

# ***Rural Systems Visioneering: Paradigm Shift*** ***from Flux Monitoring to Sustainability Metrics***



Joon Kim, Minseok Kang & AsiaFlux collaborators

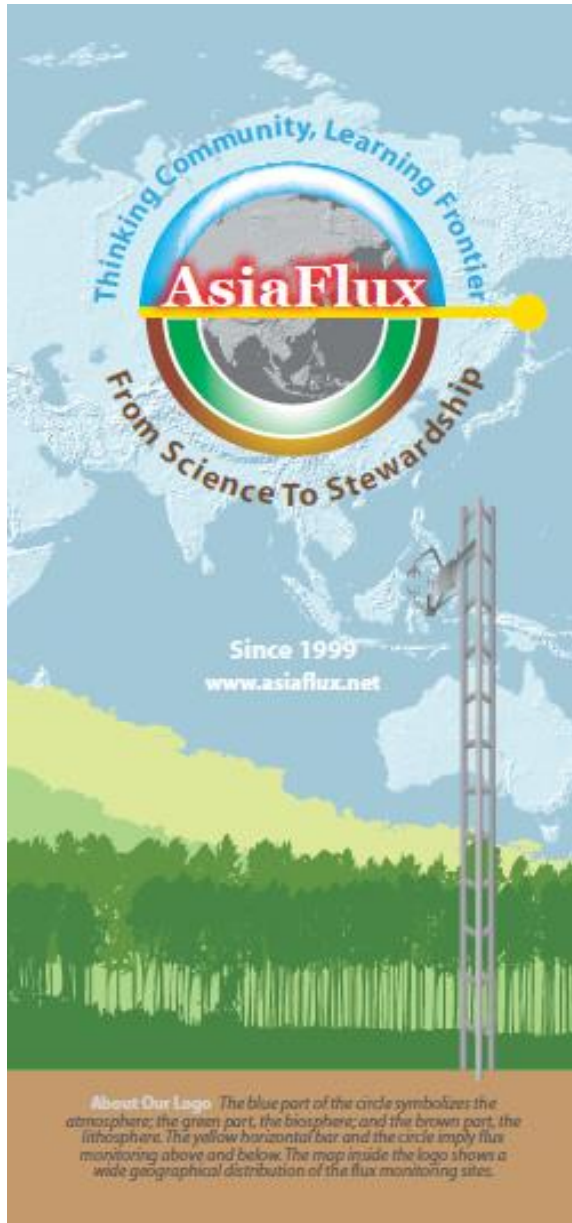
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**Great thinking**  
precedes  
great achievement.

**Right question**  
gives birth to a  
**Vision**  
that is greater than  
the visionary



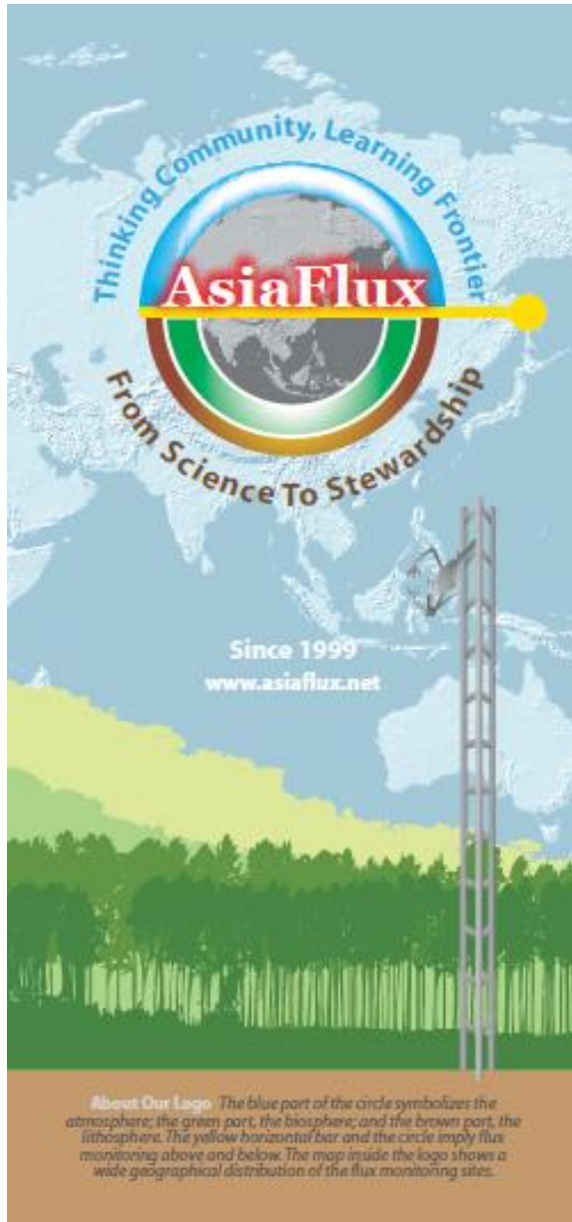
# Mission

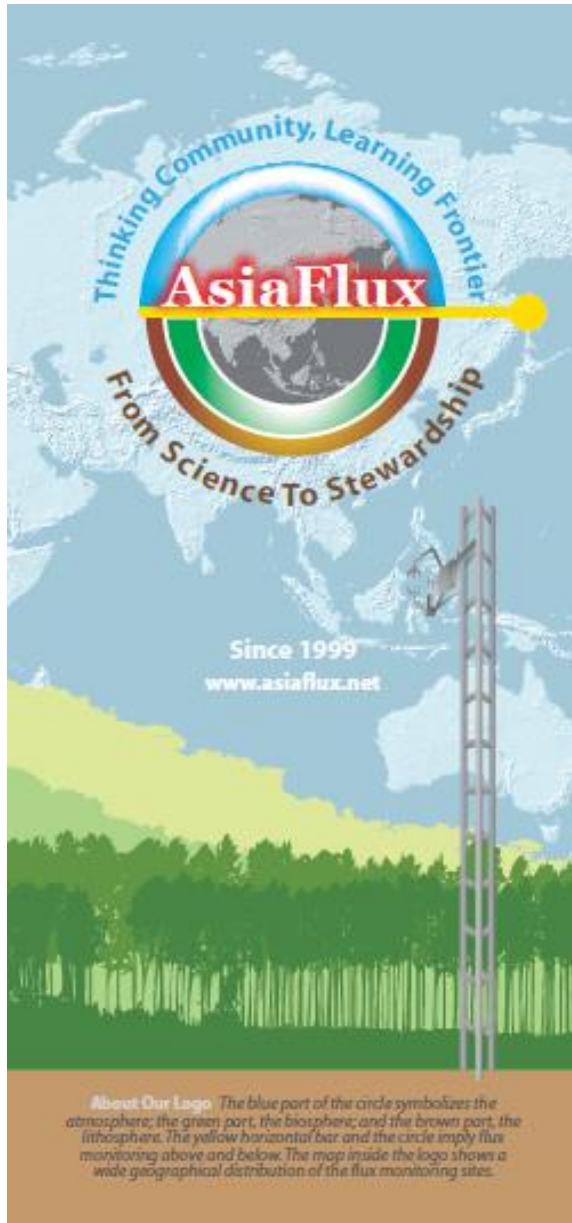
To bring Asia's key ecosystems *under observation* to ensure **quality & sustainability** of life on earth

( Kim, Yu & Miyata, 2008 )

# Purpose

1. Develop a forward-looking collaborative research and data sets on energy, matter & information flows in key ecosystems;
2. Provide workshops, joint conference & training courses on current and future challenges posed by global changes; and
3. Cultivate next generation of scientists with skills & perspectives, prepared to engage in local to global sustainability challenges as informed stewards and leaders through resilience-based systems thinking (e.g. engineering of vision)





# Vision

A community\* where science and technology work more directly for sustainable ecological-societal systems in Asia

- \* Community: groups of people who welcome, honor and exchange one another's gifts & talents



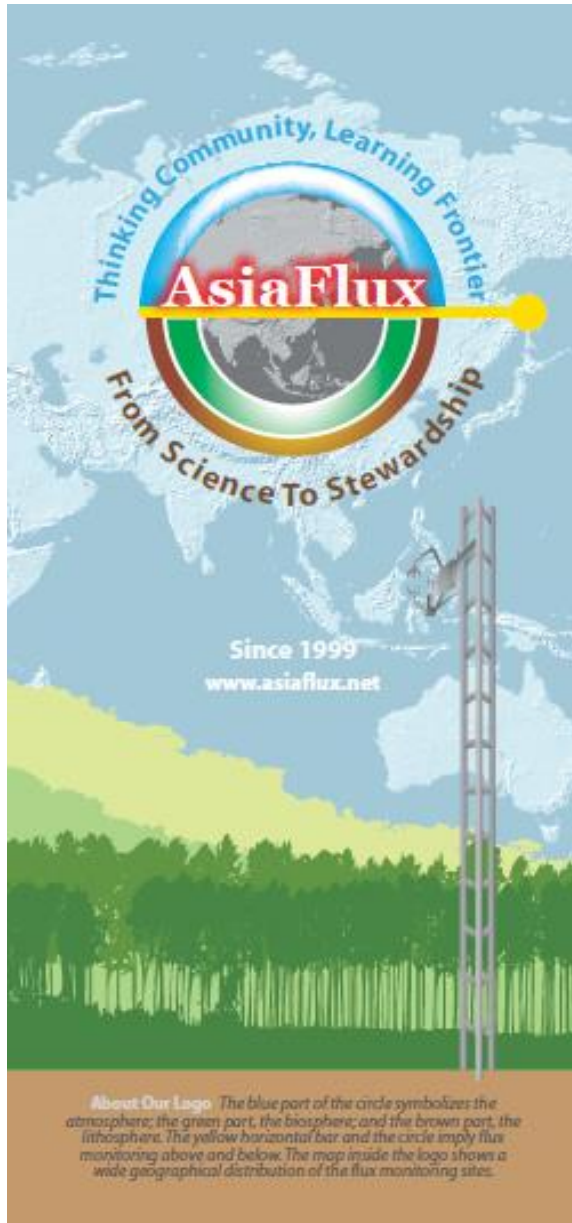
# What is *Vision*?

( Kim & Oki, 2011, 2013 )



*Purpose gives birth to a Vision*

- **SEEING** beyond the majority
- **Origin:** "*videre*" (to see, *L.*) - the ability to see, to discern, to focus, and to stay focused
- **Foresight** with **Insight** based on **Hindsight**
- The key to **Unity**, the magnet for **Commitment** & the determinant of **our Destiny**



# Our Concerns

“How can *Science*  
provide *Services* to  
cultivate *Stewardship*\*  
toward *Sustainability* ?”

\* Steward (manager) +  
ship (character, skill)

# ***‘ Visioneering ’***

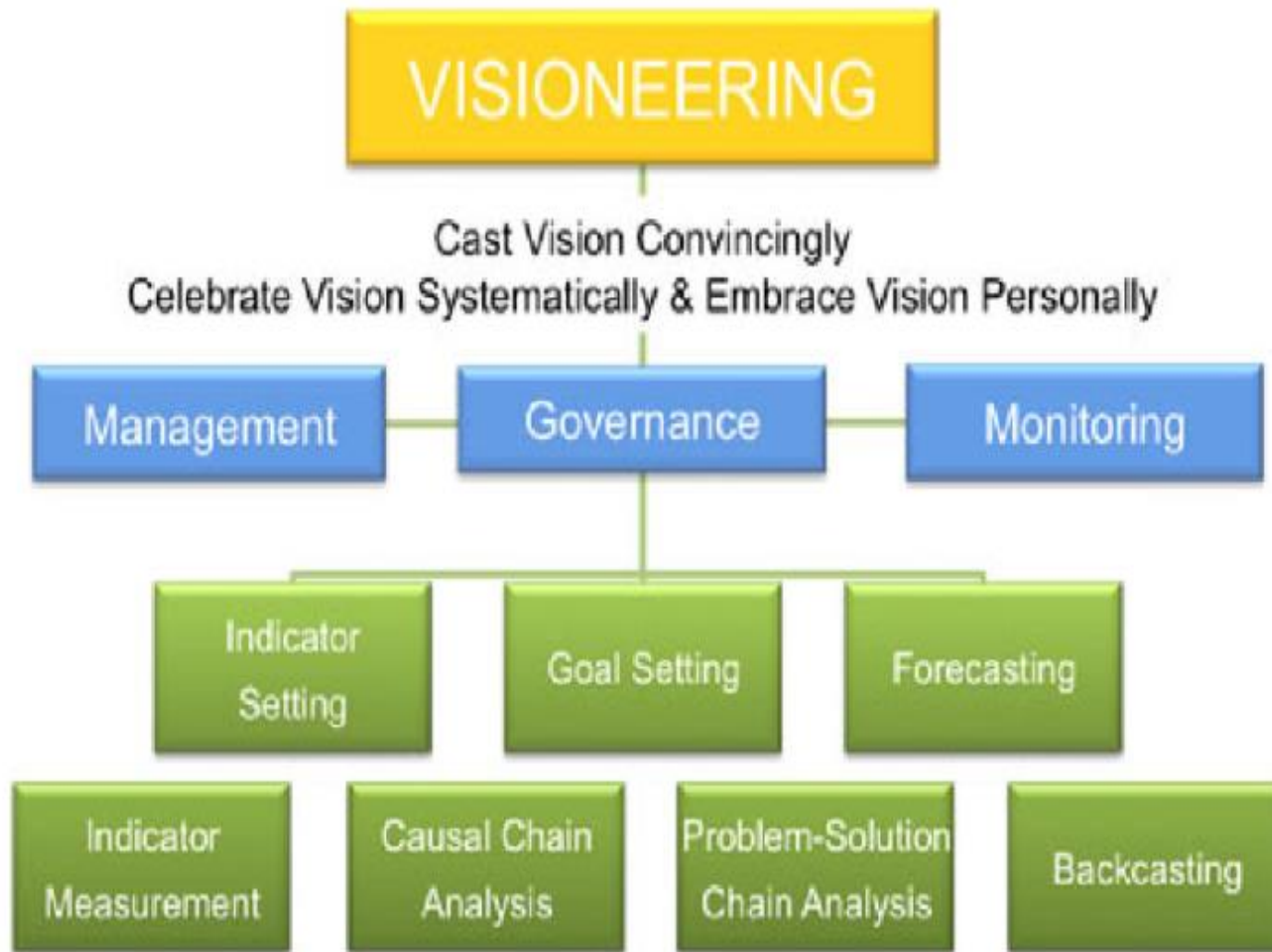
( Kim & Oki, 2011 )



*Vision is a mental picture of what it could be, inspired by the commitment of what it should be*

- **Engineering of Vision**
- **Engineering** : Skillful *‘direction’* & creative *‘application’* of experiences & scientific principles to develop process, structure, and equipment to fulfill the purpose
- Visioneering requires the *synergy* of inspiration, conviction, action, determination, and completion





( Kim &amp; Oki, 2011 )

# ***Visioneering***

- **Governance:** Continuing process of providing & refining the vision, learning, resolving trade-offs, and planning to adapt to the unfolding situation
- **Management:** Operationalizing the vision; translating vision into reality by developing & implementing strategies to promote/discourage specific forms of self-organization
- **Monitoring:** Synthesizing the observations to a narrative and providing feedbacks that serve as the source of learning required for successful adaptation

( Kim & Oki, 2011 )

VISIONEERING IS AN ESSENTIAL FRAMEWORK FOR

# SUSTAINABILITY

Its elusive definition has been evolving ...

**Development** that meets the needs of the present without compromising the ability of future generations to meet their needs (WCED 1987);

**Cultural Adaptation** made by society as it becomes aware of the emerging necessity of non-growth (Daly 1993);

**Process** that is farseeing enough, flexible enough, and wise enough not to undermine the ecological-societal systems of support/services (Meadows et al. 2004); and

**Possibility & Destiny** that human and nature will prosper together (Kim & Oki 2011)

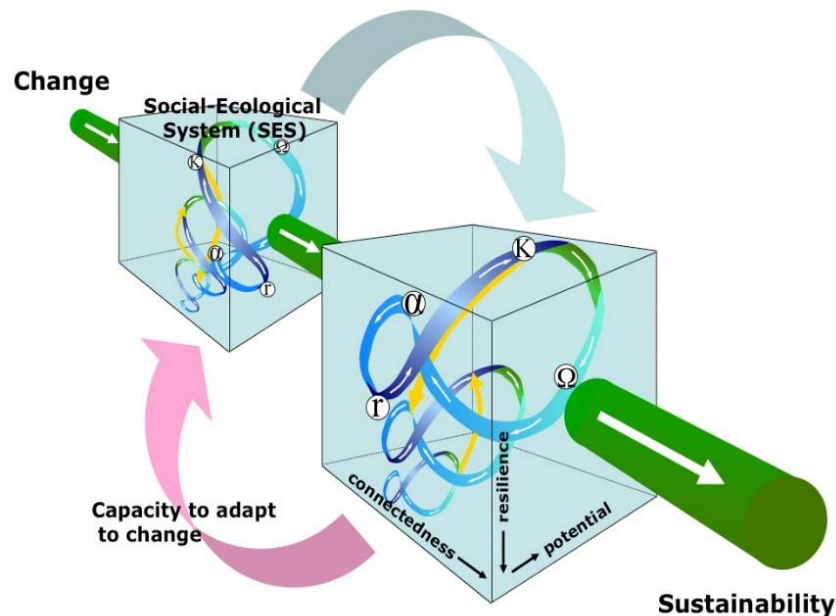
# Bottlenecks to Sustainability

## Lack of Three Basics

- (1) **Understanding** of the **complex** nature-human coupled **systems** and their co-evolution
- (2) **Resilience** and capacity building to perform the **transformation** needed
- (3) **Willingness** to embrace and implement changes & challenges

## Ecological-Societal Systems:

A combined system of social (rural & urban) and ecological components and drivers that interact and give rise to results, which cannot be understood based on social or ecological considerations alone



## Complex Systems:

characterized by large networks of components, giving rise to robust collective behaviour (e.g. self-organization; sophisticated computation and information processing; and adaptation and evolution via learning processes

# PARADIGM SHIFT (adapted, Logan 2013)

| From : First Window                        | Toward : Third Window                          |
|--------------------------------------------|------------------------------------------------|
| Mechanical models                          | Ecological models                              |
| Reductive science of physics and chemistry | Constructive science of ecology and complexity |
| Time reversal                              | History – time has a direction                 |
| Newtonian mechanics                        | Emergent dynamics                              |
| Things, particles                          | Processes                                      |
| Atomism, Nodes                             | Systems, Links, Flows                          |
| Homogeneity                                | Heterogeneity                                  |
| Laws-deterministic-predictable             | Processes-emergent-unpredictable               |
| Universal Laws of Physics                  | Laws of Self-Organization & Complexity         |
| Objects create processes                   | Processes create objects                       |
| ...                                        | ...                                            |



# PROCESS

(Ulanowicz, 2009, 2011)

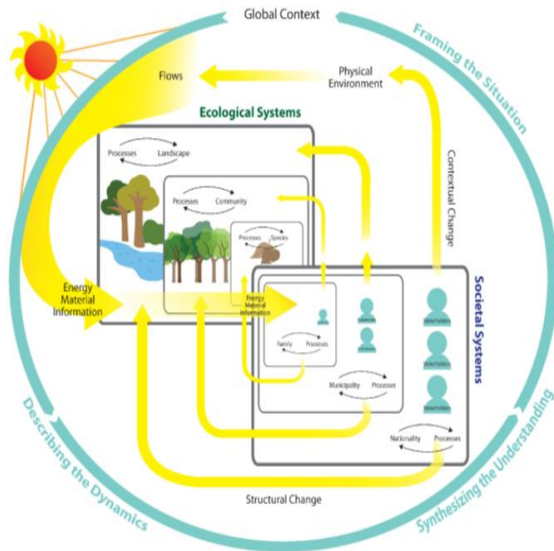
- **Definition:** the interaction of random events upon a configuration of constraints that results in a nonrandom but indeterminate outcome
- **Implication:** Living systems arise *not* out of the set of immutable laws (that regulate all physical order) *but* rather as the result of natural *processes* (that create living order out of abundant chaos). In shaping living systems,
- ***PROCESS*** is more important than *LAW*

# SELF-ORGANIZING SYSTEMS

- Self-organization - Spontaneous appearance of organization or (global) order from local interactions
- Organization is distributed over all the components: collective and robust (interaction propagate throughout the system)
- S-O system – collection of many interacting agents\*
  - \* agent - elementary system component; acts on environment; goal-directed; a black box transforming input into output)
- the implicit goal\* of the system is the ‘attractor’ of the system’s global dynamics

\* function – what the system robustly does (system itself determines its purpose); robust = stable, invariant under most disturbances

# SUSTAINABILITY



- It's about maintaining the integrity of the combined ecological-societal systems
- Integrity is preserved when the systems' self-organizing processes are preserved

- We must consider such relationship and challenges to develop ecosystems science that allows to study the co-evolution of ecological systems and societal systems.
- Few tracks contextual elements of such relationships

**futureearth**  
research for global sustainability

 **SUSTAINABLE  
DEVELOPMENT GOALS**



**Call for applications: Sustainable  
Development Goal Labs**



## Rural Systems Visioneering

# Global Leadership in Planetary Stewardship, **Future Earth's SDG Labs Selection Criteria**

- with a high degree of Innovativeness;
- with transformative potential;  
and
- that could scale with articulated scaling potential





Out of 331 proposals, 21 SDG Labs selected and will be endorsed during 7<sup>th</sup> International Conference on Sustainability Science



ICSS2017

## Rural Systems Visioneering



24-26 August 2017,  
Stockholm, Sweden



### The Winners for Sustainable Development Goal Labs

by **ir3s-admin** 03/02/2017

NEWS

Today we are delighted to announce the 10 SDG Labs for the International Conference on Sustainability

<http://www2.ir3s.u-tokyo.ac.jp/icss2017/the-winners-for-sustainable-development-goal-labs/>



# Rural Systems Visioneering

is a *Co-design* Process:

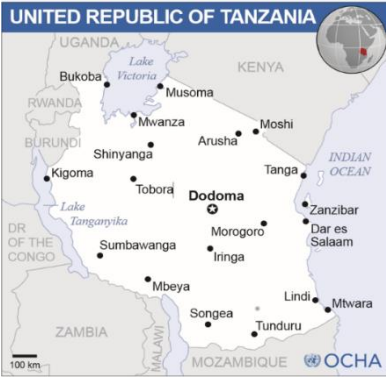
- **Co-Create** innovative sustainability science & technology necessary for the renewable energy-based, climate-smart agricultural, and resilience-based educational fields with rural villages & various stakeholders
- **Co-Grow** with rural villages in Arusha region, through the **visioneering** – an harmonious triad of adaptive governance, adaptive management and adaptive monitoring for sustainable rural systems

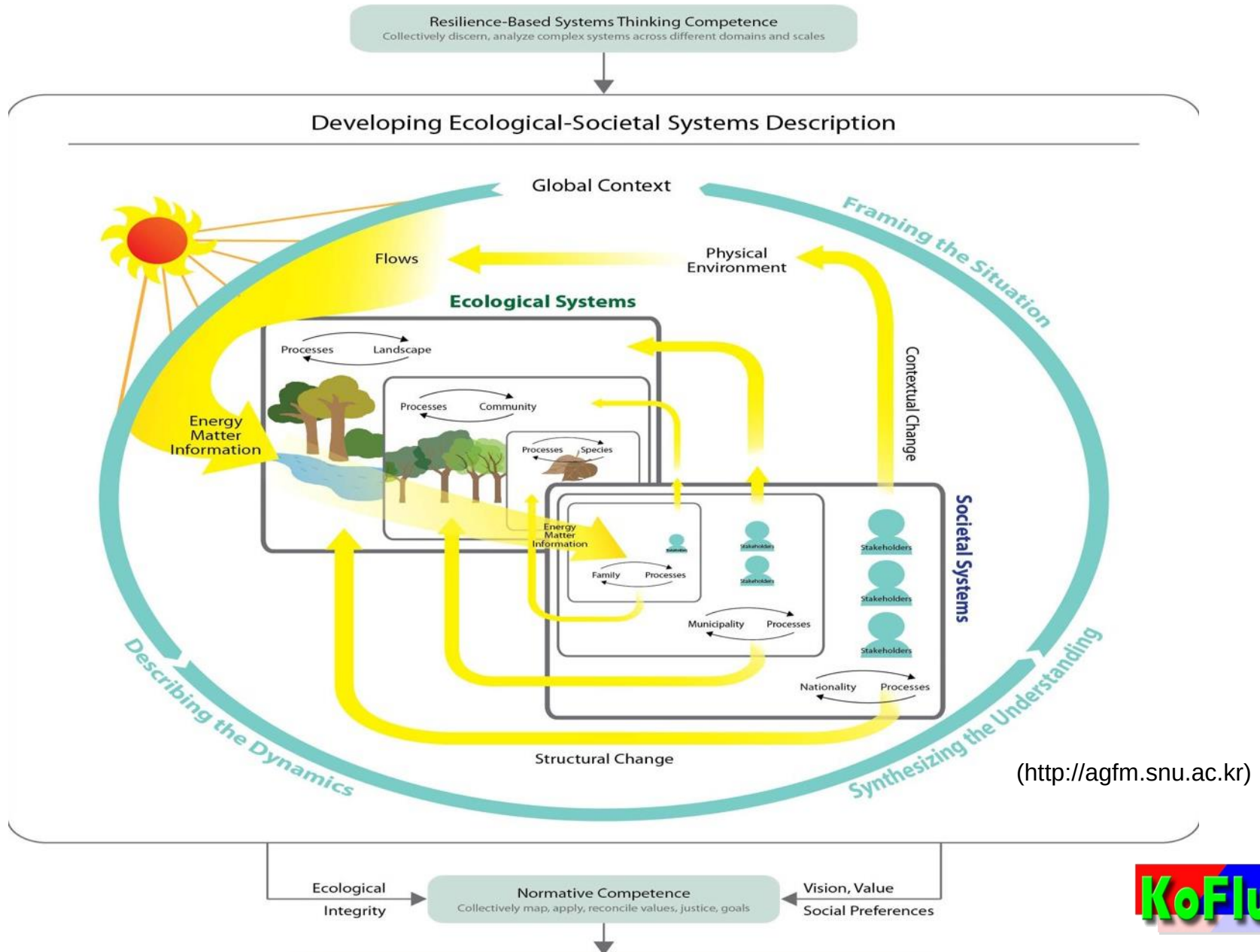
# Rural Systems Visioneering in Arusha, Tanzania

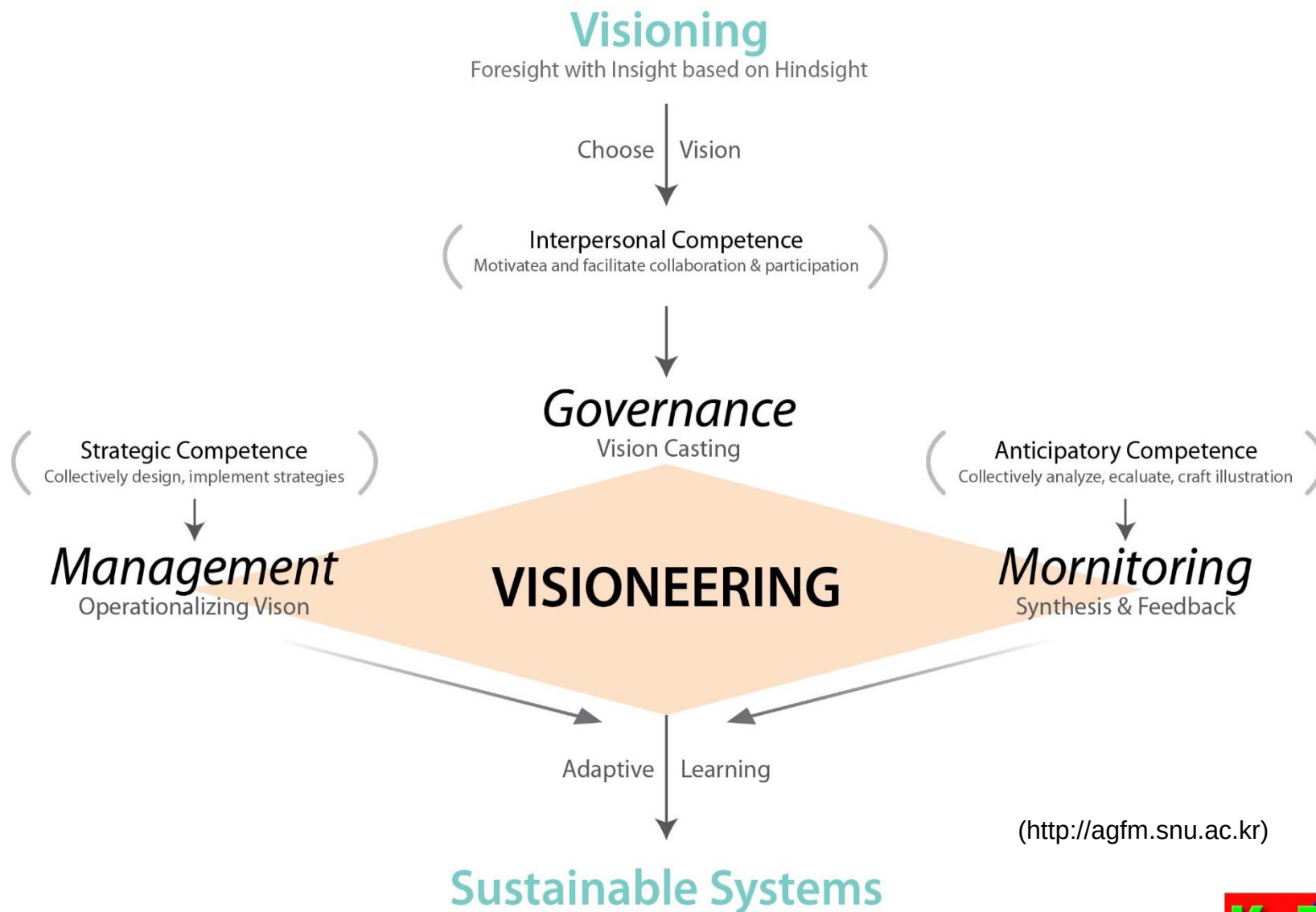
## Background:

We want to learn from rural off-grid villages to overcome their fundamental concerns :

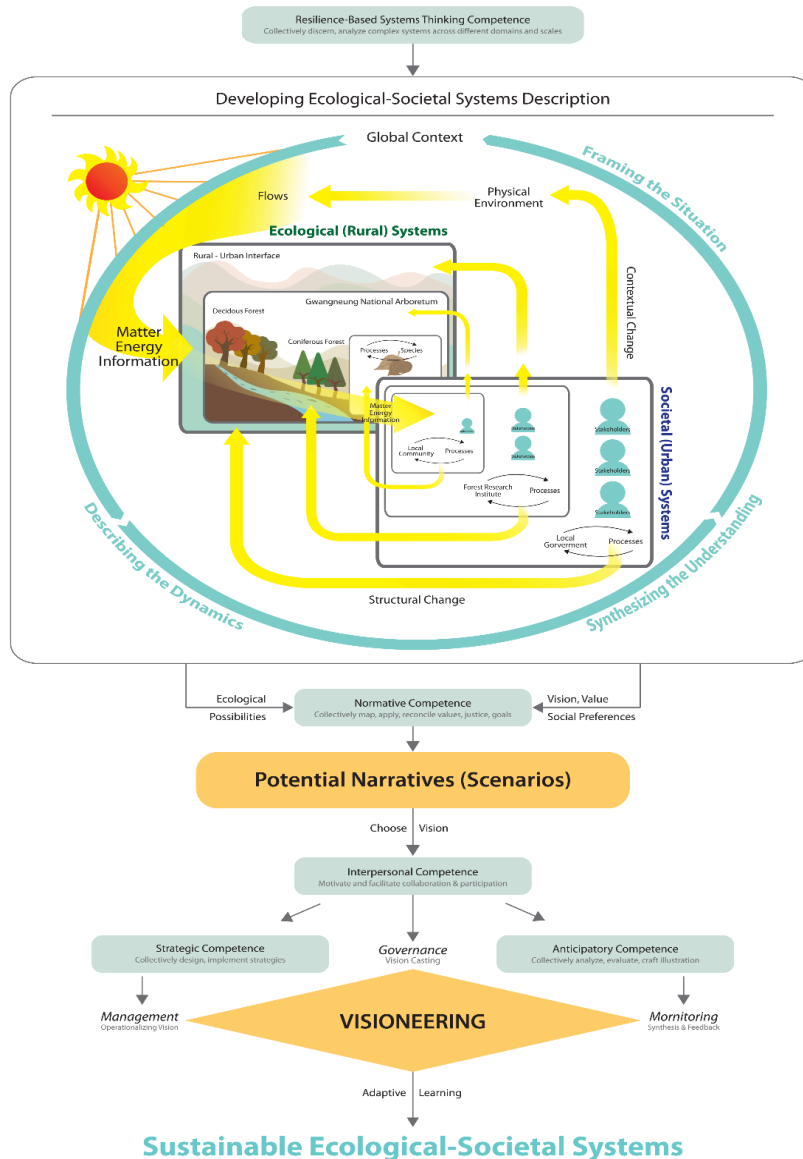
- Lack of resources (e.g., electrical power, storage for food),
- Lack of infrastructure (for management and monitoring),
- Lack of quality education, training and mentoring, and
- Lack of motivation, vision and its engineering - visioneering (Kim & Oki 2011)







## Sustainability Education and R&D



# Rural Systems Visioneering will implement

1. Self-Organizing Hierarchical Open Systems - Visioneering (SOHO-V) framework ;
2. Complex systems science-based sustainability education nurturing key competences (e.g. systems thinking, normative, strategic, anticipatory & inter-personal competences) ;
3. Climate-smart agriculture/forestry & quantitative assessment based on biotic / network / thermo-dynamic indicators by monitoring/modeling energy-matter-information flows in and out of rural systems using inexpensive measurement network, modeling & remote sensing ;
4. Ecosystem models combined with 'Agent-based' modeling for emergent solutions for better efficiency/mitigation/resilience for smallholder farmers and policy-makers dealing with multiple perspectives.



# CLIMATE SMART AGRICULTURE AND FORESTRY

aims to help the world achieve *Triple Wins* with a mission  
to *Prevent Hunger* by sustainably

1. Increasing productivity & income,
2. Reducing greenhouse gas emission &
3. Building system resilience to (natural  
and human) disturbances





# SUSTAINABILITY METRICS

is required in order to

- (1) **Monitor changes,**
- (2) **Identify the triple wins, and**
- (3) **Compare the benefits with  
the associated costs,**

**it is critical to develop holistic indicators to evaluate progress and the required data to establish such indicators based on thermodynamic, network, and information-theoretic thinking.**



Complex Systems Science

Process Ecology

Ecohydrology

Information Science

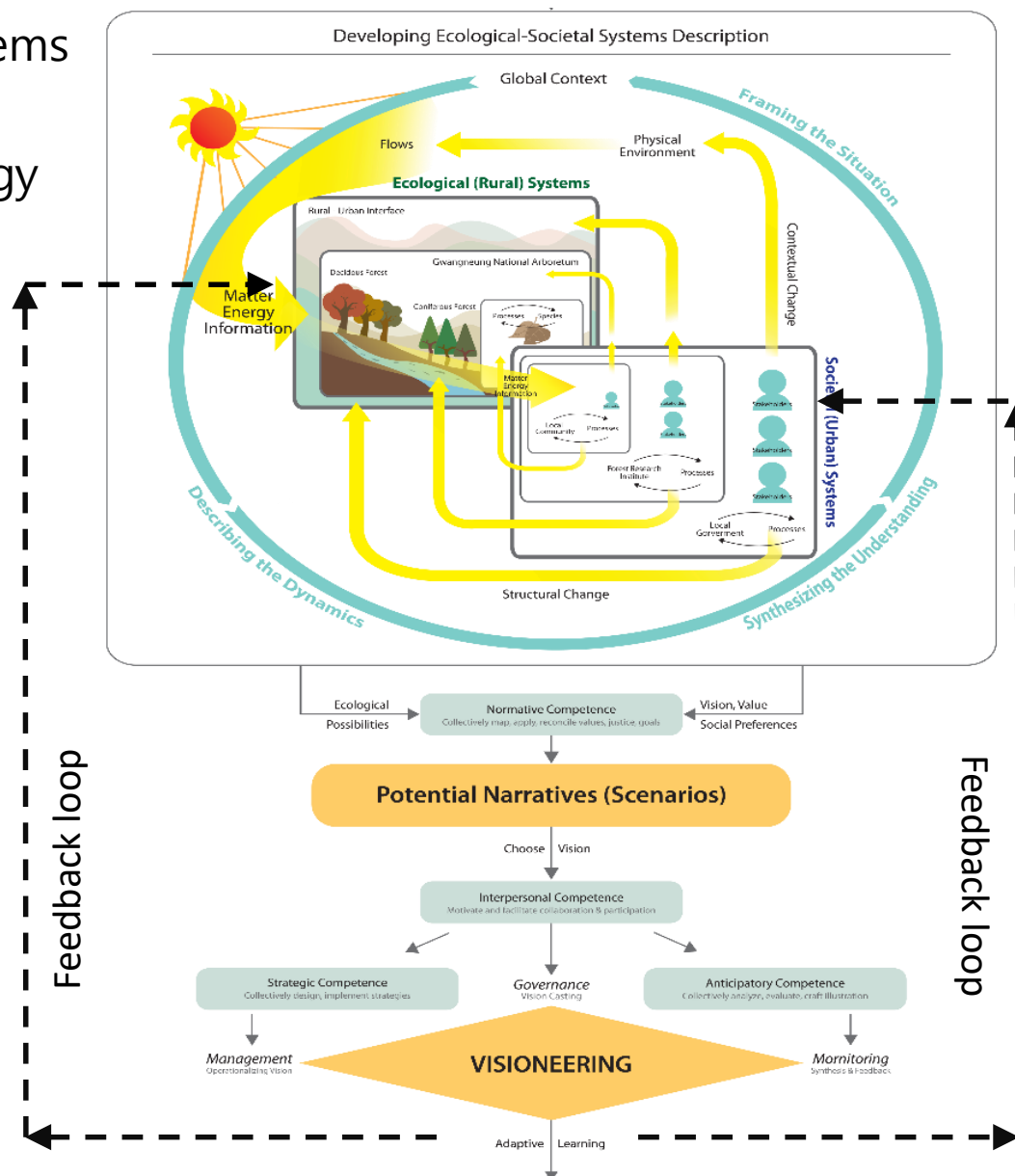
Network Science

Sustainability Science

Ontology &amp; Epistemology

Pedagogy

Ethics



Atmospheric Science

Biogeochemistry

Socio-Hydrology

Ecological Economics

Social Physics

Data-driven Sciences

Info-Dynamics

Morphogenetic Engineering

# AsiaFlux will continue creating space to deal with emerging paradigms

- for re-thinking ecosystems science processes and nurturing diverse functional groups (e.g. knowledge carriers & retainers; interpreters & sense makers; networkers & facilitators; stewards & leaders; visionaries & inspirers; innovators & experimenters; entrepreneurs & implementers; and followers & reinforcers
- We invite you all to our new community space where science meets and interacts with others, where interests, values and decisions are discussed, fought over, and hopefully negotiated and reconciled.
- Welcome to the new AsiaFlux agora!

*“ From the Cowardice that dare not face new Truth,  
From the Laziness that is contented with half Truth,  
From the Arrogance that thinks it knows all Truth,  
Good Lord, deliver us ! ”*

*- African prayer -*

