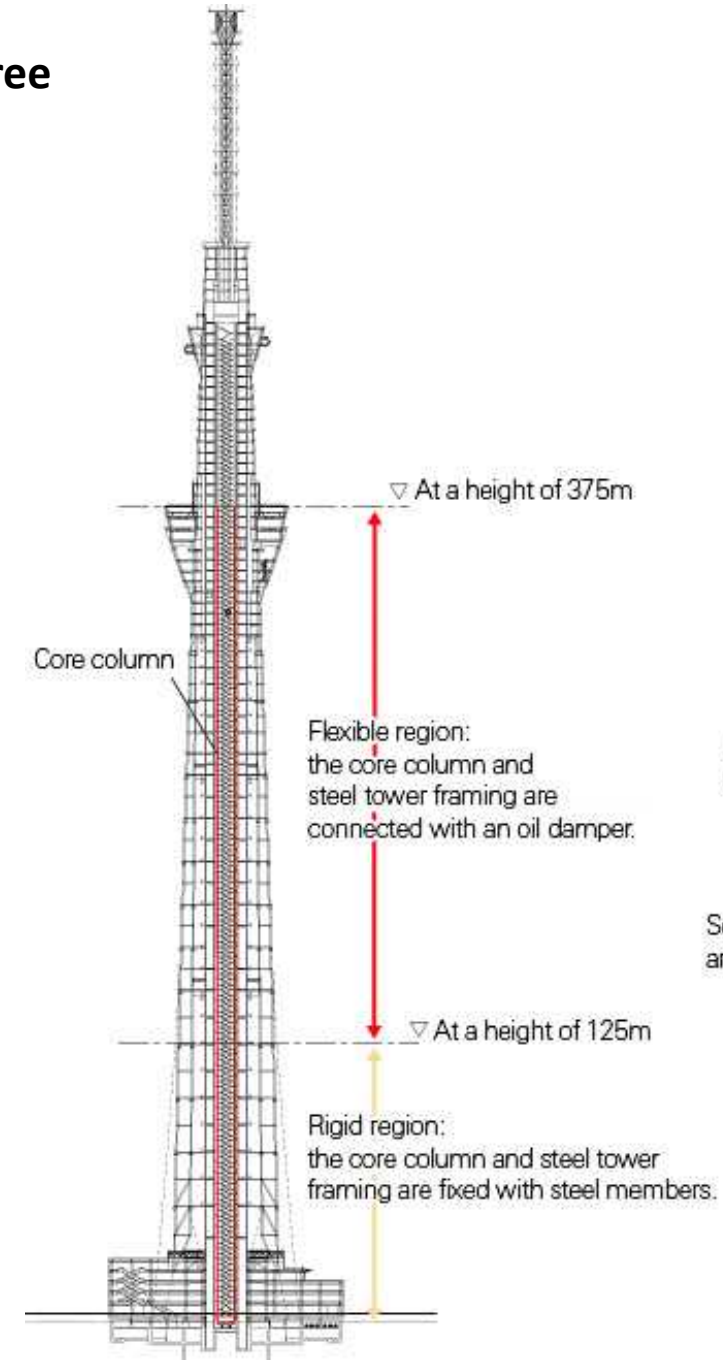
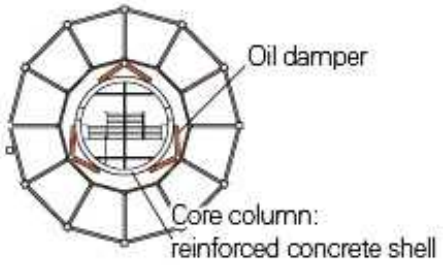


Fig. 1. Structural construction of five-story pagoda.
Source: Oktubo 2016

Japan
Tokyo Sky Tree





Sectional plan of the core column arrangement in the flexible region

Contemporary vernacular

Pakistan

Shelter by arch. Yasmeen Lari
Resilient to floods

Historical Monuments at Makli, Thatta

Shelter by Yasmeen Lari, 2005

Contemporary vernacular

Burkina Faso

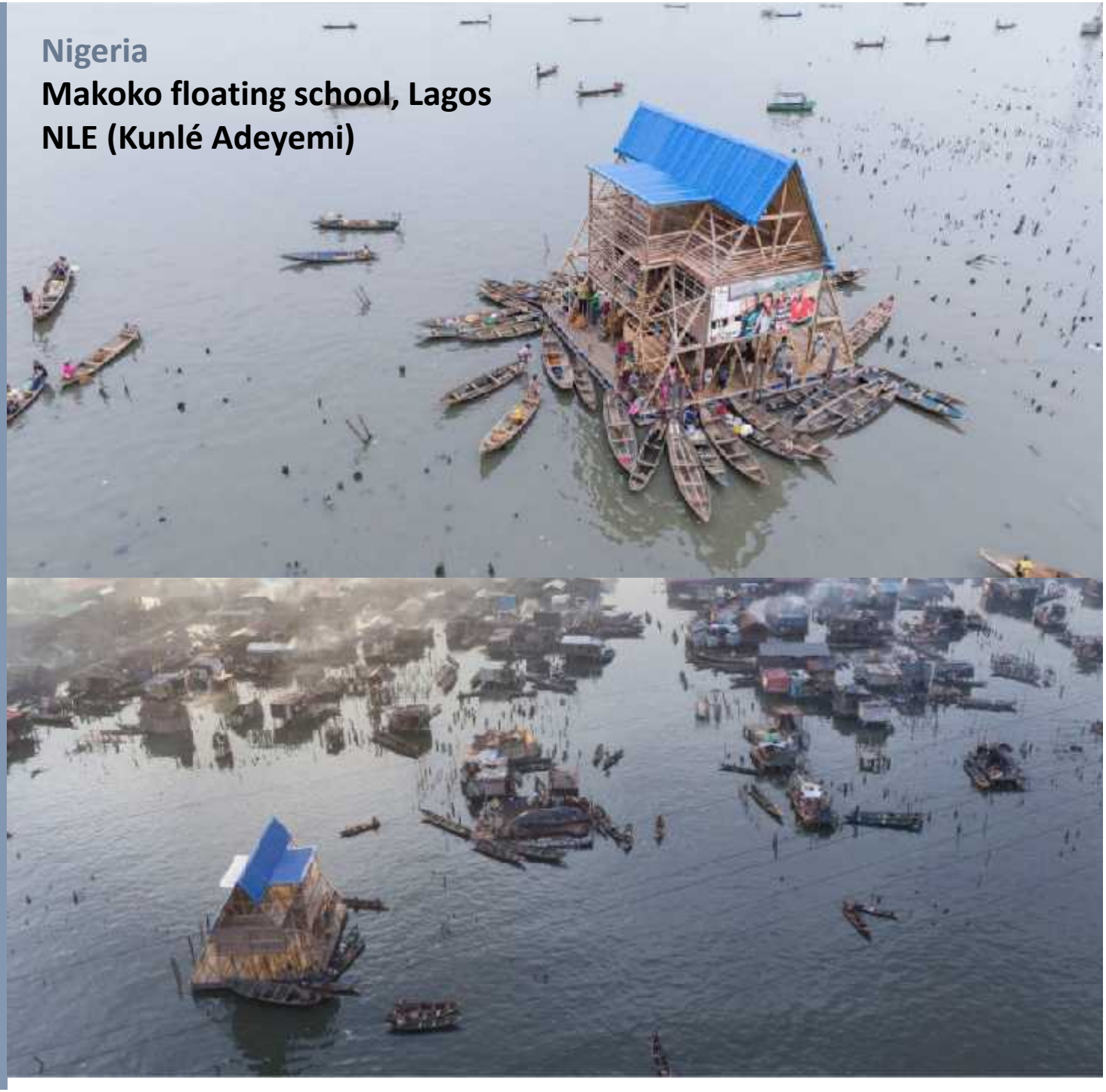
Lycée Schorge Secondary School, Koudougou

Kéré Architecture

Contemporary vernacular

Nigeria

Makoko floating school, Lagos
NLE (Kunlé Adeyemi)



Contemporary vernacular

Kenya

The Red Pepper House, Lamu

Urko Sanchez Architects

Contemporary vernacular

Morocco

Preschool of Aknaibich

BC architects + MAMOTH

Contemporary vernacular

Burkina Faso

Gando Primary School Extension

Kéré Architecture

Thank you

For more information:

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United Nations
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