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Организация
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Natural Sciences Sector
Social and Human Sciences Sector

United Nations
Educational, Scientific and
Cultural Organization

From
the People
of Japan

Inception Symposium[1] on Broadening the Application of the Sustainability Science Approach in support of the 2030 Agenda for Sustainable Development

UNESCO Headquarters
5 - 6 April 2016

Report[2]

Introduction

The Inception Symposium on Sustainability Science, held in Paris, France at UNESCO Headquarters on 5 to6 April 2016, was a series of three in the context of a project generously supported by the Government of Japan "Broadening the Application of the Sustainability Science Approach". It explored ways to bridge academic work on sustainability science with the growing interest for this approach on behalf of the policy-making community. It also considered a pioneer platform through the demonstration of scientific perspectives and successful case studies on sustainability science. In parallel, the relevance of the Sustainable Development Goals (SDGs) and the 2030 Agenda for Sustainable Development was highlighted i the Symposium as a transversal matrix for guiding. A multi-stakeholder involvement and a multidisciplinary approach have been ensured in the Symposium as well as the presence of Member States.

Sustainability Science is reflected in 37 C/4 and C/5 through the Strategic Objective 5, "Promoting international scientific cooperation on critical challenges to sustainable development". Para. 52: "UNESCO will put into practice integrated approaches to science and engineering for sustainable development, called 'sustainability science'"; and Strategic Objective 6, "Supporting inclusive social development, fostering intercultural dialogue for the rapprochement of cultures and promoting ethical principles", Para. 58: "UNESCO will seek to develop a future-oriented understanding of the dynamics at work, based on the approach of sustainability science, to assist countries in the design and review of inclusive evidence-based public policies" as well as with the Strategic Objective 1, "Supporting Member States to develop education systems to foster high quality and inclusive lifelong learning for

[1] http://en.unesco.org/news/how-science-can-help-create-sustainable-world
http://fr.unesco.org/news/comment-sciences-peuvent-aider-creer-monde-durable
http://es.unesco.org/news/como-ciencia-puede-ayudar-crear-mundo-sostenible

[2] Prepared by Dr Christine A. Iskandar, UNESCO

all".

In the 36 C/5, Japan's proposal to integrate sustainability science followed by a large support, in the 37th Session of the General Conference, of several Member States, such as: Côte d'Ivoire, Canada, Democratic Peoples' Republic of Korea, Egypt, Germany, Japan, New Zealand, Poland and Slovenia. In Fall 2015, UNESCO Natural and Social Sciences Sectors together with the Japan Ministry of Education, Culture, Sports, Science and Technology (Japan/MEXT) initiated the project on "Broadening the Application of the Sustainability Science Approach".

The Project benefits from multi-stakeholder involvement of the Steering Committee which is composed of:

- Maik Adomssent, Leuphana University Luneburg
- Eduardo Brondizio, Indiana University and Future Earth
- Mathieu Denis, International Social Science Council (ISSC)
- Kazuki Fukuda, Japan/MEXT
- Heide Hackmann, International Council for Science (ICSU)
- Joanne Kauffmann, University of Tokyo
- Luiz Oosterbeek, International Council of Philosophy and Human Sciences (CIPSH)
- Lutz Möller, German National Commission of UNESCO
- Mohamed Saber, National Research Center (NRC), representative of the Government of Egypt
- Kazuhiko Takeuchi, United Nations University (UNU)
- ADG/SC and ADG/SHS (or their representatives)
- UNESCO Headquarter and Field Office

Guidance from the Project Steering Committee and value-addition of a UNESCO-led initiative in the area of sustainability science:

- A bottom-up process, largely driven by expert communities, Member States and Field Offices , beside the vision and priorities of Member States;
- Operationalizing the discourse on sustainability science will require taking into consideration various experiences, aspirations, views and perceptions;
- In light of key developments in late 2014/2015 (Sendai Action Plan on Disaster Risk Reduction, Nagoya Global Action Programme on Education for Sustainable Development, Addis Accord on Financing for Development, 2030 Agenda for Sustainable Development, Paris Agreement on Climate Change), sustainability science represents a possibly very useful way to orient the work of UNESCO in support of these processes and deliberations;
- Bridge diverse schools of thought and of practice of science and education with the policy community in demonstrating and stepping up the contribution of the sciences and education to the 2030 Agenda for Sustainable Development;
- Outputs will be in the form of policy guidelines.

In 2015, a new ambitious sustainable development agenda was adopted. The international community of stakeholders is actively engaged in translating the vision of the Sustainable Development Goals (SDGs) into action. In this regard, the many targets accompanying the SDGs, together with the recently agreed SDG Indicators, will assist in determining realistic and measurable objectives. The policies to implement the 2030 Agenda are human rights-based and transformative but need to ensure policy coherence. Sustainability Science has a fundamental role in that, and four themes are underscored: role of ethics, intercultural dialogue for knowledge production (conceptual frameworks and methodologies but also need appropriate narratives), role of youth and role of UNESCO in relation to global governance of science.

Several keynote speakers and presenters of case studies framed the discussions from which these main points emerged:

- The roots of sustainability science go back even before the Brundtland report;
- Drawing upon all available knowledge, from all relevant disciplines and all relevant stakeholders (co-production);

- Universities need to rethink their self-image as “ivory towers”;
- Problem-oriented, i.e. oriented towards a “real problem” defined in the world with stakeholders, co-design), not mainly addressing a research question as defined by the scientific community ;
- Universities need to work out a clear strategic framework for fulfilling a vision of becoming sustainability universities;
- Transforming higher education for a sustainable tomorrow;
- The cultural dimension of sustainability is conceptually and strategically indispensable for research and education;
- Education for Sustainable Development (EDS) plays a central role in the promotion of sustainability science;
- EDS must be holistic, contextual, critical, transformative and committed to equity;
- Sustainability science needs to present a new vision for a sustainable society that reintegrates social-ecological systems while promoting interaction with the global community;
- Global understanding is an essential human condition;
- The main goal of the International Year for Global Understanding (IYGU) is to promote global understanding in an praxis centered way and change problematic actions;
- The relevance of taking into account peoples politics:
    - Emphasizing the cultural dimensions of sustainability
    - Local, individual choices outline global change
    - Change must come from the bottom-up
- R & D plays an important function in achieving sustainable development;
- EIA is a safeguard tool to attain sustainable development with minimal adverse environmental impacts (Protection is better than treatment);
- Sustainability science currently loosely framed until a new one is established;
- How to move from academia to government;
- Science and society not just crossing disciplinary boundaries;
- The role of science beyond a tool for competitiveness in the world market;
- Sustainability science helps to frame and articulate STI in the context of contribution to society/sustainability;
- Historic examples of sustainability “Archaeological perspective on (demonstrated) adaptation”;
- Is there a North and South science? Is there such a thing as gender driven science?
- Role of technology in cities over-emphasized;
- Cityscore (governance based, e.g. Boston; C-neutral Copenhagen (not only technology but based on public involvement; Stockholm too);
- Goal of sustainable planning and management is inclusiveness, and the link to resilience;
- We look at Sustainability science in cities mainly in terms of technology (ICTs, transportation, circular economy etc.) but: think of people;
- Sustainability science has to address local peoples’ needs;
- Stakeholders other than scientists not just recipients of knowledge but real actors and partners;
- Environmental conservation, social equity, economic feasibility as well as the importance of culture;
- Working across scales to clarify the connections between local conditions and global consequences;
- Taking into account the anti-science, the alienation;
- Shifting conceptions related to science: science as a public good;
- Theoretical and methodological aspects to be met by evidence (case studies);
- Evolution of social sciences to have sustainable structural change effects.

The following sections present a brief overview of the insights that emerged from presentations, case studies and discussions.

From academic advances in sustainability science to their applications in public policy: Challenges and required steps

In its relatively short history, sustainability science has developed rapidly and successfully. It is increasingly acknowledged as a valuable approach for integrating scientific disciplines, to address complex problems defined cooperatively by science and society. Sustainability science brings a focus on solving problems, engaging a broad range of stakeholders outside academia, recognizing that for knowledge to be truly useful it must be co-produced through close collaboration between scholars and practitioners.

It also seeks to combine scientific knowledge with other knowledge systems, such as traditional and local knowledge, leading to a more inclusive and effective interface between science, policy and society. It also aims to promote visions for solutions through rebuilding a sound relationship between human society and the environment (coupled with social-ecological systems).

With the success of sustainability science, the focus is now shifting from academic questions of definitions and methods to the challenge of how it can be applied to transforming society, and how a scientific approach can solve real problems in society. In order to effectively apply sustainability science in this way, several key issues must be addressed:

- **Moving beyond the inter-disciplinary to a trans-disciplinary approach.** How to better link processes of research planning, monitoring and assessment, and decision support, to build systems for adaptive management and societal learning.

- **Education and capacity building.** Applying sustainability science requires special social competencies, particularly the ability to build and coordinate multi-stakeholder partnerships. Effective educational programmes are needed to develop in students the skills necessary for engaging with these varied stakeholders and acting in a coordinated manner.

- **Networking and North-South collaboration.** The innovative approach of sustainability science requires networks and partnerships. North–South collaboration is of particular importance, and for these capacity development and funding initiatives is essential to build research capacity. Local and regional networks must be linked with global networks, such as the **Future Earth Initiative**.

The academic landscape of sustainability science has changed considerably over the years. It involved discussions in each specialized field, including engineering, agriculture, health sciences and economics. Now, it has become more interdisciplinary - integrating more disciplines to pursue a comprehensive understanding of human-environmental systems. Sustainability science has rapidly evolved into an independent academic discipline growing beyond other specialized fields.

Sustainability and resilience are complementary. Sustainability is a normative goal for society to achieve, and the study of sustainability plays an essential role in paving the way toward that goal. Resilience has the ability to absorb the external shocks and stresses that affect nature and society, and to stabilize social-ecological systems as needed. Social-ecological systems in the past were more closed and integrated in traditional local communities, but with economic growth and the advent of globalization, these systems began to break down, destroying the harmonious relationship between human activities and natural ecosystems.

Good governance is essential to achieving a sustainable society. It is important to establish a multi-level, nested governance structure through close-knit collaboration between global and local actors.

An enhanced interface between science, policy and society is also vital. Strengthening connections between a variety of stakeholders supporting good governance for a sustainable society - including governments, private sector organizations, NGOs and other civil society actors - is particularly indispensable for fulfilling the visions of sustainability science. Among the greatest challenges facing the humanities are the development of new natural capital businesses in collaboration with various stakeholders involved in sustainability science, and the pursuit of new inclusive wealth based on the value consciousness of improving comprehensive welfare standards, including health and education.

Sustainability science also promotes the co-evolution of academia and society. **Future Earth**, a new international research platform focusing on the global environment, also emphasizes the importance of promoting transdisciplinary approaches that enable the co-design, co-production and co-delivery of knowledge. In order to involve society in conducting research from the planning stage, measures should be taken to strengthen the interface between science, policy and society. The Intergovernmental Panel on Climate Change (IPCC) provides a successful example for strengthening the science–policy interface. Based on IPCC reports, the **Paris Agreement** on climate change included goals for limiting the rise in global temperatures and achieving a zero-carbon society by the end of the twenty-first century. The Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (**IPBES**) is also expected to contribute to ongoing assessments and scientific findings for biodiversity policies. In particular, IPBES needs to ensure scientific objectivity in its assessments and analysis while incorporating traditional and local knowledge into scientific knowledge systems.

Paralleling these highly visible initiatives the scientific community was struggling with ways and means to give substance and coherence to the concepts of sustainable development and sustainability and to identify a means to measure progress toward such development in order to ensure its acceptance as a valid subject of scientific inquiry.

The need for new approaches to integrating and creating new knowledge became apparent. Beginning with the publication of *Our Common Journey* by the US National Academy of Science in 1999, academies of science and scientific organizations around the world supported the need for a new approach to science, sustainability science, that would not only result in more robust understanding of the inter-connectedness of social, environmental and biophysical issues but would also lead to an action that would transform the relationship between people and nature.

Dealing with issues that span different spatial and temporal scales (such as global environmental issues, climate change, and persistent poverty) would require a very high level of integration and structuring of knowledge. Designing programs to achieve such integration in rigorous and useful research programs remained problematic.

Precedents for analyzing problems in coupled human-environment systems were to be found in what had become known as “global change” science focusing on the earth as a system through multi-disciplinary research aimed at improved understanding of the structure and functioning of the biosphere and the effects of human activity on both. Global change science is about what the human-environment condition is and who, what and where are the vulnerabilities that result from it. Sustainability science goes further, asking what the human-environment condition can or ought to be.

Ensuring the dissemination of knowledge for sustainability requires networks that transcend disciplinary, cultural, geographical, and societal barriers. Interactions between scientists across many disciplines in addition to the education of sustainability scientists themselves as well as between scientists and all sectors of society are essential. In the past, such networks tended to be centered on developed countries in both scope and participation, and lacked communication and coordination between them.

Recognizing this, participants at the 2009 International Conference on Sustainability Science held at the University of Tokyo, issued a statement recommending the creation of a **network of networks** on sustainability science to facilitate effectiveness through the promotion of a means to enhance synergies, cultural and geographical diversity, 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 agenda, and education, training and greater participation of students in both developed and developing countries.

One example of how sustainability science can be effective for addressing complex sustainability issues is the case of recovery efforts in Japan following the Great East Japan earthquake and

tsunami of 2011. Japan has focused more attention on building a sustainable and resilient society. The country's National Biodiversity Strategy, which was revised after the catastrophic disaster, states that Japan should aim for a society that coexists with nature, namely, a society in which people recognize that nature provides threats as well as blessings, and enjoy the benefits of nature in everyday life while being prepared to prevent and reduce the consequences of natural disasters. Furthermore, the attendant accident at the nuclear power plant in Fukushima has boosted the prospects of adopting renewable energy.

Moving from knowledge to action for sustainable development requires a level of participation on the part of all parties incorporating knowledge from outside academia, and dealing with different values and political interests that is typically outside the comfort zone of scientists. A 2013 UNESCO hosted conference on "Promoting Integration and Cooperation for Sustainability" identified three essential elements to overcoming impediments to action:

- To approach sustainability holistically by building social-ecological resilience;
- Forge strong collaborations between scientists and multiple stakeholders throughout the research process; and
- Strengthen education for sustainability at all levels and in both developed and developing countries.

The participatory approach in sustainability science is inherently one of engagement. Politicians and most decision-makers have no feeling for what it is like to live in extreme poverty. The issue of climate change is so immense that it is almost impossible to be envisaged on a personal level. Sustainability scientists can address the goals and targets of the 2030 Agenda. They will identify solution options for many of these. Sustainability science in its message of the need to change must get beyond objective facts to help people understand what is true for them personally both in terms of the crisis being addressed and what can be done about it.

Towards a social policy for sustainability

The sustainability science approach is essential for effective decision-making with regard to global sustainability, since social, environmental and cultural systems are closely linked. Prominent research programmes within economics, the environmental sciences and transition theory are explored through diverse case studies, revealing challenges and advancements for transdisciplinary research. New practice based on science-society-research partnerships, experiential learning in higher education, iterative and participatory modelling has become manifest. Archaeology has highlighted the high capacity of mankind, from its origins, to adapt to climate change and to find sustainable solutions to ensure the survival and the development of societies of hunters-gatherers, sedentary farmers and nomadic herders.

Climate change, to a larger context, saw the development of major landscape infrastructures for field irrigation, at periods, probably locally variable, between 3 000 and 2 000 BC:

- Irrigation channels from rivers (Mesopotamia, Central Asia)
- Irrigation from the altitude snow melting (South Caucasus, Central Asia),
- Water recession basins from natural flooding of rivers,
- Oasis (Desert areas),
- Water immersion (rice field)

Such an infrastructure needs an ongoing maintenance and then implies investment-based governance, political stability and no destruction or abandoning by invaders. The risk of a progressive soil salinization has to be managed.

The example of hydro-agricultural systems by recession basins, from the natural flooding of the Nile to the sustainable development of the valley with the construction of recession basins, is well known. The exceptional yield of 10 hundredweight per hectare in the Nile valley has only been exceeded in 19th century. Such a high level production has allowed feeding a part of the population dedicated to build the monuments of ancient Egypt (like the industrial revolution in 19th century).

Incas is one of the best the examples of the agricultural systems with vertical zoning and specialization of cultures:

- Irrigated cropping systems (corn, bean, cotton) in the oasis of the coastal plain,
- Irrigated cropping systems (corn, bean, lupine, quinoa) in area Quechua,
- Cropping system of potato in the Suni area,
- Pastoral system in Puma area,
- Slash and burn system (cassava, corn, coca) on the wooded slope of Amazonia.

Since ancient Egypt, and particularly during the Roman Empire, important works of infrastructure have allowed the culturing of deltas and marshes:

- Sewage of deltas: Nile delta, Po delta, Rhone delta, Gange delta, etc.
- Marsh draining : Marsh of Poitou
- Dewatering of polders : Netherlands (until – 7m)

It is interesting to point out that a climatic change or an economic crisis is not the only unique explanation for complex systemic collapses. The example of the French revolution in 1789 shows also that processes of societal attitudes and weaknesses of governance may play an important role in history:

- The explosion of the Volcano Laki in Iceland (1783-85) led to the origin of a rotten climate, poor harvests, speculation on wheat flour and scarcity involving popular riots
- A weak Governance (Louis XVI),
- A society blocked without courage of reforms (Turgot),
- Bankruptcy due to the accumulation of debts (Necker),
- The societal attitudes of the French people, whatever their class of origin (asking for equality for some, refusal to abandon privileges for others, want to be annuitant for the haves),

Archaeology demonstrates the high ability of humans to adapt to climate change and their capacity of a sustainable investment to manage it, since the end of the Neolithic period five thousand years ago, even with a technology very much rudimentary than today. It is the reason why archaeologists, who are the experts of the deep past, are generally more optimistic about the difficulties of adaptation and the ability of modern populations in managing in the short term the actual warming of the climate and in the long term, the coming back of the new ice age.

“Anti-science” in sustainability and resilience

Three major dimensions characterise the current relation between science and society. The first dimension is that the growing specialization of science and technology provides ever stronger solutions for human needs. The second dimension relates to a growing gap between adaptation processes and a restrictive understanding of science. The humanities are the interface between these two processes, since they extend the space and time scale of problems, offering the occasion to make sense in such scale.

The third dimension is the decrease of participation of people in the production of science and technology. The alienation of people’s engagement in the scientific production processes allowed for an “Anti-science” discourse. The context of this threefold trend is the progressive integration of socioeconomic and environmental processes that for the first time in history confront ethnocentric cultures with the tangibility of unique humankind challenged by common dilemmas.

Building from this understanding, one must consider four main issues: theoretical context; the need to make sense; the praxis of knowledge; and the methods that should be considered for sustainability science. *If science was born from the belief in essential logical causality, through the valorisation of reason, observation and experiment, to what extent is it compatible with negativism and post-modern relativism?* The critique of positivism, instead of building into a comprehensive integrated dialectic dimension, moved towards relativism, thus reinforcing anti-science.

A crucial consideration when discussing sustainability science is to understand the relation between knowledge and governance. The key component of governance is knowledge, through two

complementary poles namely: abstract knowledge reasoning on causality (awareness and science) and applied knowledge connecting needs and resources (logistics and technology). This means that governance is only feasible when its actors share a common (cultural) knowledge, i.e., an informed knowledge fed by tradition and new experience.

The challenge for sustainability science is to be ready to be put into question, to allow for people to engage in practicing such science, including the questioning of the concept of sustainability itself, so that it might be generated through debate and not mere faith.

There is a difference between processes that may be analysed through hard and natural sciences, standardized methodologies and perceptions of those processes that are culturally driven. This leads us to a second question: *How do human rights and ethical considerations on the access to territories and heritage impact on the retreat of science?*

The difficulties of sustainability science also derive from the current way of managing science: valuing primarily quantity, short term deliveries and knowledge fragmentation; producing skilled workers with limited integrative knowledge, unable to make sense of their work; allowing people to perceive this loss of sense and to look for alternative narratives that might make sense.

Anti-science is not simply, or even mainly, a discourse of negation. Society is unable to understand the complexity of the debate on global change. For this reason it hesitates between negationism and catastrophism. This leads us to a third question: I*s useful technical knowledge a process restricted to science researchers? What may be the role of traditional knowledge in a sustainable science programme?* A sustainability science strategy needs to be built from the traditional knowledge experiments, framing their efficiency into a foresight process that abstracts and formalizes, i.e. science that is capable of delivering.

This implies the need to recognise and overcome some major examples of anti-science progress, not always recognised: the segregation of the humanities, the divide between fundamental and applied sciences, the focus of funding on short term deliveries and the strict alienation and its cognitive implications.

It is due to such a compound of anti-rational trends that anti-science often blocks the possibility of knowledge advances, for instance when the search for human origins is put into question, or when misunderstandings about climate change implications block behaviour adaptations.

This is also the scope of the Apheleia strategic partnership for integrated cultural landscape management for global and local sustainability (www.apheleiaproject.org), which attempts to foster a combination of participative projects and abstract reasoning, fixed on specific territorial transformative projects.

The major challenge for the future of sustainability science is to bridge the gap with society, which leads us to a fourth question: *Can the interlinkages between adaptability, vulnerability and resilience be understood by society based on programmatic disputed goals (e.g. sustainability), or do we need alternative methods of engagement?*

Science is about reason, awareness and critical reasoning, but despite its mainly abstract nature it may only be understood through concrete operative procedures. Alienation is the key problem in this context, seating in the root of anti-science but also of other disruptive behaviour, such as cultural radicalism.

The explanation of science relevance requires a strategy of participation, and in this process knowledge and governance are interlinked. **Three strategic recommendations** descend from these considerations:

- Sustainable science strategies should be built as part of governance strategies;
- Education, participative experiments, science based narratives and dilemmas debates should be promoted as comprehensive “packages”;

- Sustainable science should be based on an integrated framework involving mid-long term humanities dilemmas and short term natural and social problems.

Finally, this leads us to three proposals:

- On **resources** (establishing a list of examples of transferable projects should be made available, that may be found in the World Humanities Conference of 2017 privileged forum);
- On **education** (at school level, at least one discipline or area of studies in all pre-University education should bring together human, social, natural and hard sciences, discussing dilemmas);
- On **research** (funding of science and society projects should consider projects focused on involving people in the making of science (participative science).

Urbanization and sustainability science

In the last years, from multiple initiatives both in research and in actual projects, especially in European and North American countries, cities have gained the attention of key actors for the achievement of sustainability around the globe. Cities as catalysts for sustainability are the theme of two main networks with global coverage in the theme, the C40 and the RC100 (Resilient Cities).

RC100 has as objective to help cities around the world to become more resilient in face of challenges posed by environmental, social and economic changes connected to growth during the 21st Century. C40 gathers a network of megacities committed with facing environmental changes, through the reduction of greenhouse gases and mitigation of climate change. Prioritizing on the global agenda, dozens of international networks are also involved in the subject. Among them, the Local Governments for Sustainability (ICLEI), United Cities and Local Governments (UCLG) and CityNet.

Sustainable cities and communities became, in 2015, the eleventh item of the seventeen "Sustainable Development Goals (SDGs)". The text enables the visualization of the direction for required efforts: "Make cities and human settlements inclusive, safe, resilient and sustainable". Equally clear is that the planet cannot follow a sustainable, prosperous and functional trajectory without sustainable and resilient cities.

The 2016 International Year of Global Understanding – IYGU, has an approach in the same direction, from local to global. In this way, cities are the organisms where local modifications can lead to global sustainability.

Jeremy Rifkin, is his book The Third Industrial Revolution, contends that now and in the future, survival will be based more on cooperation than in competition, as well as the strengthening in the sense of belonging to a territory that leads to a mutual and positive relation with this territory. He also predicts: "In twenty-five years from now, millions of buildings – homes, offices, shopping malls, factories, industrial and technology parks – will be renovated or constructed to serve as 'power plants' as well as habitats".

To become sustainable, cities will need to interact with each other in low carbon promotions, transformational processes associated with science, engineering and innovations that will redesign the current cities (smart grid, distributed energy, intelligent buildings, electric public and private transport vehicles, innovation on treatment of solid waste,).

The world looks with heightened attention to cities. The North American city of Boston and its sophisticated system called "CityScore" were recently featured on The Economist. Copenhagen moves towards being the first capital carbon emission neutral in the world, an objective to be achieved by 2025. There is the progressive transition to renewable fuels, especially in heating systems.

Shinagawa Ward, a small region in Tokyo, aims to meet a 'climate positive' emissions target of net-negative operational GHGs emissions, and the area of Hammarby Sjöstad, in Stockholm, with urban redesign and innovation. The Shinagawa Project also aims to serve as a testing ground for smart

grid technologies, fuel cells, recycling, renewable energy and cutting-edge measures in buildings and transportation.

Hammarby Sjöstad is an urban project development, south of Stockholm's South Island, in Stockholm. The decision, in the 1990s, of recovering the area, has opened the door for a redevelopment with the concept of "circular urban metabolism", which involves the reuse of waste, water, energy and used materials, as well as a strong involvement of the residents and neighbours.

This October the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) will take place in Quito, Ecuador, where the main objective is "to secure renewed political commitment for sustainable urban development, assess accomplishments to date, confront poverty and identify and address new and emerging urban challenges for the establishment of the 'New Urban Agenda'."

Important as they, these are not only the tools provided by computer science that enable us to organize, monitor and propose advances in public management systems, but also multiple source renewable energy technologies, waste reuse, water reclaim, intelligent buildings, means of transportation that generate their own energy that are essential and interdependent.

Cities *per se* are territories that require a systemic approach. Integrated Management of Territory – IMT – the methodology that incorporates, among other variables, culture as a transversal element, is an applicable and useful tool in this context. IMT goal is to be inclusive, have focus in dilemmas and not only problems, enable the rise in peoples understanding of the territory and its inclusion in the globe, search for territory resilience in face of the imponderable and reachable sustainability.

Additionally, it is necessary to highlight new issues that cities confront, such as **increased immigration**, on which we still do not have enough experience to deal with culture clashes. Studies, observations and new propositions are necessary.

The complexity of the city, taking into account the variables involved in reaching sustainability, leads to many groups to propose the creation of the Science of Urbanization. Sustainability Science is confronted with problems of urban areas: Transdisciplinary research, science-policy dialogue, opportunities for innovation and old structural constraints, fragmented research agenda and climate change mitigation; urban Sustainability Science research needs to go beyond risk assessments of natural hazards and assess systemic risks from a social-ecological perspective.

Institutional assets and multi-stakeholders networks in Caribbean SIDS are considerably more robust and extended than what might be commonly assumed (community, national, sub-regional, regional, and international levels). Caribbean SIDS have attained a well-developed North-South collaboration on sustainability science, especially with North America and with several European countries.

Caribbean SIDS still present a large potential for South-South collaboration on sustainability science, in particular in relation to Pacific SIDS and SIDS from Africa, Indian Ocean, Mediterranean and South China Sea (AIMS). The experience of Caribbean SIDS contains valuable lessons in relation to the importance of communication for advancing sustainability science. Case studies related to sustainability science in Caribbean SIDS may inform the preparation of the **Guidelines of the project**, especially in relation to linkages with **SDG16** "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels".

Sustainability science involvement in different sectors

It is generally accepted that sustainability is achieved when we are able to balance the economic, environmental and social dimensions of life. The goal of this model is to safeguard the well-being and happiness of mankind, for the present generation as well as generations to come.

Unfortunately, the world we live in lacks this balance. Our present systems dictate that happiness and well-being are dependent on the size of economic development and growth. To promote and sustain economic growth, society has been urged to produce and consume more. This has been going on for decades. Consumerist mentality has become the order of the day. This has led to unsustainable economic activities, which in turn led to the depletion of natural resources, increased pollution, and broadening the rich-poor gap, all in the name of growth.

The post-2015 development agenda has seen 17 Sustainable Development Goals (SDGs) being adopted by the global community in 2015. Changes are taking place for the better, slowly but increasingly, testifying to the global commitment of sustainable development. Despite the progress, due to the complexity and inter-relatedness of the sustainability issues, tough challenges lie ahead. Governments need to think and organize themselves differently.

Education empowers women and men as well as develops new and relevant skills, which are essential to address the challenges of sustainable development. Science is important as it lays the foundation for new approaches and technologies to be identified to address future global challenges. It also provides answers that are testable and reproducible using scientific methods, which allows it to be used in informed decision-making.

In the context of sustainability, the science for sustainability or sustainability science should be “use-inspired”. The 2015 Harvard Public Opinion Project reported that 23 percent of young adults when asked to describe their view on climate change selected the choice: “Global warming is a theory that has not yet been proven.” It also reported that respondents doubt the ability of scientists to honestly report the data and trends they observe in the climate. This is despite the fact that scientists agree that climate change is happening and very likely is due to human activity.

Scientists nowadays not only have to be ethical, but must also be seen to be ethical in their conduct. This is because of the difference in the time frames of scientific discoveries and the policy community’s needs to make quick decisions.

Since the beginning of the new millennium, Universiti Sains Malaysia (USM) recognized the fact that it needs to change to remain relevant in the higher education arena. It began with a number of focused initiatives related to sustainability such as the Healthy Campus (Kampus Sejahtera) Programme (2000) and USM as a United Nations University Institute of Advanced Studies Regional Centre for Expertise for Education for Sustainable Development (RCE Penang, 2005).

One of the most significant activities was the 2005 extensive scenario planning exercise, which took into account the worldwide trend towards globalization and the need to address national aspirations for holistic and people focused development that would be environmentally sustainable and socially inclusive.
Almost a year later, following an extensive university-wide consultation, the scenario planning exercise identified and adopted the University in a Garden Scenario (2006) from a total list of six different scenarios. It was believed that this scenario will allow USM to respond best to the rapid democratization of knowledge, and the transition to knowledge based economies.

In 2008, USM was selected by the Ministry of Higher Education Malaysia as the only university in Malaysia to implement the Accelerated Programme for Excellence (APEX). APEX is a fast track development programme introduced to facilitate selected universities to raise its level of excellence. Under the APEX Programme, realizing the need to change and embrace sustainability as the new paradigm, USM has set its vision to be “Transforming higher education for a sustainable tomorrow.”

USM adopted the Blue Ocean Strategy as a tool to “realign itself in the transformation process to move into uncharted space and untapped markets” by focusing on radical resource efficiency, renewable energy, whole systems design, industrial ecology, nanotechnology, bio-innovation, poverty alleviation and peaceful coexistence.

The Centre for Global Sustainability Studies (CGSS) was established in 2009 to drive sustainability

related activities. CGSS led the development of the USM Sustainability Roadmap and Action Plan to ensure that the Sustainability Agenda in USM is on the right track.

USM has introduced many academic and research programmes that focus on building long-term sustainability science capacity building. One of the most notable postgraduate sustainability programmes in USM is the Masters in Sustainable Development Practice (MSDP). This is the USM's version of the Masters in Development Practice (MDP) Program coordinated by Columbia University, New York. It is a mixture of core courses from natural sciences and engineering, social sciences and arts, management sciences and health sciences.
The MSDP programme is a unique training aimed at cultivating sustainability practitioners who have the disciplinary depth but lack interdisciplinary coverage and indicators on skills required to be effective practitioners.

USM has also introduced other Postgraduate programmes such as the Master in Sustainable Cities and Communities offered by the School of Humanities, MBA in Sustainable Development offered by the Graduate School of Business, Master of Communication (Science and Environmental Journalism) offered by the School of Communication, M.Sc. in Environmental Science offered by the School of Distance Education, Master of Science in Environmental Engineering offered by the School of Civil Engineering, to name but a few.

USM introduced in 2011, a sustainability course, WSU101 - Sustainability: Issues, Challenges and Prospect as an elective. The first offering of WSU101 in 2011 attracted 127 students. It is now offered in 3 USM Campuses and the number of undergraduate students in USM Main Campus enrolled in this course for this semester is 482.

In 2014, USM established a high-level "University Sustainability Council" chaired by the Vice-Chancellor and with the membership that includes all four Deputy Vice-Chancellors, Heads, Directors and Deans of sections responsible for sustainability mainstreaming at the institutional level. All sustainability initiatives of USM is under the purview of this council.

The council headed the formulation of "USM Policy on Sustainability 2014". It identifies specific areas under WEHAB+3 that forms the focus for action, which is aligned to the national development needs, and global strategies for action. The policy provides specific guidelines to address core issues in four domains:

- **Teaching (formal, non-formal and informal education)**

Policy: Integrate sustainability into academic curriculum at all levels using all modalities of delivery. This is to ensure that necessary knowledge, skills, perspectives, value systems and issues are introduced and their relevance to the three pillars of sustainability is emphasized.

- **Research and Innovation (process, fundamental basic, action/applied and sustainability science research)**

Policy: Champion sustainability research activities that are trans-disciplinary and promote advanced innovative thinking, new knowledge creation and the ability to use and disseminate knowledge to find solutions to pressing sustainability challenges based on WEHAB +3 priorities.

- **University-community engagement (Industry, village, NGOs, Civil Society/non-state actors, business and policy communities)**

Policy: Promote knowledge/skill transfer programmes using ESD principles and practices to address community needs and challenges.

- **Institutional arrangements (utilities, infrastructure, transport, waste, and soft structures involving data, software and networks)**

Policy: Integrate sustainability into the core governance system of the university to create an innovative enabling environment within which the other components (Teaching, research and community engagement) operate efficiently.

USM has just completed APEX Phase 1 (Laying the foundation) and have moved on to APEX Phase 2 (2014 – 2025). Efforts are being accelerated to ensure that our quest for excellence will generate human capital with first class mentality to become a sustainability-led university of world-class standing.

Revolution and innovations in sustainability science and governance

Dealing successfully with social and climate changes on a worldwide level requires people to understand their own lives in a global context. With globalization, everyday actions operate within and generate new geographical conditions in which things that are spatially distant are no longer temporally isolated but are instead very close. Communication technologies allow information to be transmitted and exchanged in real time. Everyone is directly or indirectly part of a globalized geographic reality.

This new conditio humana, or human condition, requires people to have a more wide-reaching awareness of their own lives. It necessitates bridging the gap between local acts and global effects-because thinking globally and acting appropriately on a local level presuppose global understanding. The 2016 International Year of Global Understanding (IYGU), proclaimed by ICSU, ISSC and CIPSH at the WSSF in Durban, centers on the idea that the local and the global issues are intertwined in manifold ways. For a year, IYGU intends to foster research, education, and debate about both local and global processes, with the goal of developing a blueprint for a new geographical view of a radically changing world.

Environmental Impact Assessment (EIA) is a systematic inspection of the unintended consequences of a given project to reduce or mitigate the negative consequences and capitalize the positive ones. This imposes studying the environmental feasibility of the consequences that might disturb the environment, natural resources and/or human health. EIA can modify and improve the project design, ensure efficient resource use, enhance social equity, identify the measures for monitoring and managing environmental impacts and provide project sustainability. It seeks to justify that the sustainable development options are environmentally and economically sound; confronting any possible adverse environmental consequences early in the project cycle and setting plans to improve, minimize or compensate them.

EIA must be done prior to any activity or license initiation by the competent administrative authority. In the Egyptian legislations, projects which are subjected to EIA are identified according to their type of activity, extent of natural resource exploitation, location, quantity of production and type of energy used. The projects are screened into three main categories based on the severity of possible environmental adverse impacts: white, grey or black. The white list includes projects with minor environmental adverse impacts and is normally being approved on the basis of a simple environmental screening. The **grey list** includes projects with minor environmental adverse impacts and their applicants must carry out a more elaborate environmental screening. The **black list** includes projects with potential adverse impacts and requires a full EIA study. EIA activities include setting up of a database; evaluationation of how significant adverse impacts are, identification and evaluation of mitigation measures and alternatives, developing of a monitoring plan and preparation of an EIA report.

Determination of the significance of potential impacts on employment opportunities, noise, air emissions, traffic hindrances, waste management, land use, infrastructure, risks associated with industrial hazards. Diseases dissemination and socio-cultural settings should also be catered for in EIA. Distinguishing between positive and negative, direct and indirect, un-avoidable or irreversible, intended and non-intended, imminent and non-imminent consequence should be considered. Quantitative description of the adverse impacts in terms of environmental costs and benefits are useful. Impact analysis of industrial projects should be divided into constructional and operational impact analysis.

A management plan to mitigate or reduce significant negative impacts to acceptable levels should be set in place, including feasible cost-effective measures, together with a financial estimation of the

costs of adverse impacts, compensations to affected parties for impacts which cannot be mitigated. An inclusion of the measures for emergency response to accidental events, e.g. ruptures, leaks or tanker truck accidents, fires, explosions, should be described as appropriate. A management plan including proposed work protocols, budget estimates, maintenance schedule, staffing and training requirements and other necessary support services needed to implement the mitigating measures are a core part of EIA.

Some Egyptian Successful Stories are underlined:

- An efficient food project was implemented by multidisciplinary National Research Center (NRC) staff members in two villages at Nile Delta and the desert to transfer appropriate technologies for the sake of sustainable development. Most of the community members were very cautious and refused to participate in the project. Thereafter NRC offered incentives to those who will cooperate, few agreed and responded. The application of the new technologies at both villages achieved distinguished success that was witnessed by all the members of both local communities. The most pronounced result was increasing peanut yield from quarter Ardb/Feddan to 24 Ardb/Feddan (4200 m^2) due to the application of a new farming system, including nematode treatment. The next season most of the local community members participated in the project without incentives, just for the sake of reaching high production levels and attaining sustainable development.

- A National Biodiversity Strategy and Action Plan (NBSAP) were prepared till 2030 for the sustainable use of biodiversity in Egypt. This document was written by a scientific team using R&D inputs. The document was published by the Egyptian Environmental Affairs Agency (EEAA) in 2015 and financed by UNDP and GEF.

- EEAA in collaboration with GIZ prepared an annual report for solid waste management in Egypt (2013) using R&D tools to achieve the sustainable management of solid wastes in Egypt.

Co-designing the development, and future, of sustainability science

Sustainability science is needed now more than ever, with humanity facing unprecedented challenges that require researchers and policymakers to develop integrated, transformative solutions. With the adoption of the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change, the international community has affirmed the need to build more sustainable societies. Sustainability science has the potential to play a key role in this global effort, as an approach that integrates scientific disciplines, and builds links between science, policy and society.

The 2030 Agenda itself provides a strong example of how science can have a significant impact at the global policy level. The interdisciplinary scientific concept of "**planetary boundaries**" underlies the acknowledgement in this international agreement that the health of the planet is critical for long-term economic and social development, and that growth is possible within global limits.

Achieving the Sustainable Development Goals (SDGs) will require a strong scientific basis, and must be done through close collaboration between scientists and policymakers. This applies not only to the implementation, but also to the indicators and monitoring mechanisms that will measure progress. There are significant opportunities for sustainability science to contribute to this process through the co-design and co-production of research, and translation of scientific knowledge into policies and actions.

The ability of sustainability science to combine expertise across disciplinary, sectoral and geographical borders also has strong potential in the context of the 2030 Agenda. This can be seen in initiatives such as **Future Earth**, which connect scholars from across the world in partnership with the users of science, applying an integrated, solution-oriented approach to research on global change and sustainability.

Another important feature of sustainability science that must be applied and further developed is its ability to combine scientific knowledge with other knowledge systems, such as traditional and local knowledge, leading to a more inclusive and effective interface between science, policy and society.

We were asked to consider how the reflection within natural and social science on their increased societal relevance, and the dynamic relation between them, be better incorporated into emerging policies that integrate the science-policy-sustainability nexus?

The representative of the United Arab Emirates (UAE) announced the existence of an exclusive model of an academic program focused on sustainability science, in the Arab States, which is the Faculty of Sustainability Sciences and Humanities of the Zayed University and strengthened by the opportunity to develop a collaborative relationship in hosting and the organization of the second (regional) Symposium.

Key lessons learned and recommendations that emerged from the Inception Symposium:

- Essential to make sustainability science a tangible experience for professors and students;
- Bolder actions are needed to integrate sustainability into academic curricula at all levels;
- Champion sustainability research activities that are transdisciplinary and that prioritize innovative thinking and new knowledge;
- Conscious efforts to highlight the direct connection between EDS and three particular targets of the 2030 development agenda: targets 4.7; 13.3 and 12.8;
- The forthcoming regional symposium of this project should provide an opportunity to discuss the **cultural dimension of sustainability**;
- Making visible impacts on local actions for global sustainability;
- Invest in the bottom-up movements;
- Moving from knowing about sustainability to living sustainably;
- Promote global understanding that is relevant to sustainability science through:
    - Research: Bringing together the humanities, social and natural scientists;
    - Education: Bringing research results at all levels to the classrooms throughout the world;
    - Information: Utilization of print media, social networks, internet platforms and TV programs;
- Utilization of **Environmental Impact Assessment (EIA)** as a tool for achieving sustainable development;
- Involvement of National Commissions, UNESCO Chairs and ISPs;
- Value-addition of future work is the connection with the policy process and taking into consideration the regional differentiation;
- Recognize that human and ecological systems are dynamic and their inter-connectedness is always changing;
- The need for multiple approaches that are sensitive to cultural, geographical and historical diversity;
- The development of policies should be sensitive to the need for **broad-based participation of stakeholders**;
- Work toward strong partnerships from inception to implementation in the research process;
- Ensure institutional support for strengthening the linkages between research, policy and decision-making;
- Conscious engagement of the **arts and philosophy** are necessary to advance progress toward attainment of those goals.

Conclusion

Science is a human endeavor, which takes place in given cultural contexts; therefore, the Sustainability Science Project is sensitive to the current debate on the role and responsibility of science in different social, economic, environmental and cultural contexts.

The influential and clearly value-adding of the Symposium and the Project as a whole is strengthened

in that:

- Sustainability science is an issue of a **normative nature**: it is an approach that will allow capitalizing on research as a tool to solve problems. It will assist in tackling complex problems related to sustainability, from disaster risk reduction to food, water and energy security nexus, to societal decarbonized paths, by informing the design of integrated sectoral policies based on the best scientific knowledge available. Sustainability science can help us illustrate and categorize the crosscutting role of the sciences in the realization of the 2030 Agenda for Sustainable Development.

- Sustainability science provides us with the unique opportunity to translate the notion of **inter- and trans-disciplinarity to action** in the context of formal and non-formal education activities, with a focus on tertiary education. Sustainability science becomes a clear tool for implementing the Nagoya Plan of Action on Education for Sustainable Development.
- **Resilience and adaptation** are essential conditions in our quest for sustainability, and these must be informed by science and other knowledge. Sustainability science should address the challenges laid out in relevant international provisions complementary to the 2030 Agenda, namely the Paris Agreement on Climate Change and the Sendai Plan of Action on Disaster Risk Reduction.

The very positive close collaboration and synergistic work of the three UNESCO Sectors and Major Programmes involved: Natural Sciences, Social and Human Sciences, and Education are also praised.

The Symposium ended with some key questions:

- What kind of knowledge is needed to inform the 2030 Development Agenda?
- How can natural and social sciences engage in a dialogue with each other as well as with other relevant knowledge such as indigenous and local knowledge in producing the required knowledge basis?
- Can co-design of research questions based on the involvement of multiple stakeholders be scaled-up from local realities to address national and international challenges?
- How can the education sector adapt to promote inter- and trans-disciplinarity?
- What are the new institutional settings that may be required for mainstreaming knowledge on sustainability issues?

Annexes

- **Programme**

English
https://www.dropbox.com/home/SuS%20Inception%20Symposium%20Agenda?preview=UNESCO_SUS_1_1_Final_Agenda_E.pdf

French
https://www.dropbox.com/home/SuS%20Inception%20Symposium%20Agenda?preview=UNESCO_SUS_1_1_Final_Agenda_F.pdf

- **Presentations**

https://www.dropbox.com/sh/5bdxxhkvxlp07ra/AACdQwbiT8NyZYEeX7O3aMVla?dl=0

- **Photos**

https://www.dropbox.com/sh/geaxzn4jvwdk4ql/AACz7r-CzP5S1xEgjL7sbUm7a?dl=0