GIS-Based Housing Design to Reduce Earthquake Risks

Yuxi Zhao and Suying Li

Beijing Forestry University

Funded by International Foundation for Science

Outline

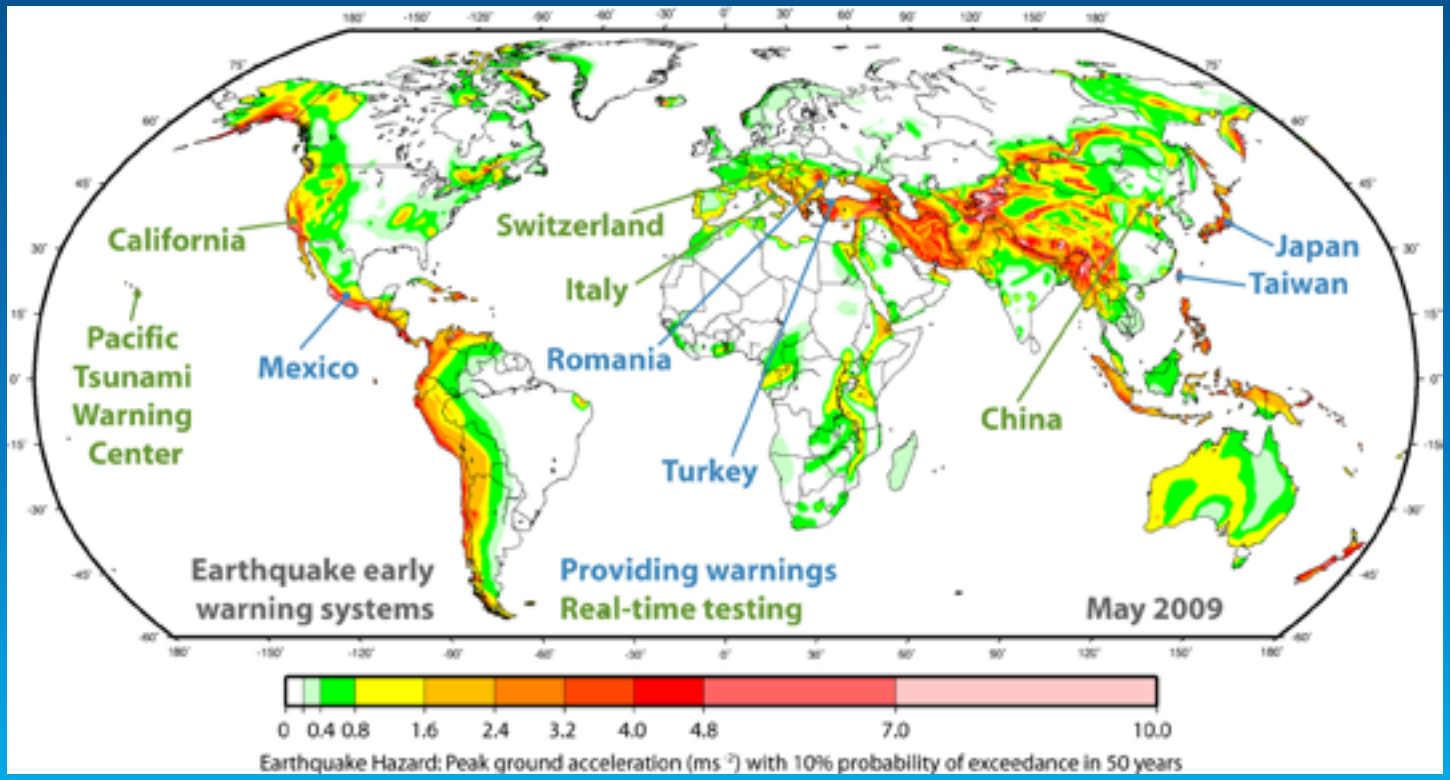
- Introduction
- The Problem: Traditional Bamboo Housing Design
- The Solution: GIS-Based Bamboo Housing Design
- The Way Forward

Outline

- Introduction
- The Problem: Traditional Bamboo Housing Design
- The Solution: GIS-Based Bamboo Housing Design
- The Way Forward

Introduction

- **China is a developing country with 1/3 of the world's continental earthquakes and 1/2 of the earthquake life losses.**



Introduction

- **China is a developing country with 1/3 of the world's continental earthquakes and 1/2 of the earthquake life losses.**

  - **developing country: people's *affordability***
  - **earthquake: housing's *security***

Introduction

Laminated Bamboo Lumber:

reduce environmental impacts by 40%

- **security: 5 times as sturdy as reinforced concrete structures**
- **affordability: 60% cheaper**

Introduction

- ***HOWEVER…***

  with the abundant bamboo resources and cheap labor:

  - **China exports 54% of the world's bamboo construction materials currently in using**
  - **The living conditions in the earthquake prone rural areas still remain the same**

Introduction

Why don’t China benefit from its own bamboo manufacture?

Outline

- Introduction
- The Problem: Traditional Housing Design
- The Solution: GIS-Based Housing Design
- The Way Forward

The Problem: Traditional Bamboo Housing Design
(pre-fabricated)

Architectural design
(foreign country)

Manufactured in factory
(China)

Assembled on site
(foreign country)

The Problem: Traditional Bamboo Housing Design
(pre-fabricated)

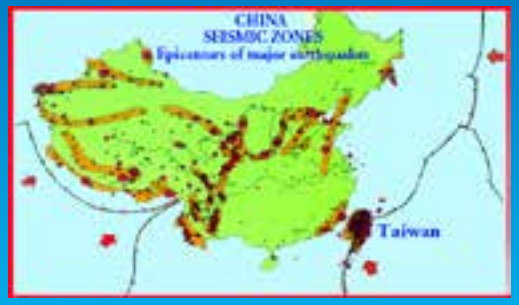
Rural Earthquake Prone Areas in China:

developing country: people's *affordability*

earthquake: housing's *security*

- Information about local people
  - what are their needs and preferences?
- Information about local buildings
  - Chinese building traditions?
- Information about local landscape environments
  - what is the local geospatial information?

Do ***not*** suit the diverse Chinese markets



Outline

- Introduction
- The Problem: Traditional Bamboo Housing Design
- The Solution: GIS-Based Bamboo Housing Design
- The Way Forward

The Solution: GIS-Based Bamboo Housing Design

Is there a “one formula for all” solution?

module

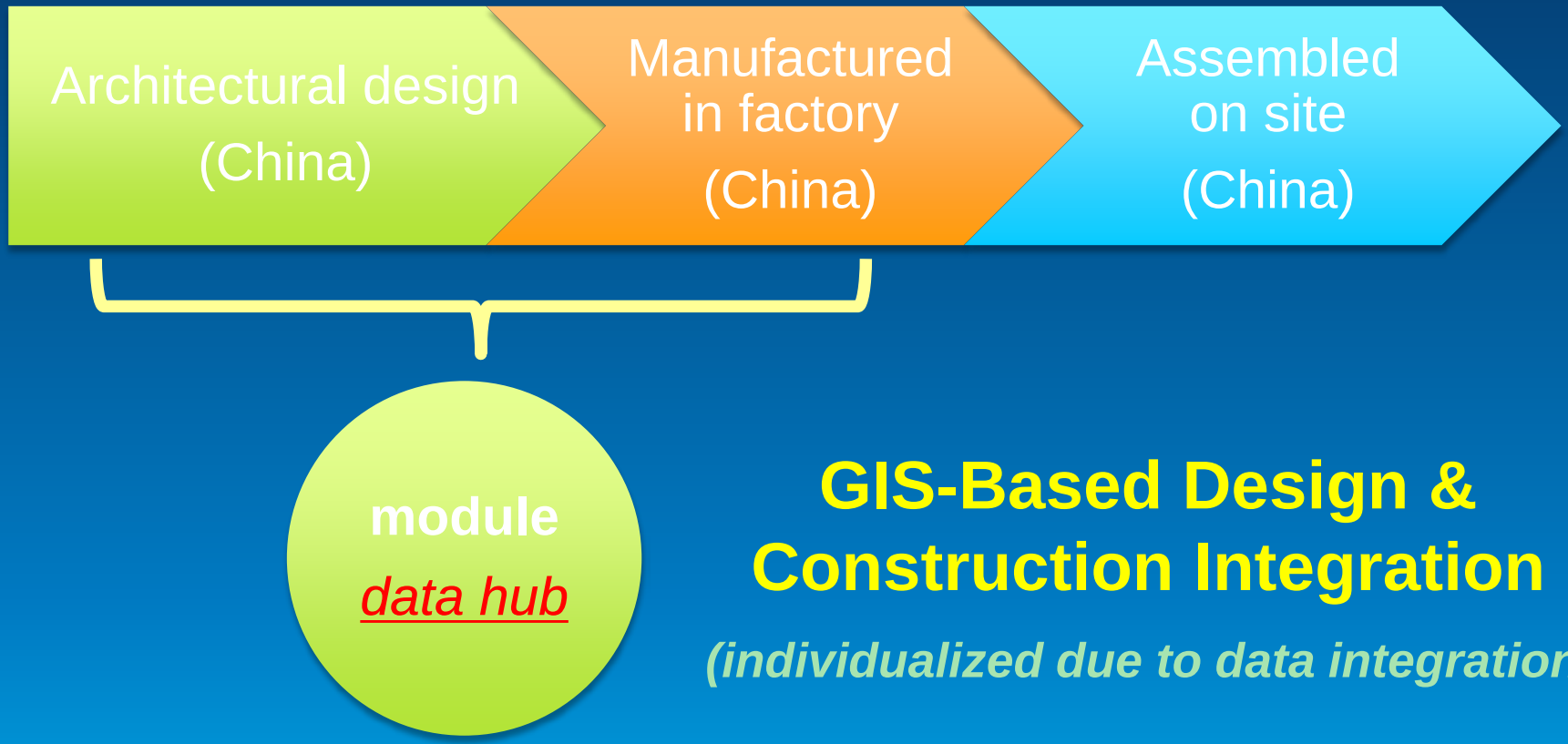
data hub

Attributes are set
(several types)

Attributes are alive & evolving
(endless types)

GIS-based big data housing design

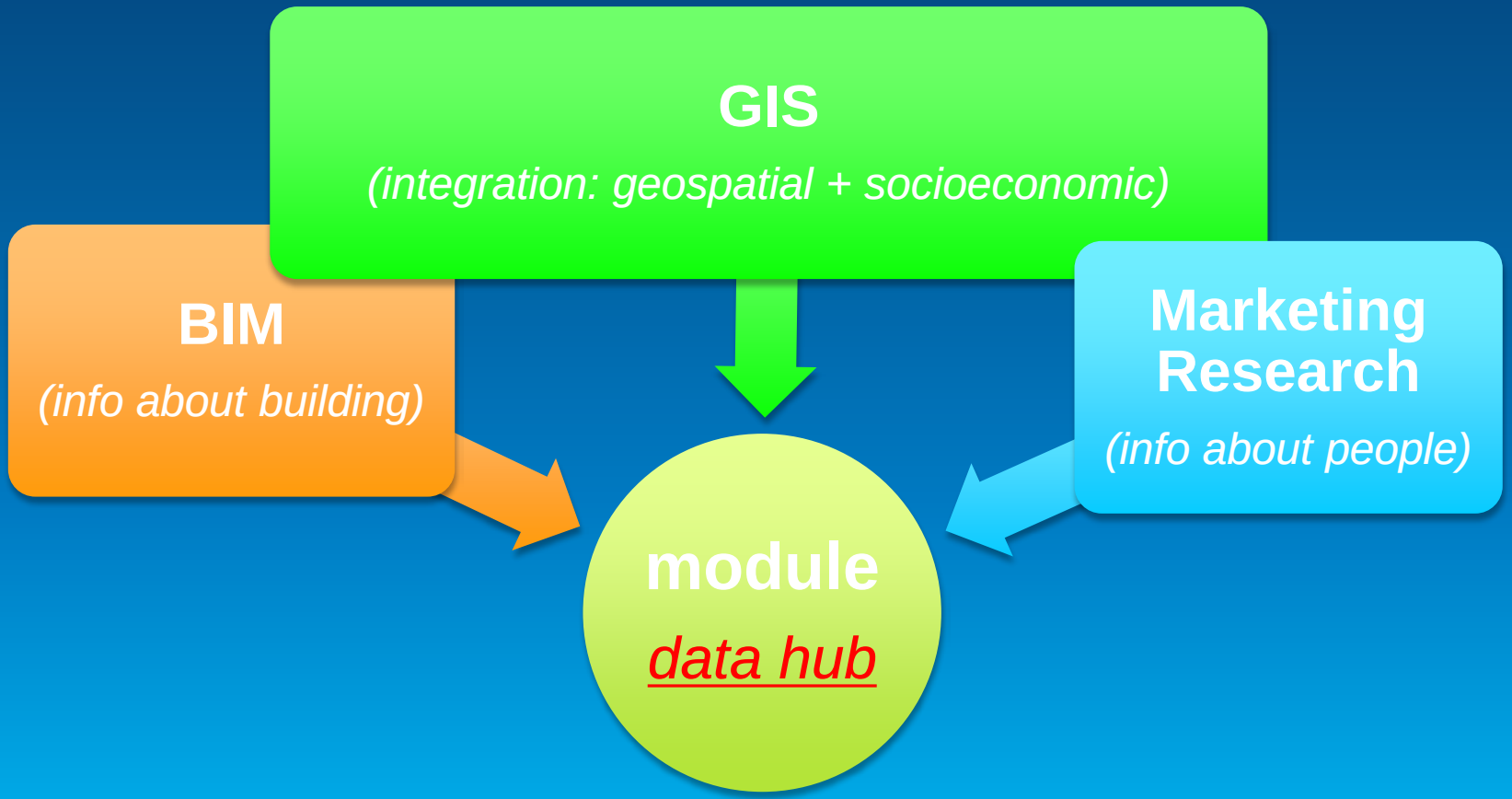
The Solution: GIS-Based Bamboo Housing Design



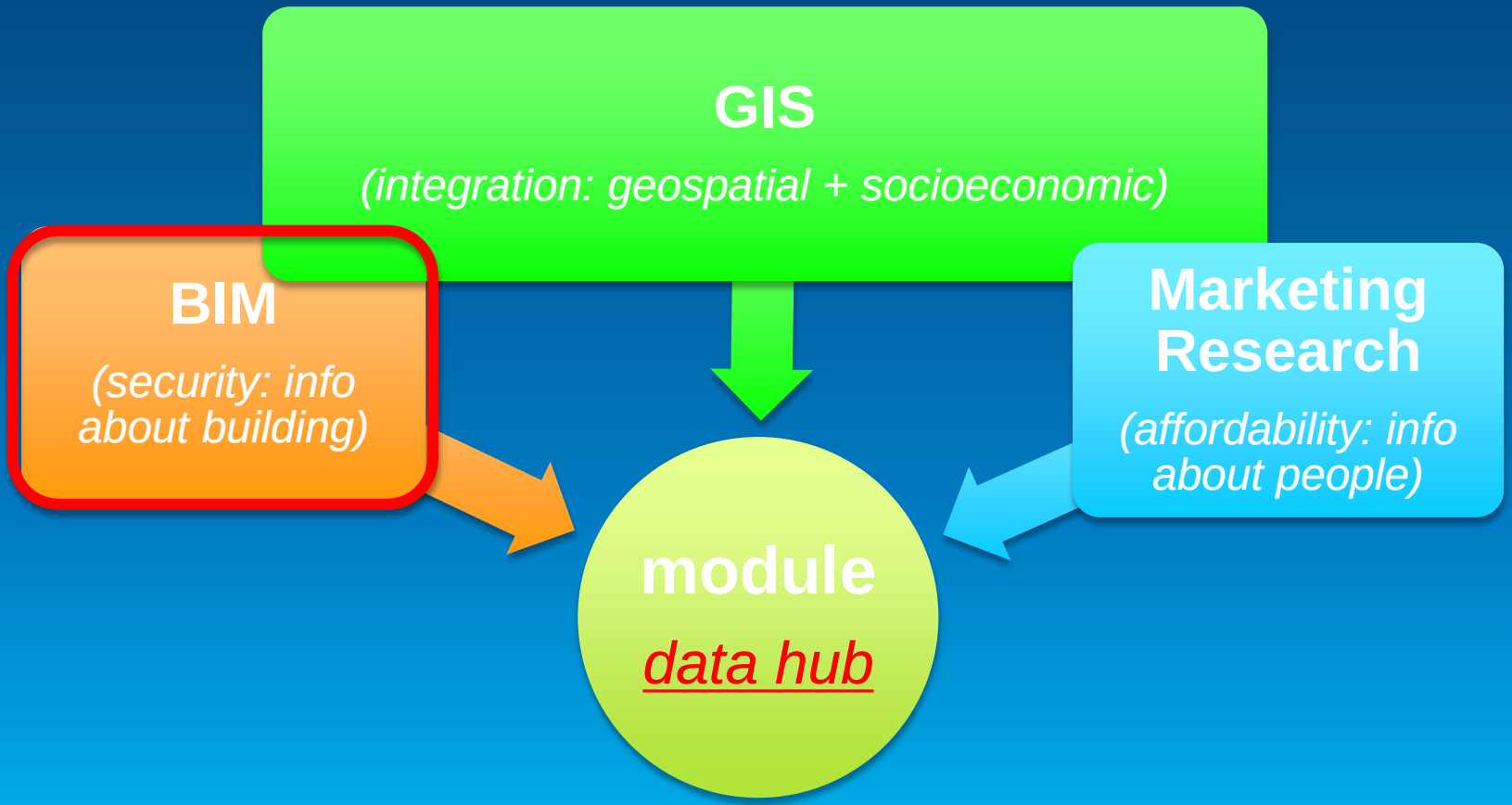
GIS-Based Design & Construction Integration

(individualized due to data integration)

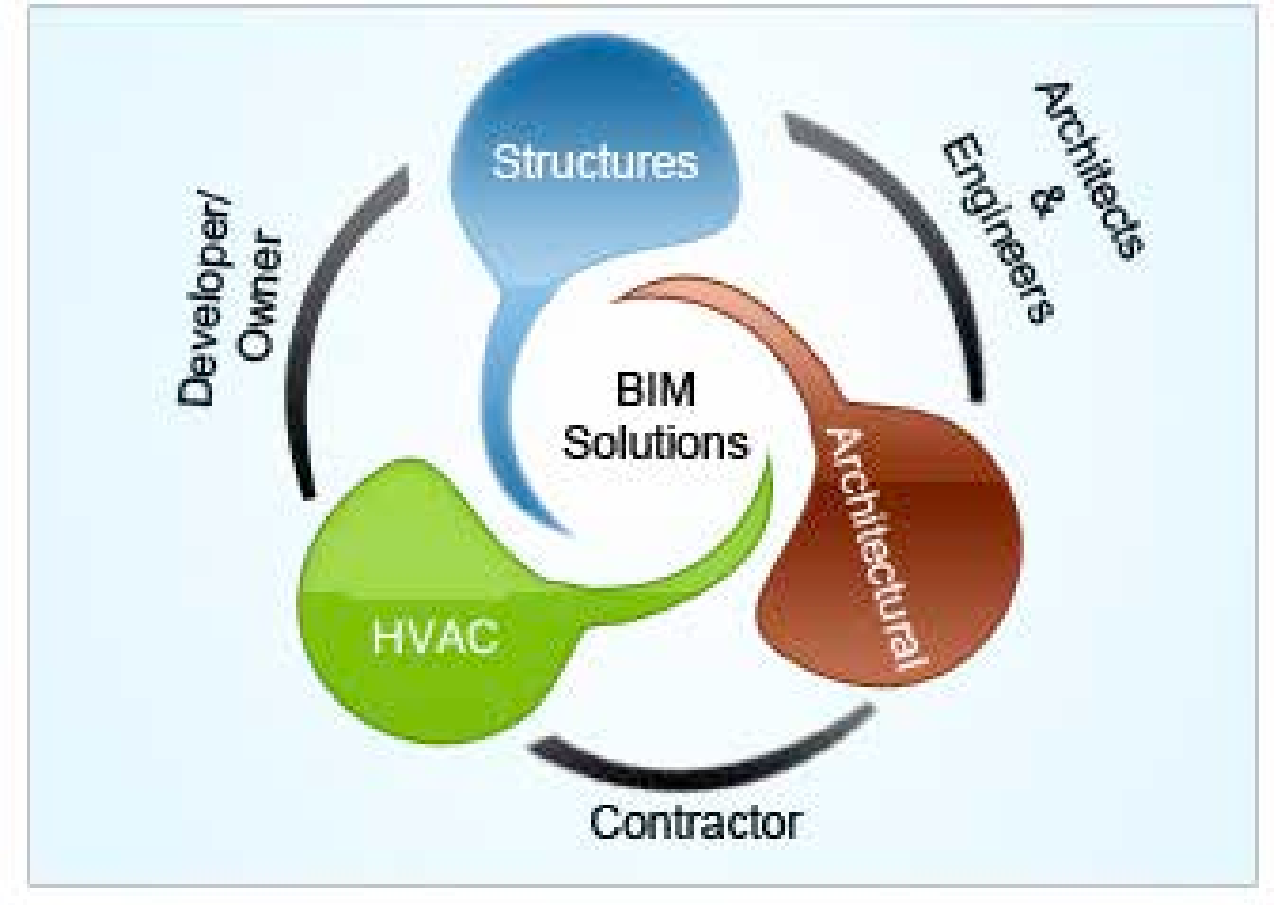
GIS-Based Design & Construction Integration
(individualized)



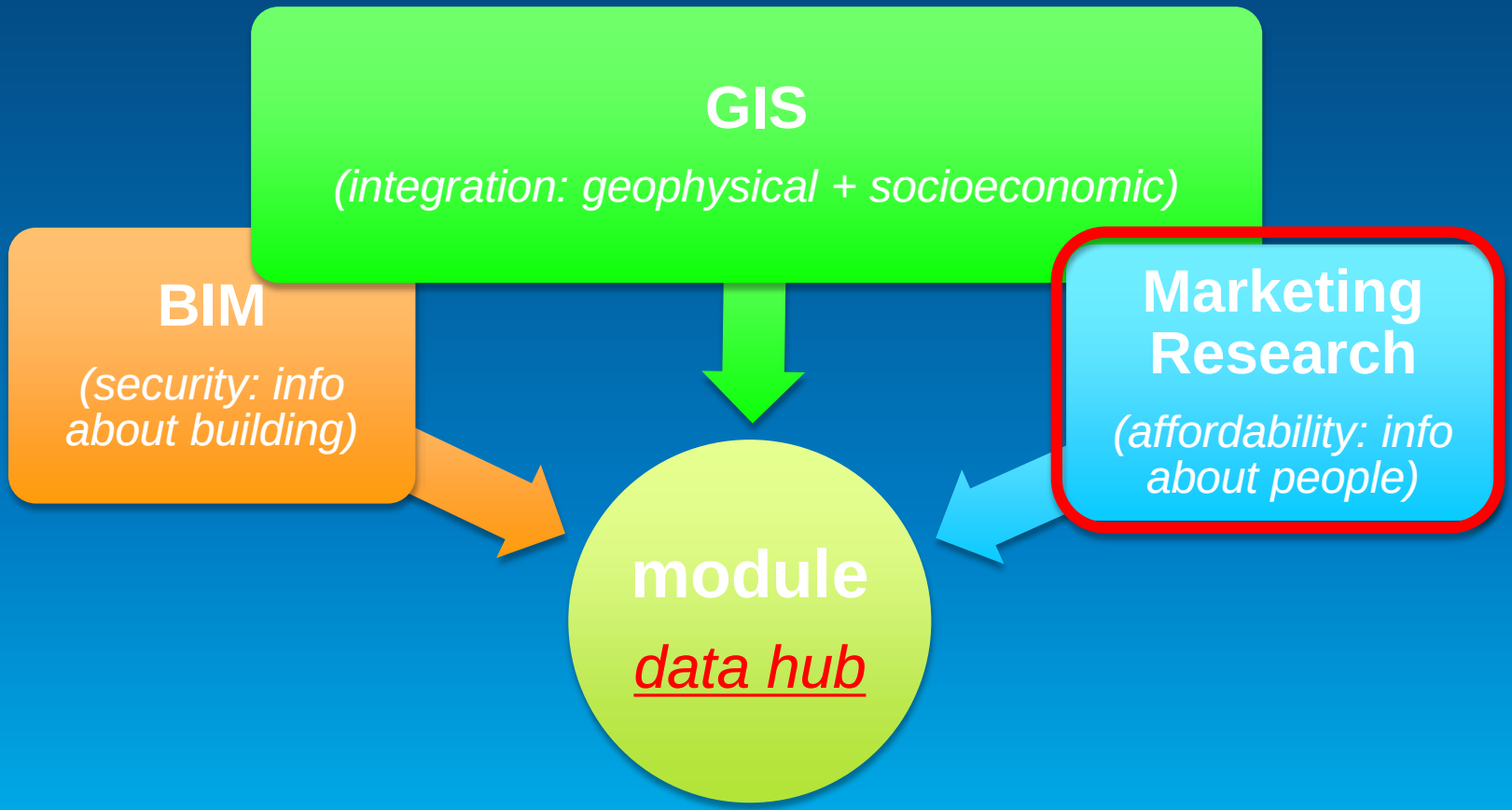
GIS-Based Design & Construction Integration
(individualized)



BIM: information about the building



GIS-Based Design & Construction Integration
(individualized)



Marketing Research: information about people

现代竹结构住宅调研

现代竹结构建筑研究问卷

现代竹结构建筑研究组
北京林业大学

感谢您参加本次调查，您的回答将被严格保密，请放心作答。

您提供的信息将对现代竹结构建筑的研究与推广带来极大帮助。

- 所有问题答案均没有对错，请根据您的实际情况作答
- 如果答案不确定，请提供一个您可能接近的估计
- 如果可能，请让家庭中对住宅选择最有决定权的成员填写此问卷
- 如果您有多处住房，请按照您所答问卷的地址答题
- 纸版问卷与网络版问卷内容完全相同，请仅选择一种方式

（网络版问卷地址：https://www.surveymonkey.com/s/bamboohousing）

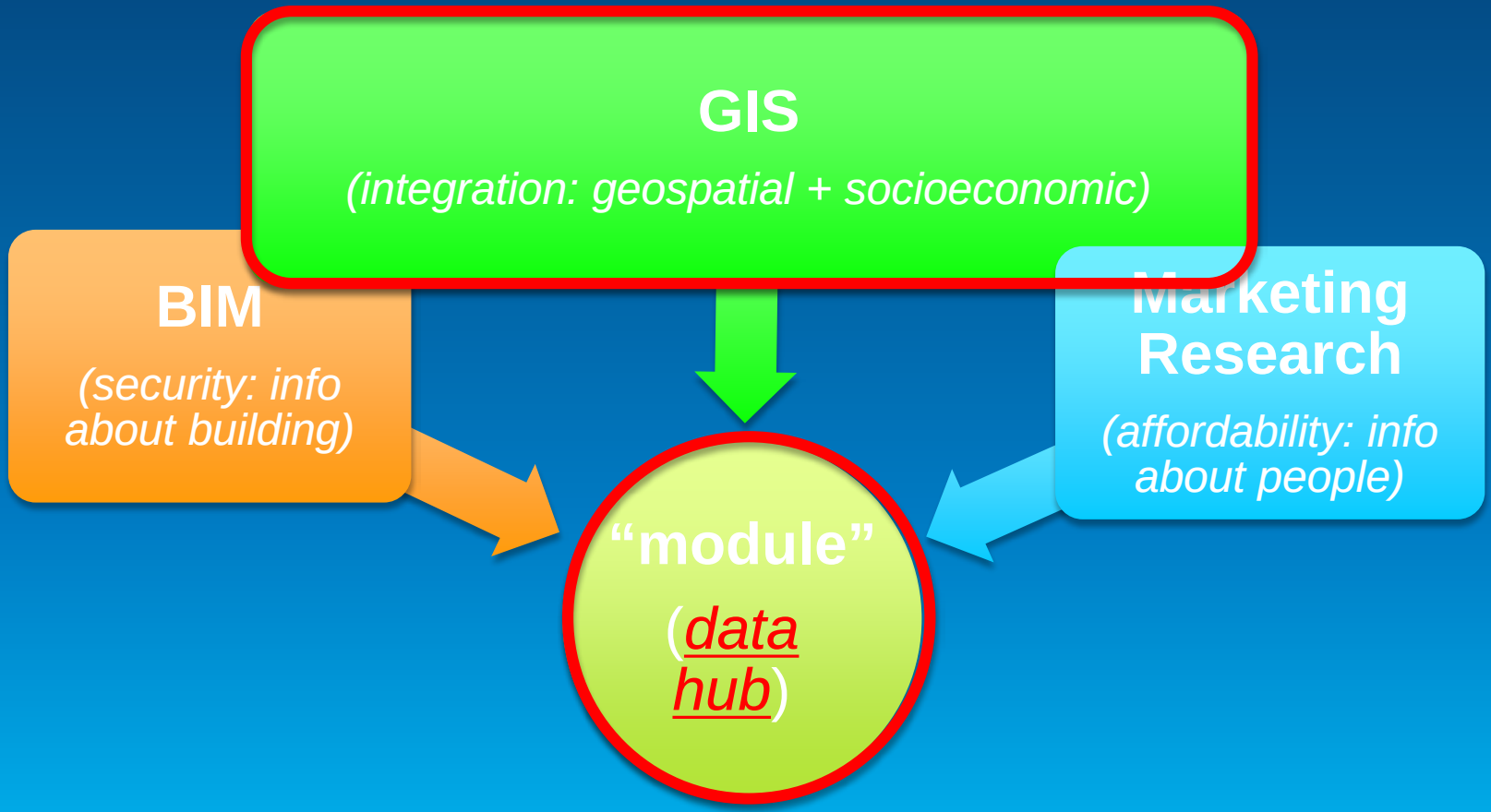
本问卷复印有效，欢迎您把本问卷介绍给您的亲戚朋友。所有回答问卷者均可参加抽奖。您推荐的亲戚朋友越多，您的获奖概率越高哦 :-)

如果您参加本次调查是由于朋友的推荐，请写下对方的推荐号码（选填）：

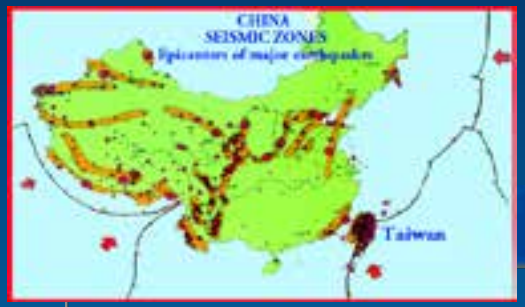
_____

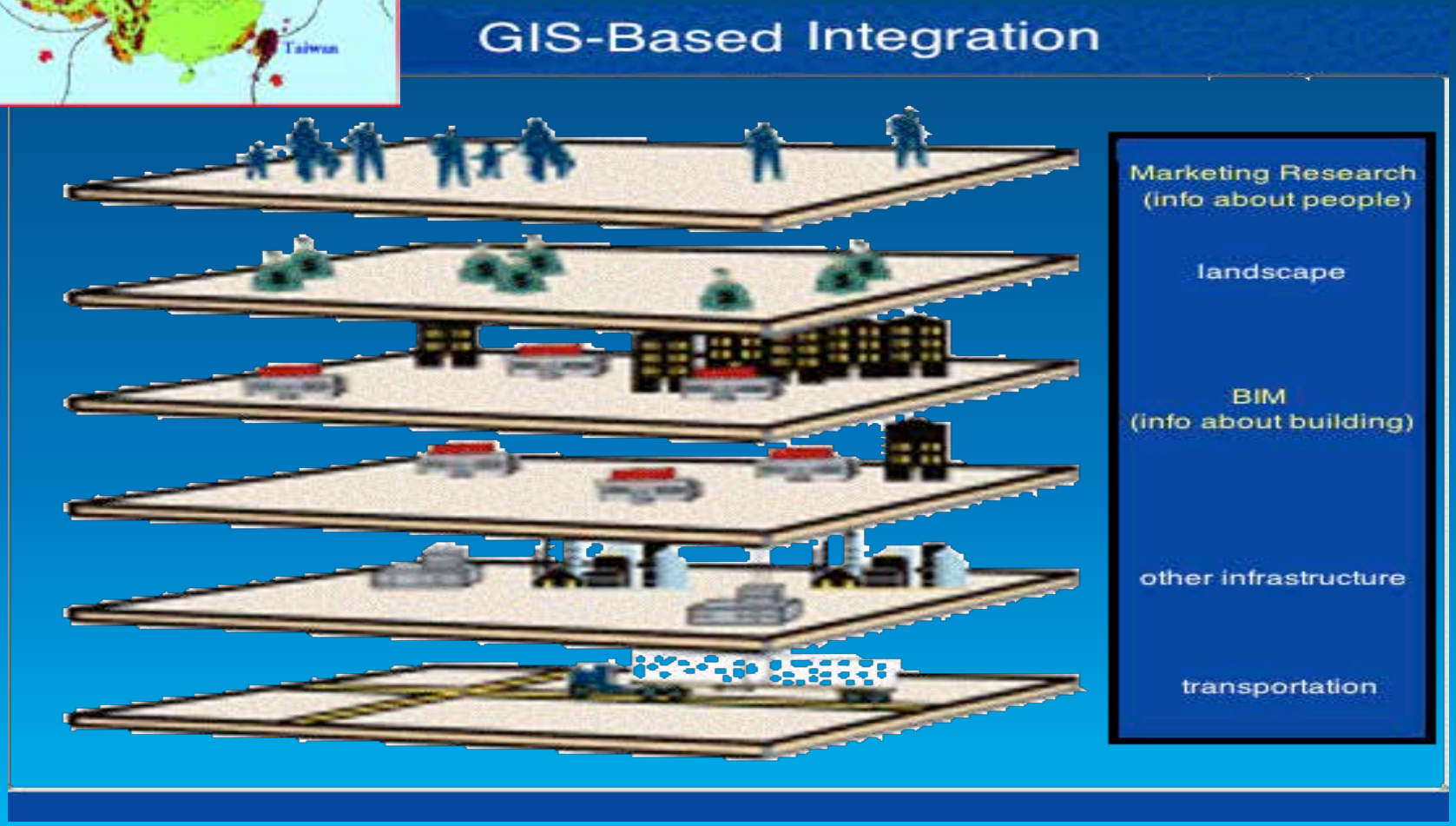
北京林业大学 | 国际自然科学基金（IFS）

GIS-Based Design & Construction Integration
(individualized)



GIS: integration of geophysical and socioeconomic data





GIS-Based Design & Construction Integration

(individualized design based on MODULES)

Module

data hub

Attributes are alive & evolving (endless types)

Geophysical:

- Recent earthquake info
- Other geospatial info
- BIM information

Socioeconomic:

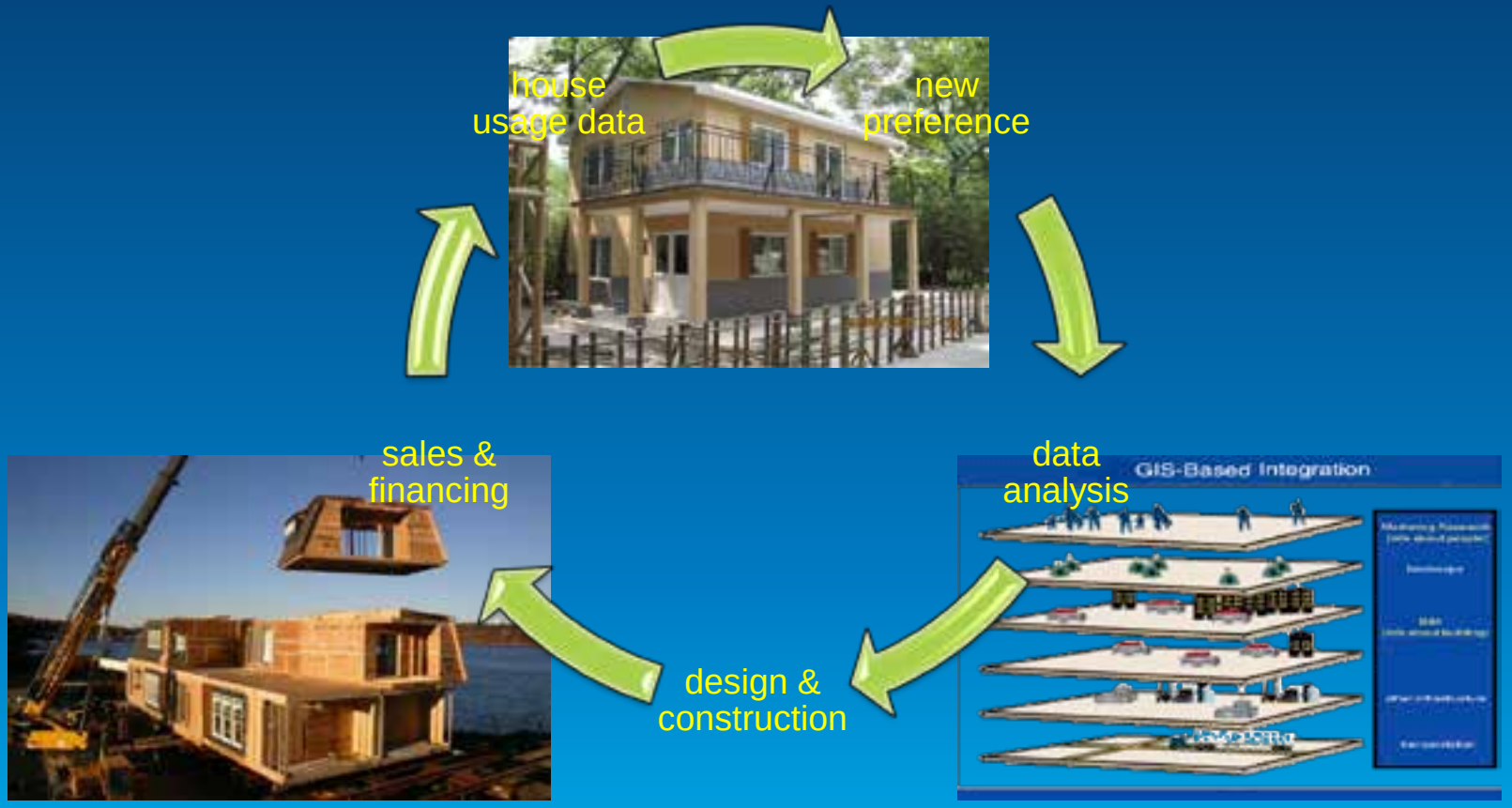
- Affordability
- Preference
  - Style
  - Material
  - Space division
  - Cultural
  - …

Outline

- Introduction
- The Problem: Traditional Bamboo Housing Design
- The Solution: GIS-Based Bamboo Housing Design
- The Way Forward

The Way Forward

Big Data Based Housing Design and Life Cycle



Acknowledgement

International Foundation for Science (IFS)
Stockholm, Sweden

Thank You!

Yuxi Zhao & Suying Li
Beijing Forestry University