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The Need for Sustainability Science Education in Indonesia

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Abstract. The pursuit of continuous economic development for the sake of human well-being has resulted in worsening environmental conditions. This development, which shows no sign of deceleration, means that the human biosphere is facing complex and interrelated problems that threaten the sustainability of human existence on Earth. With regard to this, Sustainability Science emerges as a new kind of science that needs fundamental reorientation among human beings. Sustainability Science is a discipline that points the way towards a sustainable society. It is transdisciplinary effort addressing symbiosis between human activity and the environment. Basically, Sustainability Science is a use-driven (problem- or need-oriented) science that uses an inter (trans) disciplinary approach and focuses on human-environment systems, it aims to seek solutions for present and future environmental-related problems (web of problems) in order to achieve a sustainable society (indicated among others are changes in values, attitudes and actions). In the context of Indonesia, where economic development has put environmental sustainability in jeopardy, Sustainability Science education seems to be very relevant. This paper describes a proposed curriculum developed for a post-graduate program for Sustainability Science education. The proposed curriculum adopts the Mind-Skill-Knowledge model.

Keywords: Economic development, sustainability, environmental.

INTRODUCTION

It is a general consensus that education plays a crucial role in attaining human well-being, in particular, and sustainable society in general. A society that lives in harmony with nature is one of the essences of sustainable society. But this is a learned behavior, so the fundamental question is: what kind of education? We need an education that not only raises environmental awareness but also can enable societal transformation. In other words, we need a different kind of science that is primarily use-inspired and no longer an elusive concept.^{1,2} Thus, we need a transformative education that may bring society to understand the importance of a sustainable human and nature relationship.³ In this regard, there is a need for science to go beyond the questions of how coupled human-environment systems have evolved in the past and are functioning in the present day, and then further developed in the future.⁴

It is clear that currently sustainability is in crisis, not only human sustainability but the sustainability of the entire Earth. The current human sustainability crisis is because of complex factors mostly related to economics, like supremacy of materialism indicated by, for example, the majority of humankind looking for better education merely for exterior life (better economic welfare).⁴ We are witnessing the growing power of profit over sustainability for the sake of short-term gain, and this is occurring in developed as well as developing countries. Even the least developed countries are following the same pathway.

On the other hand, sustainability is in crisis because of the role of modern sciences as parts of the root cause of the current, unsustainable world. There is a big gap between science and problems related to sustainability. Science seems to be incapable to meet the present and future challenges posed by complex and interconnected environmental problems. Unfortunately, the root causes of the problems are poorly understood, and this makes the

underachievement of modern sciences in accomplishing sustainable society more obvious. Thus, there is an urgent need for science to transform itself if a more sustainable society is the ultimate goal of its societal contribution. Such transformation needs structured, systematic and massive changes in academia, practitioners and the public in general.^{5,6}

The crisis of sustainability can be observed very clearly in the context of Indonesia. Currently, there are almost no environmental problems absent in Indonesia. Local, regional, as well as global environmental problems can be encountered in this country. On the other hand, there is barely concern among decision and policy makers to evaluate the successfulness of the implementation of national development with regard to the achievement and maintaining a sustainable human-nature relation.

EXPERIMENTAL DETAILS

This paper elucidates how it is important to make science closer to society's needs, from the perspective of the sustainability issue. On the other hand, it is also imperative for science to reveal the practicality of the sustainability concept. In order to accomplish these objectives, observation, discussion with experts, literature reviews and evaluation of the existing program (and curricula) for Environmental Studies and Sustainability Science in some prominent Indonesian and Japanese universities were performed. Observation and discussion with experts were also conducted through an international symposia and conference on topics related to Sustainability Science.

RESULTS AND DISCUSSION

Sustainability Science

We are now observing that fragmentation of knowledge has resulted in specific knowledge for the sake of specialization and professionalism, which ultimately leads to giving priority advancing materialism.⁴ While on the other hand, there is an urgent need to promote interactions aimed to gain holistic knowledge for the sake of developing an integrative worldview. It is expected that through this, transformation of society will be able to achieve a sustainable society.

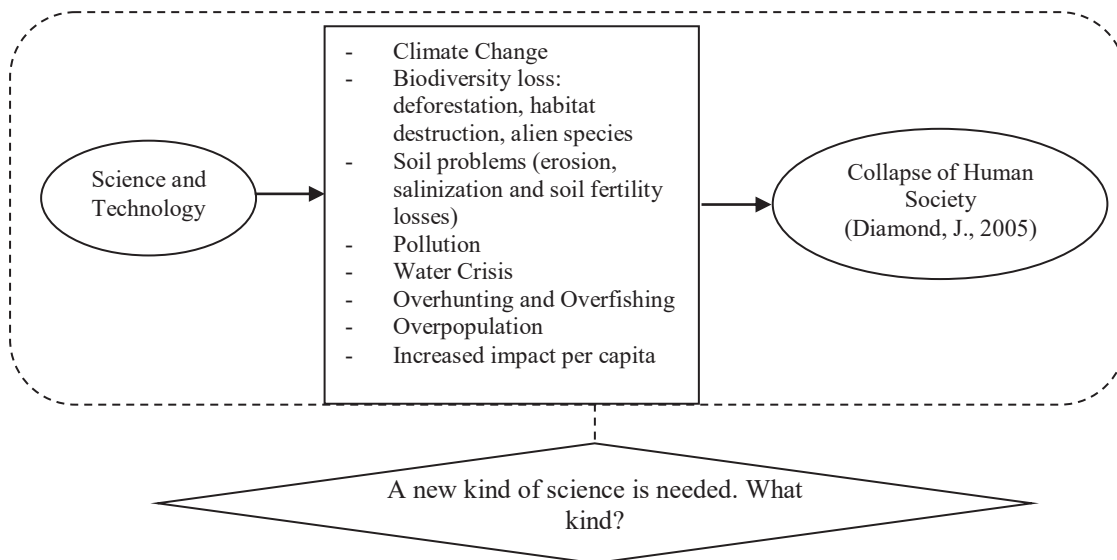


FIGURE 1. Sustainability crises due to the development of modern science and technology that lead to the collapsing of human civilization.⁷

We are all aware that the other side of science and technology is its detrimental effect on the environment. We are now experiencing an unprecedented sustainability crisis caused by climate change, biodiversity loss, deforestation, habitat destruction, alien species, soil problems (erosion, salinization and soil fertility losses),

pollution, water crises, overhunting and overfishing, overpopulation and increased impact per-capita (Fig.1). All these causes may lead to the collapse of human society.⁷ Therefore, it is not exaggerating to say that we need a new kind of science that may take us to a more sustainable future. A science that may help human beings to solve the problems they are facing based on common understanding of the problems and compromise based solutions. That science is Sustainability Science, which has some fundamental characteristics, i.e. it is trans-disciplinary and has potential to fill the gap between theory, practice and policy.⁸ Sustainability Science aims to promote intergenerational knowledge that may transform human attitude towards maintaining the integrity and capability of the environment.

Sustainability Science seems to be the forthcoming science to avert societal collapse. This newly emerging science has its origin from Sustainable Development. In this regard, Sustainable Development is considered from a scientific perspective.⁹ Sustainability Science creates ways for society to improve its capability to interact with nature in a more sustainable way. Sustainability Science can be understood as ‘science for sustainability’, which means science closer to society’s needs to solve sustainability problems. On the other hand, Sustainability Science can also be interpreted as ‘science of sustainability’, a better understanding of the complex human-nature interrelation and its sustainability.

In order to understand the science of (as well as sustainability) the so-called Sustainability Science, it is very important to recognize the three central systems and their interactions.⁵ They explain that the global system is vital for human survival because it maintains climate conditions, provides human beings with diverse natural resources and so on. But on the other hand, this global system is also influenced by human activities. Global warming is an obvious example of how humans (or the social system) affect the global system. In order to achieve a sustainable society, the social system with its politics, economy, industry and technology must work in such an order to establish a society with low carbon usage. On the other hand, the human system with its components (security, lifestyle and so on) must be directed to interact with the global system to accomplish sustainable human security.

The three central systems are highly relevant to be used as the basis when we discuss Sustainability Science and climate change⁵. In fact, these two issues are not mutually exclusive. Climate change is basically the impact of unsustainable development. It is important to point out that climate change is not merely about increasing concentrations of greenhouse gases. It is about interpreting biophysical phenomenon from social viewpoint, i.e. it is also about the impact of consuming and wanting more, lifestyle change and the adaptive capacity of a society.¹⁰ Therefore, we will lose the big picture of the real problem if climate change is seen from a mono-disciplinary perspective.

Sustainability Science is expected to seek opportunities to reduce threats of climate change. This new kind of science brings together scientific and experiential knowledge, and at the same time, it also serves as a medium for alternative solutions of climate change. Thus, Sustainability Science can be used to shape public policy related to climate change.

New Generation of Sustainability

Because human sustainability is in crisis, it seems that there is a necessity to consider the new generation of sustainability from two meanings. Firstly, it is essential to redefine our understanding of the meaning of sustainability. This means that it is necessary to define sustainability in practical terms rather than rhetorical and political. Apart from that, sustainability should be understood as being cross-sectorial rather than a single sector. Secondly, we need a new generation of sustainability in terms of human resources with a trans-disciplinary perspective. It has been almost four decades since the concept of Sustainable Development was launched for the first time. The first generation of leaders and thinkers of sustainability are fading out. It is time to produce the next generation of future leaders, thinkers and practitioners of sustainability. In the simplest term, we need sustainability ‘doers’.

Why do we need to redefine our understanding of sustainability? Because sustainability has been discussed too much in political than in scientific domains. This has raised a fundamental question: have we achieved the ultimate goal of Sustainable Development? We need to redefine our understanding of sustainability because environmental awareness through environmental education seems inadequate to put sustainability in practice and to produce future leaders of sustainability. To achieve this, it might be useful to consider not placing sustainability issues too close to the political domain.

In regards to the sustainability issue, of course, we need to see some facts about Sustainable Development concept. We must admit that we have failed to fully implement Sustainable Development due to some factors, among others:

- Lack of common vision and commitment among parties in developed as well as in developing countries;
- Lack of scientific and experiential knowledge about Sustainable Development; therefore, it is necessary to integrate scientific and local knowledge;
- Lack of practicality of sustainability concepts and how to achieve them.

These failures cannot be set apart from the fact that we are lacking an inter- and trans-disciplinary way of thinking. To resolve this, we need to create Sustainable Development educational and we need to institutionalize this education of Sustainable Development. In other words, it is about time to shift Sustainable Development from the political to academic agenda.⁸ Why is education so important? Because education plays an important role in shaping public policy, including in the implementation of Sustainable Development concepts. But until now, the role of Environmental Education and Environmental Sciences (studies) seems to be far from our expectations in achieving the ultimate goal of Sustainable Development, i.e. a sustainable society. Therefore, we should bring Sustainable Development to the mainstream and make it educational. By taking such a measure, it is expected that the ultimate goal of Sustainable Development could be better accomplished.

Sustainability Science Education

Back to idea of making Sustainable Development educational and to put sustainability education into practice, it is very important to have a well-defined concept. There are at least four important factors, i.e. the three central systems,⁵ characteristics of Sustainability Science,¹¹ basic components of Sustainability Science and present and future sustainability issues that should be taken into account as the platform to construct an educational model of Sustainability Science, for example the M-S-K model as illustrated in Fig. 2.¹² This model has the ultimate goal of enabling participants (students) to gain practical expertise on sustainability issues. To achieve this, the educational model should combine four relevant and interconnected elements: holistic knowledge, expertise, mind and skill.

The distinct differences between conventional and sustainability education (at postgraduate level) using the M-S-K model.¹² Conventional educations at the postgraduate level tends to create barriers among disciplines, and there is almost no integrative or cross-cutting ideas in conventional education. This education model has resulted in a pigeonhole in ways of thinking.

While, Sustainability education through the M-S-K model offers great opportunity to students to develop their holistic knowledge without neglecting the importance of specific knowledge (T-type education), mind and skills are other important factors to improve competency. Furthermore, the mind factor is essential because it helps students to develop their motivation (they have to convince themselves that every environmental problem is solvable), beliefs (self-confidence), synchronic consciousness (means that students can show strong consideration or empathy to others of the same generation) and diachronic consciousness (inter-generational empathy).¹² In this regard, the skills factor is not in the sense of professional skill, but more of communication, collaboration and problem-solving skills.

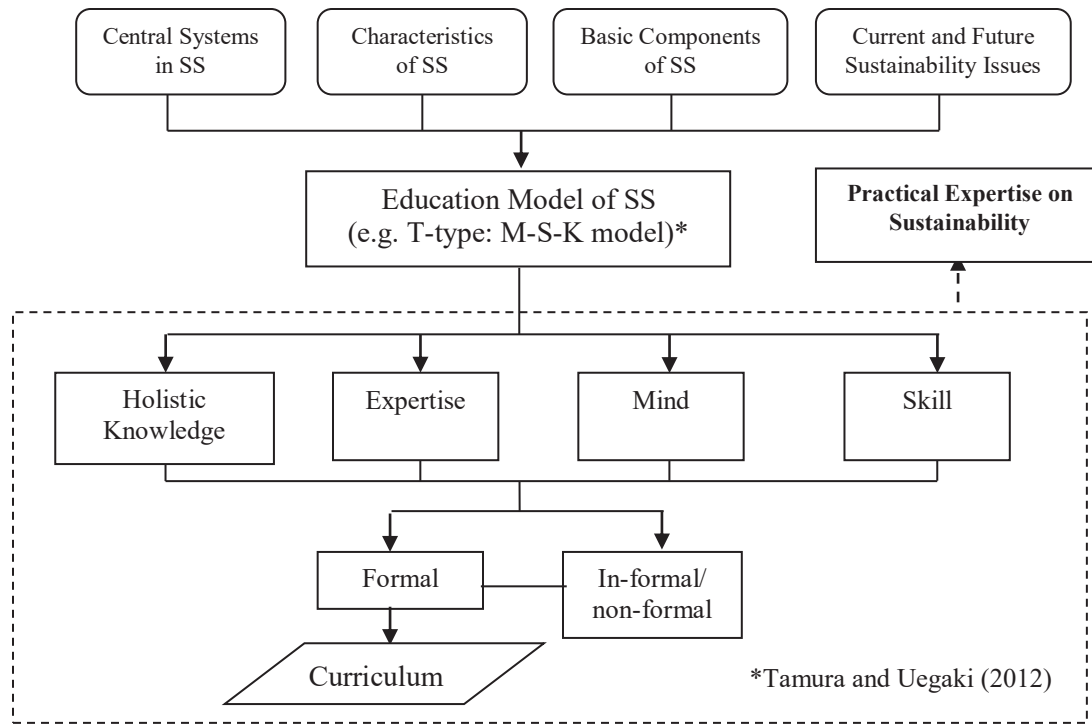


FIGURE 2. Proposed concept of sustainability education in Indonesia.

It is worth mentioning that there are challenges and constraints in the development of Sustainability Science in Indonesia, among others:

- Continuing fragmentation of knowledge: the continuing dominance of mono-disciplinary over inter- and trans-disciplinary.
- Incorporation of sustainability issues into present educational system.
- Structural reform: vision, institution (allowing establishment of interdisciplinary departments, cross cutting disciplines), curriculum (combining formal and informal), research funding, publication (not just for the sake of pursuing a high impact factor), change of mindset among academia, practitioners and policy makers.
- Institutionalization of Sustainable Development education needs structural and functional reform in higher education: open mindedness among scientists to recognize an extra-scientific approach.
- Blending scientific and experiential knowledge: building research partnerships among ‘first class’ (champions) scientists with different backgrounds of expertise and culture as well as with between scholars and stakeholder groups.
- Involvement of ‘outsiders’ in scientific discourse and the learning process for sustainability issues: it is very important to include experiential knowledge developed by the non-scientific community.
- Methodologies and techniques in Sustainability Science: as an emerging science in its premature phase, its body of knowledge and methodology is still in its formation.
- Problem of ‘linearity’ in Indonesia’s career system: trans-disciplinary science must ignore the issue of linearity.

In the case of Indonesia, the development of Sustainability Science education does not necessarily have to start from scratch, because some initiatives have been carried out such as link and match, problem-based learning, student-centered learning, competence-based curriculum, internships and practical works. What needs to be done is shifting the focus to sustainability issues.

Sustainability Science as a trans-disciplinary science is not merely a research-oriented science, but since one of its characteristics is problem solving-oriented, it is also very important to understand well the conceptual framework of a trans-disciplinary research process on sustainability issues. This framework of describing trans-disciplinary research is an interface between social and scientific practices.¹³ The process consists of three phases:

- Phase A: problem framing and team building. Problem framing combines societal and scientific problems.

- Phase B: co-creation of solution-oriented transferable knowledge.
- Phase C: (re)integration and application of the created knowledge.

Trans-disciplinary research using the concept of Sustainability Science can prospectively be applied for understanding complex and interconnected problems as hypothetically illustrated in Fig. 3 taking the example of the City of Bandung. Figure 3 illustrates the complexity of problems in Bandung that may lead to unsustainable conditions in the near future. There is no single discipline or solution that is able to find an effective solution. So, Sustainability Science could be used to look for a solution for the issues faced by Bandung City through the involvement of relevant fields and parties.

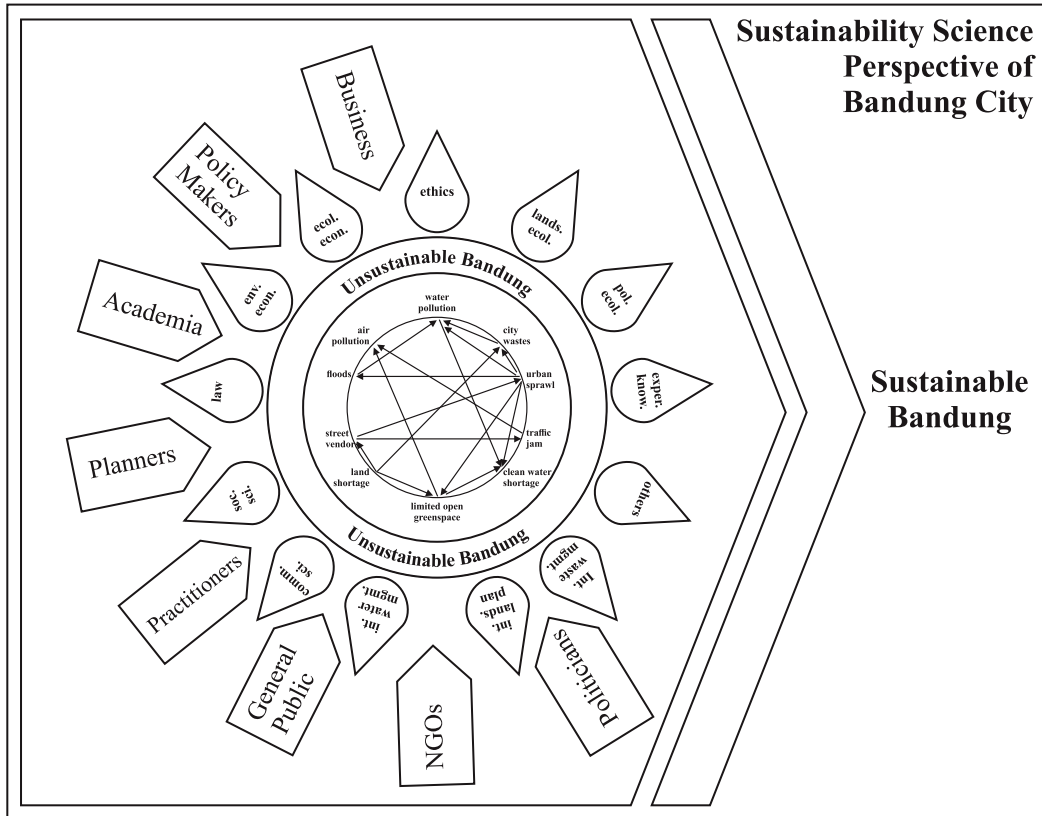


FIGURE 3. Sustainability Science perspective of the City of Bandung.

SUMMARY

There is a need to look for a new generation of sustainability to make the concept of sustainability more practical than rhetorical. Education that not only raises environmental awareness, but also can make societal transformation plays a crucial role in attaining a sustainable society. We need such education. Sustainability Science is a new kind of science that may help human beings to solve the problems they are facing based on common understanding of the problems and compromised solutions. Sustainability education offers a great opportunity to students to develop their holistic knowledge without neglecting the importance of specific knowledge. The development of Sustainability Science in Indonesia is prospective despite some challenges and barriers.

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