A NETWORK OF NETWORKS FOR SCIENCE OF SUSTAINABILITY: A NEW CHALLENGE FOR THE UNIVERSITIES

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Abstract: *Sustainability is a concept that focuses on the future maintenance and longevity of human well-being and security. It considers interaction within and between global, social, and human systems, including areas such as climatology and components of agriculture, industry, forestry and fisheries, and human communities in general, as well as the various systems on which they depend. Sustainability is often viewed from the perspectives of the environment, resources and energy. Global sustainability is the term used when the concept is considered on a worldwide scale. All universities have an important role in problem-solving to leave a sustainable world to future generations. Through their research, universities are expected to provide timely solutions to these problems and to closely coordinate with policy-makers if these solutions are to be promptly and appropriately implemented. Collaboration with a range of stakeholders including civil society and the private sector is also important to ensure such solutions are practically applicable and appropriate to build a sustainable society. Universities must work together in the areas of sustainability research and policy analysis toward this end. At the same time, the academic objectivity of universities is a key strength which should not be sacrificed. To restructure scientific knowledge in this manner, a unifying framework is necessary, facilitating this integrated problem-solving approach among research disciplines. Essential to such a framework is the creation of a "network of networks" (NNs) that links the various discipline-specific research networks already in place, thereby utilizing and augmenting their respective strengths and knowledge bases. In this network of networks, interdisciplinary cooperation among universities in different regions can be effectively enhanced through initiatives such as student exchange, faculty exchange and joint research projects.*

Key words*:* Sustenaibility, environment, university, network of network - NNs

INTRODUCTION

Sustainability began as a subset of environmentalism, as concern about how to manage to flow of natural resource inputs and human-generated outputs (pollutants and waste) in a way that could go on, if not for ever, at least for a very long time. For many years the scientific and technical world was discussing of the environment in term of conservation. The conceptual base was that the human activity should be always taken into consideration the fundamental aspects related to the environment conservation, preserving the state and maintaining the original conditions. It also can be defined as a static view of the system in a world where all the parameters are in changing and interrelated equilibrium.

This view was creating a real conflict between the human needs (commodities and food) and the dynamics in the environment. With time was evident that this conflict was impossible to control and management of the environment was becoming very problematic. The last decade has witnessed the emergence of a range of increasingly lively movements to exploit science and technology (S&T) in the quest for a transition toward sustainability.

The need for sustainable development initiatives to mobilize appropriate science and technology has long been recognized. Early research on sustainable yield management of renewable resources provided the foundation for the International Union for the Conservation of Nature's seminal *World Conservation Strategy*, published in 1980. But we have to reach the 1987 with the Brundtland Commission's report *Our Common Future* to have a real breaking point and a step forward toward the "Sustainability Science". The report defines sustainable development as "*the development that meets the needs of the present without compromising the ability of future generations to meet their own needs*".

For the first time, the sustainable development of the environment was linked to human development. Man and environment are two components that have to develop together, in equilibrium, applying knowledge in support of decision making for sustainable development and allowing the maintenance of the system. In this context the concept of sustainability was preserved in the Agenda 21 action plan that emerged from the United Nations Conference on Environment and Development in 1992 (Kyoto). Over the succeeding decade, the discussion of how S&T could contribute more effectively to sustainability intensified, involving numerous researchers, practitioners, scientific academies, and development organizations from around the world. By the time of the World Summit on Sustainable Development, held in Johannesburg in 2002, a broadly based consensus had begun to take shape on the most important ways in which S&T has already contributed to sustainability, on what new R&D is most important, and on what stands in the way of getting it done (Clark and Dickson, 2003).

SUSTAINABILITY

The US Environmental Protection Agency considered the sustainable development as a real revolution comparable to the Neolithic Revolution (Agricultural Revolution) when human have been changed from pickers to farmers or to Industrial Revolution of Nineteen Century with the begin of the modern states. It is evident that the concept of environment sustainable development is a real change in the way of considering the relation between humans and the environment. Sustainability has been described as the Three E's: elements, Environment, Equity and Economics. It is clear that the three E's have as central theme the relation between man and the environment and to raise the perfect equilibrium between these elements is probably the most challenging goal that the global society has at present. It will be more important in the future because the growth of the world population and the international economy.

To leave a healthy environment to our future generations we need to consider three aspects: (1) the scientific knowledge to understand what it is occurring to our environment to become sustainable, why it is occurring, where are the limitations, weaknesses and restrictions, and how to transform a non-sustainable system in a sustainable one; (2) the economic conditions to perform the changes; (3) the political mechanisms to obtain the wanted changes.

The former General Secretary of the UN Mr. Kofi Anan, in 2001 declared that "*Only by understanding the environment and how it works, we can make the necessary decisions to protect it. Only by valuing all our precious natural and human resources, we can hope to build a sustainable future. The Millennium Ecosystem Assessment is an unprecedented contribution to our global mission for development, sustainability, and peace*."

In other words sustainability is achieved only when there is full reconciliation between the economic development, the growing and changing human needs and aspirations on an equitable basis, and the conservation of the limited natural resources, preserving the capacity of the environment to absorb the multiple stresses that are a consequence of human activities (Hay and Mimura, 2006).

At the international level, the Johannesburg Summit (2001), building on the United Nations Millennium Declaration, has defined these priorities in terms of the so-called "WEHAB" targets for water, energy, health, agriculture, and biodiversity.

AGRICULTURE

The agriculture is one of the human economic activities that are strongly affecting the environment in much different ways. We know that agriculture needs to increase yields to feed and sustain the growing world population. But agricultural activities continuously disturb natural conditions which in turn affect agricultural productivity and menace the sustainability of agriculture (Yuya Kajikawa, 2008).

Sustainable agriculture is related to three major aspects: climate change, land use and biodiversity.

1. Climate Change. Agriculture is the major contributing to greenhouse gasses with the 23% of total emission. If we consider the major greenhouse gases we can see that 9% of global CO_2 emission and 49% of methane is coming from agricultural practices and agricultural by-products. Moreover, 90% of nitrogen oxides are produced by agriculture. It is not clear which will be the effect of climate change on agriculture but some papers has reviewed the potential impacts of climate change and air pollutants on plant growth, diseases and soil carbon pools. (Schmidhuber and Tubiello, 2007).

2. Land Use. Land use change is strongly affecting the soil C content which is reduced under the traditional agricultural practices. Emblematic is the so called "corn belt" in USA, that in 50 years of intensive agriculture with a strong use of synthetic chemicals lost 63% of total carbon.

Now days land use change is manly in less developed countries. In South America land use provoked and emission of 1.5 billion tons of carbon, in Asia around 1.0 billion tons and in Africa 0.5 billion tons. In North America land use determined an emission of 0.2 billion tons (data from Climate Change Information, UNEP, IUC, 1997). All this carbon became CO_2!

3. Biodiversity. Biodiversity is disturbed directly by the agricultural activity. Specialised agriculture is strongly affecting the biodiversity of local areas, invading and disturbing the whole ecosystem. The lost of territories is reducing the sites for wild fauna and the entire system becomes poorer. Very often the rehabilitation of degraded areas with exotic plant species is producing an evident disturbance creating non sustainable environment. Data from UN refer that biodiversity changed slowly in the last 300 years but in the next 40 years world biodiversity will be reduced to 25% as effect of human impact.

The non sustainable characteristic of modern agriculture is evident if we consider that in developed countries the production of 1kcal of food requires 12-13 kcal of inputs while in less developed countries the ratio is only 1 to 3.

Is this a matter of development or it is a better and more rational use of the environment? Probably both reasons but we are now discovering the old systems of production, less aggressive and much more sustainable. Rotations, cover crops, organic production, zero tillage are all practices that we know are eco-compatibles, respecting the environment and allowing a sustainable use of the ecosystem.

SUSTAINABILITY SCIENCE

But what is it sustainability science?

Let's consider sustainability science as a multidisciplinary research field promoting science focused in sustainability-related issues in many different fields including agriculture, fishery, forestry, water, energy, economics, sociology, and all other sciences and collecting the outcomes. In this way sustainability can work as a symbolic concept to focus attention on an issue.

Another interpretation is that sustainability science conducts interdisciplinary research that is not performed sufficiently in each discipline-based science. In this case, sustainability science has an important role in educating and promoting people who have multiple skills and perspectives.

Now days the prevalent interpretation of sustainability science is that it is a distinct discipline involved in a transdisciplinary effort over the existing disciplines. So it is something new, with a specific knowledge, specialised on sustainability issues but having a strong link with all disciplines (Yuya Kajikawa, 2008).

In this contest, the Universities have a central and very delicate role. In fact the academia collects the needs of the society and through the research produce knowledge to make more sustainable the production of commodities and food. But probably more important is the function on education that is a key instrument for bringing about changes in knowledge, values, behaviours and lifestyles of the

societies, necessary to achieve sustainability. Contributions from academia are vital to tackle challenges of the global environmental problems such as climate change, desertification, energy consumption, which are related to the continued existence of all humanity.

Sustainability science is not yet an autonomous field or discipline

Its scope of core questions, criteria for quality control and membership are consequently in substantial flux and may be expected to remain so for some time.

Nonetheless, something different is surely "*in the air*," something that is intellectually exciting, practically compelling, and might as well be called "sustainability science." The central point of Sustainability Science of is to understand how "the World System" works and how is responding to perturbations. The World System means living and non living components present in the atmosphere, oceans, waters and lands. Moreover, we have to include the immaterial aspects as culture, costumes, languages, and all the typical aspect of complex communities

NETWORKS

It is only very recently that networks of universities are born in different part of the word related to sustainability.

At G8 University Summit in Sapporo in July 2008, international contributions representing academia decided to achieve the sustainability of the global, social and human systems and their mutual relationship and to promote education for sustainable development and construction of an international network through cooperation among universities.

For this G8 University Summit, the presidents of research universities that play leading roles in academia were invited from the G8 nations and other major developed countries as well as major emerging economies, to discuss how we take on the challenge of the global and human issues. The aim was that the results of the discussion would be supported by the G8 and other international consensus-building processes to achieve global sustainability.

Representatives of major universities and research organizations worldwide met again at the University of Tokyo on 5^{th} – 7^{th} February 2009, to foster a deeper understanding of diverse academic approaches to sustainability science and to discuss how to design a framework for integrating, structuring and organizing knowledge generated on and through the practice of sustainability science.

At the conclusion of the conference, participants issued that the effective action is urgently needed to address the serious sustainability challenges the world faces today at all levels: global, regional, national, and local. In order to ensure that sustainability science results in meaningful action, networks that transcend disciplinary, cultural, geographical, and societal barriers are crucial.

Interactions between scientists across many disciplines as well as between scientists and all sectors of society are essential.

While such networks exist at regional and global levels, they tend to be centered in developed countries, to be limited in both scope and participation, and lack of communication and coordination between them.

A network of sustainability networks can help to overcome these barriers to effectiveness and speed the translation of the newly generated knowledge to appropriate action.

In the conclusion the Meeting recommend the creation of a "*Network of Networks*" (NNs) for sustainability science to facilitate effectiveness through the promotion of different aspects. Fundamental is the identification of complementarities so as to reduce duplication of effort and to enhance synergies. Sustainability Science has to guarantee the cultural and geographical diversity in network participation and assure a greater participation of developing countries. The engagement of industry and other stakeholders from both developed and developing countries in the framing and execution of research agendas is another aspect that must be considered. Since 70% of world population is living in the South the Meeting recommend increasing the participation to the network to students and economic sectors of developing countries.

Next appointment will be in June 2010 in Rome where we will evaluate the progress of the promotion of the network and the capacity of interdisciplinary, multidisciplinary, and transdisciplinary nature of sustainability science has to provide fruitful outcomes to society. Moreover we will discuss also how to achieve valuable outcomes through scientific research itself, publishing the results to disseminate them in society.

I would like to conclude my work with the inspired words of a great man, Albert Einstein, that many years ago said: "*We will never solve our problems using the same kind of thinking that caused them in the first place*".

We should learn from him!

REFERENCES

1. **Clark William C. and Dickson Nancy M., 2003 -** *Sustainability Science: the emerging research program*. PNAS vol. 100 no. 14 8059-8061.
2. **Goerner Sally J., Dyck Robert G., Lageroos Doroty, 2008 -** *The new Science of sustainability.* Triangle Center for Complex Systems, Chapel Hill, North Carolina, USA.
3. **Hay J. and Mimura N., 2006** - *Supporting climate change vulnerability and adaptation assessments in the Asia-Pacific region: an example of sustainability science.* Sustain Sci. 1(1):23–35
4. **Reitan H. Paul, 2005** - *Sustainability Science-and what's needed beyond science.* Sustainability: Science, Practice and Policy. 1: 77-80
5. **Schmidhuber J., Tubiello F. N., 2007 -** *Global food security under climate change*. Proc. Natl. Acad. Sci. USA. 104: 19703-19708) evaluated the potential impact of climate change on food security.
6. **Yuya Kajikawa, 2008** - *Research core and framework on sustainability science*. Sustain. Sci. 3: 215-239.