Integrated Knowledge Generation for Transformations towards Sustainability: A report from the 7th International Conference on Sustainability Science

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ABSTRACT

The implementation of Sustainable Development Goals, emphasizes the importance of increased stakeholder involvement. It highlights a new role for science – a role to identify problems and provide understanding, and contribute to answers and comprehensive solutions to pressing environmental challenges. Meeting this requirement, the 7th International Conference on Sustainability Science (ICSS) focused on new knowledge generation and integration to support the implementation of the Sustainable Development Goals (SDGs) and how this knowledge is implemented by society. The 7th ICSS was held in Stockholm, organized by the University of Tokyo Integrated Research System for Sustainability Science, Future Earth, and Stockholm Resilience Centre in 2017. It produced showcases and maps the sustainability science of the Future Earth community. Future Earth support politicians charged with implementing the SDGs by giving them a navigation tool for using the relevant sustainability science.

INTRODUCTION

The United Nations 17 Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity[*1]. The goals are interconnected and the key to success on one will involve tackling issues more commonly associated with another. Enabling the SDGs requires an interdisciplinary research to bring together natural and social sciences, as well as the humanities, engineering and law. This the target of **Future Earth**, an international research program launched at the United Nations Conference on Sustainable Development and the Planet Under Pressure conference in 2012 and comprising of thousands of scientists and innovators who design and produce research together with stakeholders from outside the scientific community. Future Earth consists five Global Hubs (Canada, France, Japan, Sweden, and the United States), and three Regional Centers (Asia, Middle East, and North Africa). These hubs coordinate the international efforts on topics from the air to the oceans and biodiversity to sustainable cities, organized workshops, and support conferences such as International Conference on Sustainability Science (ICSS).

This paper reports on the interdisciplinary and transdisciplinary presentations and discussion from the International Conferences on Sustainability Science (ICSS) held in Stockholm, Sweden, on August 24-26 2017 in the context of knowledge dissemination. The purpose of ICSS is to integrate and cooperate among diverse academic fields and across geographic and national borders with a particular focus on sustainability science. The

theme of ICSS 2017 was new knowledge generation and integration, challenges and solutions from local to global to support the Sustainable Development Goals. The conference was organized by Future Earth, the Stockholm Resilience Centre, and the University of Tokyo Integrated Research System for Sustainability Science and was attended by 258 participants from 38 nations. The conference was organized into two types of sessions: SDG Labs and Future Earth Knowledge Action Networks.

The SDG Labs

The purpose of the SDG Labs is to generate prototype solutions to complex problems, to encourage innovative ways to overcome lock-ins, and plant seeds of change with potential for transformative impact. "Prototype solutions" means innovations that can fundamentally change the systems that created the problem in the first place. The SDG Innovation Labs apply multi-stakeholder processes to catalyze transformation in institutions, systems and sectors of society, such as the global food system, international governance, inequality and poverty, or ecosystem services.

SDG Labs are based on the social innovation lab concept developed by Westley and colleagues at the University of Waterloo for the Rockefeller Foundation, and take influence from earlier lab concepts (Westley et al. 2012[*2]). Social Innovation Labs have been used around the world to catalyze change. Future Earth has further evolved the concept with the Stockholm Resilience Centre, and together funded 21 SDG Labs as part of the 2017 International Conference on Sustainability Science. There are many examples of proactive Labs: in Malaysia, a Lab fostered community involvement in a water management, called Water Warriors, using a concept called "heartware"; in Nigeria, a Lab engaged jobless youths in climate mitigation; in Norway, there are Urban Eco Labs; in Madrid, there is a Lab

for 'Collaborative Thinking for a Greener City; and in Lund, a Lab for Sustainable Beer Production.

Knowledge-Action Networks (KANs)

Knowledge-Action Networks (KANs) are structures for Future Earth approaches to research and related activities that respond to societal challenges. KANs build on the broad range and diverse specialist expertise represented in the large community of researchers and practitioners within the Future Earth structure, as well as endorsed and associated organizations, projects and individuals that want to join the Future Earth Open Network (Shrivastava et al. 2016[*3]). The objectives of KANs are to:

- Identify and respond to society's needs for scientific knowledge to successfully undertake the transformation to sustainability
- Generate integrated knowledge that is relevant to decision-makers
- Develop and cultivate research that is solution-driven, inter- and transdisciplinary
- Add value to research that is or has been carried out already

The main method of KANs is to facilitate high-quality actionable scientific knowledge through the integration of research and the involvement of societal partners, following the engagement guidelines of Future Earth.

The Future Earth committee is developing and launching KANs on more than 10 topics including Water-Energy-Food Nexus, Ocean, Sustainable Development Goals, Urban, Health, Transformations, Finance & Economics, Emergent Risks, and Decarbonisation.

SDG Knowledge Action Network (SDG KAN)

The purpose of SDG Knowledge Actions Network (SDG KAN) is to bring together scientific knowledge and the processes of the Future Earth community to implement and achieve the SDGs. It is based on methodological thinking and applies integrated, system-based, solution-oriented and multi-scale (local to global) approaches. Future Earth aims to enhance the contribution of research in helping to achieve the SDGs through:

- Connecting the international research community to the SDG policy interface;
- Identifying and solving cross-cutting and cross-scale SDG delivery challenges, addressing institutional problems and systemic constraints;
- Synthesizing and proposing pathways based on existing research;
- Mobilizing an interdisciplinary scientific group to derive data and information to support the SDGs;
- Identifying critical research and funding streams for the SDGs and stimulate projects in these fields.

Towards this end, SDG KAN is undertaking collaboration with International Institute for Applied Systems Analysis on The World in 2050 with the aim to provide tools that can help craft local, national and international policy.

The SDG Interactions Framework

The SDG Interaction Framework accommodates reversibility, directionality, strength and uncertainty. The framework is designed to support

policy-makers and policy analysts with implementing SDGs 2030 agenda to transform the world by tackling multiple societal challenges and ensure wellbeing, economic prosperity, and environmental protection. Managing the interactions between 17 SDG goals and 169 targets, to exploit synergies and minimize trade-offs will be crucial to success. David Griggs, of Monash University, Australia highlights that while the UN Secretary General described the SDGs as "an indivisible whole", the problem lies in the fact that everything from government departments to university faculties and international organizations operate in silos. Early studies undertaken with International Council for Science demonstrate that if countries ignore the overlaps and simply start trying to tick off targets one by one, they risk perverse outcomes. The SDG Interaction Framework overcomes this challenge by using a scoring system was devised utilizing a simple 7-point scale of the influence of one goal or target to another. Ranging from +3 as indivisible to -3 as cancelling, this framework provides a scoring for both synergies and trade-offs amongst goals and targets. Taking this into account, it is important to note that there are other dependencies that have to be taken into consideration when undertaking the scoring (Nilsson et al. 2016[*4]).

Urban Tinkering- with rural links

Cities are experiencing effects driven by climate change, and the extent to which cities will need to cope with these challenges will continue to increase. Innovative integration of gray, green and blue infrastructure can provide strategies to deal with growing urban vulnerabilities. Jacob (1977) pointed out that how evolution is proceeding distinctly differently from a process that is de novo designed and engineered[*5]. He labeled this evolutionary process, tinkering, being primarily based on modifying and molding existing traits and occasionally resulting in totally shifting func-

tions when conditions changed. This contrasts greatly to a designed and engineered process, which starts with tailor-made material and tools and always with a specific function in mind. Urban tinkering as an approach, have the potential for moving beyond conventional urban engineering by replacing predictability, linearity and design for one function, with anticipation of uncertainty and non-linearity and design for a potential of shifting and multiple functions. Ellika Hermansson Török, SwedBio, Stockholm Resilience Centre stressed the concept of Urban tinkering could be very useful in addressing many of the urban challenges ahead. For example, transformative changes in urban infrastructure generate multiple benefits including improving health conditions in urban areas.

Challenges and solutions from local to global scales

Health KAN and sustainable food systems

Health KAN Development Teams have the potential to combine global population growth, food consumption growth, and changing dietary habits and investigate the immense challenge for the global food systems to meet the increasing demand for food and equitably healthy diets for the decades to come (Godfray et al. 2010[*6]). A crucial question is how this can be achieved without undermining the Earth's resources and crossing planetary boundaries beyond which the future prospects for humanity may be threatened (Steffen et al. 2015[*7]). Andy Haines of London School of Hygiene & Tropical Medicine, UK views the challenges to and opportunities for the development of healthy and sustainable food systems from different angles. The emergence of new food, innovations and technologies and sustainable and healthy diets can take reference from India as an exemplar and food wastage and food conscious consumer behavior from Japan.

Transformation KAN, Global Transformations-Local struggles

The successful implementation of the SDGs must bridge global target setting and monitoring with local and regional processes that are often highly contested. Very important are efforts to transform the global distribution of resources and their social and ecological impacts. At the same time, ecological and social conditions at local scale must be taken seriously to achieve a successful implementation. Meanwhile, in many parts of the world networks of scholars and praxis partners exist that address these challenges from a local or regional perspective. Waddell, Networking Action (USA) and Ruhweza, conservational International (Kenya) suggested transdisciplinarity research and co-production of knowledge as the effective approach for sustainability transformations at global scale.

Future Earth complementary activities

Future Earth is realizing the theme of new knowledge generation and integration, challenges and solutions from local to global to support the SDGs through international projects. Two examples are given below.

Integrating Nature for Urban Sustainability, Montreal

The "Integrating Nature for Urban Sustainability" project in Montreal integrates biodiversity and natural ecosystems in urban design and planning and provides a example for cities around the world to mimic and can meet global targets for sustainability and human well-being. Deployed by a partnership between Future Earth Convention on Biological Diversity, Stockholm Resilience Centre, SwedBio and the Nature Conservancy,

International Council for Local Environmental Initiatives the first phase of an ambitious interdisciplinary project has been launched. The purpose is combine urban design and planning efforts with biodiversity. This is critical as natural ecosystems, often neglected by urban planners, play an integral role in human wellbeing and contribute greatly to the sustainability of cities. Rapid urban expansion poses risks to exceptional and unique biodiversity in many cities. It is estimated that by 2050, 70% of the world's population will live in urban areas and will rely on biodiversity and healthy ecosystems for many basic services. Forecasts suggest that more than two-thirds of all species threatened by urban expansion will be in countries with low levels of political stability or regulatory quality. Scientists are uncertain about how the loss of biodiversity will affect society in those regions.

Science communication and Living Labs network, Finland

Knowledge Actions Networks provide a perfect opportunity for scientists to become visible in society and influence societal development by ensuring scientific excellence of research questions. It allows researchers to bring to the SDG discussion wider perspectives, different time scales, and information about the background and interconnectivity of problems. This is evident by the Finnish Living Lab network for global change research. Using co-designed strategies, Living Labs redefined understanding of global change issues as phenomenon. Facilitate networking events, develop mutual understanding of stakeholder & researcher needs and viewpoints of the phenomenon. Consult pilot projects, consortium-building for specific funding calls and practical testing and improving of co-design and co-production. In these activities there is a strong focus on science communication and expectation for researchers to frame, contextualizing and analyzing events in nature and in society.

CONCLUSIONS

The ICSS 2017 conference "Sustainability and the SDGs – new approaches to knowledge generation challenges and solutions from local to global scales" brought together various stakeholders to address the challenges for implementing the SDGs. The conference goal was to analyze mechanisms for new knowledge generation and integration to support the Agenda 2030. The implementation of this agenda, particularly the Sustainable Development Goals, emphasizes the importance of increased stakeholder involvement. It also highlights a new role for science – a role that is not only to identify problems and provide understanding, but also to contribute to answers and comprehensive solutions to pressing environmental challenges. The process of generating integrated knowledge, often referred to as co-production of knowledge, is challenging since knowledge is generated through a combination of scientific perspectives with other relevant perspectives and lessons learned from real-world practices, including policy-making, administration, business and community life. Further, integrated knowledge generation has to include multiple scales, from local to global. For example it is important to identify how local solutions are impacted by drivers at regional and global scales and how multiple solutions at local scales may feedback to regional and global patterns and drivers.

FOOTNOTE

*1 http://www.undp.org/content/undp/en/home/sustainable-development-goals.html

*2 Westley F, Goebey S, and Robinson, K (2012) Change Lab/Design Lab for Social Innovation. Waterloo Institute of Social Innovation and Resilience.

http://sigeneration.ca/documents/Paper_FINAL_LabforSocialInnovation.pdf

*3 Shrivastava P, Raivio K, Kasuga F, Tewksbury J, Haines A, Daszak P (2016)

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https://doi.org/10.1186/s40985-016-0039-y.

*4 Nilsson M, Griggs D, Visbeck M (2016) Map the interactions between sustainable development goals. Nature 534: 320-322

*5 Jacob F (1977) Evolution and Tinkering Science 196: 1161–1166.

*6 Godfray HCJ, Beddington JR, Crute IR, Haddad L, Lawrence D, Muir JF, Pretty J, Robinson S, Thomas SM, Toulmin C (2010) Food security: the challenge of feeding 9 billion people. Science 327: 812-818. https://doi.org/10.1126/science.1185383

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チプタゲラの小水力発電について
～災害モジュール学生実習報告

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１．はじめに

災害に強いレジリエンス（回復力）のある社会システムやコミュニティを築くにはインフラの整備に加え、それを運用する仕組みが必要となる。災害モジュールでは Future Earth 研究として、小水力発電を核とした遠隔地域におけるコミュニティづくりを追求する調査を展開している。これに付随する形で、これまで災害モジュールでは、災害頻発地域であるインドネシアのジャワ島をフィールドに「持続可能な社会を拓く決断科学大学院プログラム」における学生実習を行ってきた。

当実習では年ごとの追跡調査を可能にするため、2016 年度からフィールドを西ジャワ州の Ciptagelar（チプタゲラ）村に固定して実習を行っている。チプタゲラ村は山岳地帯に位置し、インドネシア国営電力会社（ＰＬＮ）の電力が供給されない、遠隔地域の農村である。チプタゲラ村の住