

A Critical Review of Sustainability Science Towards the Future We Want For All  
(Work in Progress)

## **Emerging Sustainability Issues and the Concept of Sustainability Science**



**UKM** UNIVERSITI  
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EDUCATION  
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#### 3.1.1 Sustainability Science in Education and Research in Asia-Pacific region

- a. Sustainability Science Centre, at Harvard Kennedy School , USA
- b. Center for Sustainability Science (CENSUS), Hokkaido University, Japan

#### 3.1.2 Lessons from Sustainability Science in the Europe

- a. MATISSE “Methods and Tools for Integrated Sustainability Assessment”
- b. Partnership Actions for Mitigating Syndromes (PAMS)
- c. NeWater Project and - Integrated Water Resource Management
- d. ARTEMIS Assessment of Renewable Energy Technologies on Multiple Scales – A Participatory Multi-Criteria Approach Sustainable Europe Research Institute (SERI)

#### 3.2 A Case Study for Applying Sustainability Sciences:

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FINAL STATEMENT

## EMERGING SUSTAINABILITY ISSUES

- **Sustainable development:** These Asia Pacific countries collectively present very diverse issues of sustainable development, ranging from the challenge of sustainable consumption and production in developed countries to the major issues such as poverty and equitable growth in less developing countries.
- **Diversity:** The diversity is an asset and is unique to this region;
  - “**Gene Pool**” of concepts that can be used
  - **Conflict potential** can also be a challenge when promoting sustainable development. Given the complexity of the issues, sustainability science has substantial potential to serve as the most appropriate approach to address such issues.
- This section is intended to highlight the ***pertinent problem, complexities, challenges and dynamism*** in the region whereby only through integrated approaches, systemic thinking, and scenario development in addressing the uncertainty, ethics and effective governance that better understanding of the issue could be acquired leading to a more accurate and appropriate solution.

## *Environment and Development in Asia Pacific – In Search for Sustainable Development Model*

- The dilemma between conservation of environment
- complexity of interactions between humans and natural systems; to what extent should the natural system be exploited for development for human being.

## *Economic Growth and Sustainability in Asia Pacific – Questioning the Patterns of Growth*

- resource constraints, including energy, minerals, water and land,
- Green economy—an integrated solution of appropriate economic growth model that the characteristics of sustainability science is needed - the multiple forms of knowledge combining science, natural science, social sciences and humanities.

## *Social Sustainability in Asia Pacific – Mainstreaming Well-Being Agenda in the Region*

- The social dimension has commonly been recognised as the weakest pillar of sustainable development,
- Interaction between the environmental and the social still remains a largely uncharted terrain.

**Challenge: Integration of the above**



## **More specific issues:**

- Poverty - Diverse Dimensions in the Region
- Gender - Inequality and the Region Development Workforce
- Health - as Purpose of Development
- Water - The Dynamic Sustainability Issue
- Energy - Addressing the Increasing Need in the Region
- Biodiversity - Preventing Further Lose to Development Need

## **Common themes**

- Complexities - multilevel, multi-stakeholder, multi-discipline
- Interdependent /systemic - one issue to another
- Dynamic - representing developed, and developing and least developing countries experiences
- Contextual – socio-cultural (local values and norms)

**A new discipline?  
Two culture to Three Culture  
(CP Snow – Jerome Kagan)  
(FRAMEWORK)**

**A new education  
system?  
EE- ESD – ESS  
(CONTENT)**

**What is the role of  
values and norms  
in SS?**

**WHAT IS  
SUSTAINABILITY  
SCIENCE?**

**What is “science” in the  
Sustainability Science –  
discipline/approach?  
(CONCEPT)**

**What is  
“sustainability” in  
the sustainability  
science?  
(EMERGING  
ISSUES)**





**Science as approach/studies**

## **b) Definition**

***“an approach to facilitate the design, implementation, and evaluation of practical interventions that promote sustainability in particular places and contexts; and to improve linkages between relevant research and innovation communities on the one hand, and relevant policy, private sector and management communities on the other”***

## Sustainability Science.....

- A field of use-inspired research and innovation like agricultural science or health science
- Defined by the practical problem it addresses, specifically those of sustainable development
- Conducted by drawing from and integrating research from natural science, social science, humanities, medical and engineering science, and by combining these with knowledge of practices
- Building a core of scientific understanding about interacting human-environment systems

- Academia has prominently responded to the sustainability with sustainability science, since the late 1990s (Kates et al. 2001; Clark and Dickson 2003; Swart et al. 2004; Komiyama and Takeuchi 2006; Martens 2006; Jerneck et al. 2011; Wiek et al. 2011, 2012).
- As a problem- and solution-oriented field, sustainability science is inter alia inspired by concepts of *post-normal, mode-2, triple helix, and other science paradigms* (Funtowicz and Ravetz 1993; Gibbons et al. 1994; Etzkowitz and Leydesdorff 2000) that employ corresponding research practices, such as *transdisciplinary, community-based, interactive, or participatory approaches* (Kasemir et al. 2003; Savan and Sider 2003; and sustainability science as a transformational scientific field.
- One key aspect of sustainability science, therefore, is the *involvement of actors from outside academia into the research process in order to integrate the best available knowledge, reconcile values and preferences, as well as create ownership for problems and solution options.*



- “New discipline without a discipline”
- Sustainability as an ancient wisdom until knowledge is compartmentalised
- Sustainability studies instead of sustainability science
- Sustainability Science depends on what SUSTAINABILITY IS

## *c) Fundamentals*



*d) Synthesis of Tools and Methods of Sustainability Science*

## Methods

- a. analytic methods -analytic methods mainly look at the nature of sustainable development, employing among other approaches the theory of complexity
  - b. participative methods - non-scientists such as policy-makers, representatives from the business world, social organizations and citizens also play an active role.
  - c. the more managerial methods - are used to investigate the policy aspects and the controllability of sustainable transitions.
- Other dimension of the methods:
    - from supply to demand-driven
    - from technocratic to participative
    - from objective to subjective
    - from predictive to exploratory
    - from certain to uncertain
  - Through these methods, sustainability science, therefore, seeks real world solutions ***by breaking down artificial and outdated disciplinary gaps between the natural and social sciences through the creation of new knowledge and its practical application to decision making with local values and norms retained***

From the practical or application perspective, the methodology advocated in sustainability science can also be synthesised as to constitute the following elements:

- Systems dynamics which allow integration of diverse models and data sets
- Indicator development for M&E
- Institutional and stakeholder demand mapping
- Scenario development, handling uncertainty and policy testing
- Capacity building for use of sustainability science outputs in governments and governance
- Capturing of Community and stakeholder perspectives and priorities
- Interface with the concepts of the Green Economy with a particular focus on equitability of benefits

# **A Case Study for Applying Sustainability Sciences: Sustainable Solution for Water Insecurity in Asia Pacific**

## **Challenges towards SS**

### **Transformational transdisciplinary approach**

- 1) Context - ✓
- 2) Content - ✓
- 3) Process - **X** — still silo

**Mind set changes on the purpose of education (e.g. vs. employability)**



## **Transformation needed in the process (of teaching and learning)**

**I was born intelligent but education ruined me...Ziglar**

**“The problems we have cannot be solved at the same level of thinking at which we created them.” Albert Einstein**





# **Sustainability Science as Collaborative learning**

# Recommendations to mainstreaming and sustain Sustainability Science:

## Institution and partners

- An international body/umbrella organisation that brings the 3 culture together (UNESCO?)
- Institutionalise Sustainability Science into ongoing international agenda – EFA, ESD, Future Earth, Future We Want etc
- Adoption of Sustainability Science into existing International Bodies framework

## Methods and approaches

- Development of fundamental indicators till testing of policy intervention – e.g integrative biophysical and societal modeling
- Framing of program and studies to suit the issues, locality, scenario generation, road-mapping, consensus building and network/partnership formation

## **Capacity Building**

- In-service and pre-service training for teachers, sponsored studies using interns, graduate students, staff exchange, post-doctoral researchers, sabbatical attachment, and secondments to work with institutions and networks advanced in SuS implementation.
- Development of standardised approaches to the application of SuS as a series of tool kits and workflows which allow early commitment and adoption without creating unnecessary competition for scarce resources and facilities.
- Support for the development of capacity and education in this field across the stakeholder profile to provide a clear pathway to sustainability
- Networking for capacity-building and promotion of research and education in basic sciences and mathematics in the Asia-Pacific
- Active, joyful and effective learning in science education for MDGs (SDGs)
- Capacity-building in STI policy development in the Asia-Pacific region
- Engaging planners, policy-makers and practitioners in STI issues, and building public awareness

# **Research**

Research:

## Concluding remarks

- New content same process different context?
  - New process same content and context?
  - New content, new process and new context?
- 
- ❑ Many conventional education systems are currently facing strong criticisms due to the pressures of reorientation to address emerging issues of the 21st century – sustainability science as one of the *structured responses*
  - ❑ Skills that are critical in nature yet still taught as generic such as systems thinking and future thinking must be further emphasized – *educating the skills and competence (transformational) vs. transferring information and knowledge (transmissive)*





Way forward question:

- What is the institutional arrangement needed to sustain Sustainability Science?
- What is the immediate capacity building program ((structure and content) to sustain Sustainability Science?
- How do we factor in the role of local values and norms into the “sustainability science”?