Asian Perspective and Research Direction in Events Held by Future Earth, Taipei

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Background

Scientists in Taiwan have long participated in the Global Environmental Change Programs of International Council for Science (ICSU) such as International Geosphere-Biosphere Programme (IGBP), International Human Dimensions Programme on Global Environmental Change (IHDP), and Diversitas since 1990+. Despite of rich scientific findings coming out of these programs, the earth system now faces an unprecedented challenge of climate change and deterioration in environmental quality due to lacking of effective change in the energy systems and living styles in our society[1]. In order to provide the knowledge required for societies in the world to face risks posed by global environmental change and to seize opportunities in a transition to global sustainability, ICSU began a long visioning process to initiate a new scientific endeavor. Under the leadership of Immediate Past President Dr. Yuan T. Lee (a Taiwanese scientist, ICSU Presidential term 2011-2014), a new scientific programme, Future Earth, was launched in 2012.

Attributable to President Lee's strong support and advocacy, Taiwanese scientists have involved in the visioning and preparation processes of Future Earth since the very beginning. As one of the ICSU's National member, Academia Sinica (AS) has been actively taking part in these processes. In fact, Center for Sustainability Science (CSS) in AS has organized several events in different stages of Future Earth. To illustrate it clear in this presentation, we classified Future Earth in three different stages, namely visioning, preparation, and implementation stages. This presentation briefly introduces one event from each stage held by AS, which served for different purpose in each stage. Major conclusions coming out of these events are presented here. In addition, The National Committee of Future Earth, Academia Sinica, Taipei, for Future Earth (shorten as Future Earth, Taipei), has officially established in 2015 under AS. The Chair of the Future Earth, Taipei, is Academician CH Liu and the Executive Secretary of the committee is Dr. SCC Lung. Along with these events, scientists in Taiwan under the leadership of CSS in AS have been brainstorming potential ways of contributing to Future Earth in Asia based on the preceding foundation. This presentation also presents the idea of Regional Thematic Centers which potentially serves for the purpose of Future Earth which promotes transdisciplinary research emphasizing multidisciplinary, co-design, co-delivery, and solution-oriented scientific research.

Visioning Stage

Identifying regional research priority was the center of attention during the visioning stage. "Brainstorming Session on Future Asia" was held on 8, April 2013 in AS, Taipei, Taiwan, in this stage. AS invited fourteen key scientists from 5 countries in Asia, namely Australia, China, Japan, Malaysia, and Taiwan, as well as ICSU's representative Dr. Steven Wilson, to participate in this brainstorming session. The main focus was to discuss priority research directions which should be carried out in Asia with co-design, co-delivery, and solution-oriented scientific research.

After intensive discussion, five research themes were identified, i.e. coastal zones, urbanization, population, energy, and core value, with reasons described below. Since Asia has long coastal lines threaten by sea-level-rise and Asian population densities along the coastal zones are high, research on "coastal zones" is important to tackle of threat of climate change on Asian society. Moreover, the trend of urbanization in Asia in recent years and the challenges along with urbanization (pollution, health, etc) put emphasis on the importance of urbanization research. The vast population number, high population density, and skewed population profile (low birth rate) in certain Asian countries also point out the urgency of population-related studies. Furthermore, the root cause of global climate change is fossil fuel; Asian countries need to find solutions on alternative energy sources considering our own economic development and natural resources. Finally, Asian countries with long history and diverse culture may need to revisit our own ancient wisdom to find "core value" in Asian society to search for an alternative development pathway rather than repeating the resource-intensive pathway of western-style development. These five priority areas identified

were further disseminated in follow-up brainstorming activities held in Asia and in the global level of Future Earth.

Preparation Stage

In the preparation stage of Future Earth, how to carry out effective research networking under Future Earth was a main concern. Since Asia covers a vast geographic area, it is difficult for one Regional Office alone to carry out all the tasks of Future Earth networking. Thus, it was needed to discuss other complement mechanisms. AS organized a meeting, "Future Earth in Asia: Regional Networking Brainstorming Meeting", on October 1, 2014 in AS, Taipei, Taiwan in order to identify potential regional networking structures under Future Earth in Asia. Fifteen key players in Future Earth in Asia from 6 countries, Australia, Korea, India, Japan, Malaysia, and Taiwan were invited to participate. The focus of this meeting was the potential networking mechanisms.

It was stressed in the meeting that our expectations for networking structure of Future Earth in Asia have four aspects. First, it should be able to assist in promoting multidisciplinary research on dynamic Asia, Asian development, and transformation to Asian sustainability which has been identified by Future Earth as three research foci. Secondly, it should help Asian scientists to initiate processes for co-design, co-production, and co-delivery within each country. Thirdly, it should be able to facilitate domestic funding for solution-oriented cross-disciplinary projects. And fourthly, it should have a strong component focusing on regional capacity building to cultivate young generation of scientists to engage in the multidisciplinary, co-design, co-delivery, and solution-oriented scientific research.

After intensive discussion, it was concluded that a Regional Office in Asia is essential to serve as a regional hub for Future Earth activities. In addition, Regional Thematic Centers may be good complements to promote Future Earth activities in the enormous vast Asian areas. There are several potential advantages of such centers. First, regional thematic centers located in one country could bring out the local expertise in that country. It could serve as a networking platform of domestic and international scientists under the umbrella of Future Earth to carry out transdisciplinary research. Secondly, it is easier to raise domestic funding to support research activities and networking via such centers. Thirdly, such Regional Thematic Centers could focus on regional capacity building. The idea of establishing regional thematic centers has been further presented and discussed in several meetings Future Earth Regional Office in Asia held afterwards.

Implementation Stage

After the establishment of Future Earth, United Nations also announce Sustainability Development Goals (SDGs) (Fig. 1). Thus, Future Earth community begins to discuss the possible contribution of scientific research on reaching the SDGs. Recently, AS organized an event to further promote Future Earth and explore ways to reaching these SDGs. Since previous research priority brainstorming meetings covered a lot of different disciplines, we would like to be more focus on certain common, important, and urgent problems Asia countries all face. The first problem identified is air pollution. Therefore, "Future Earth Asian Perspective Symposium on Air Pollution Transdisciplinary Collaboration" was held on February 29 & March 1, 2016, in AS, Taipei, Taiwan with the aim to establish air pollution transdisciplinary collaboration under the framework of Future Earth in Asia for sustainable development of Asian countries. It was sponsored by the Ministry of Science and Technology, Executive Yuan and co-organized by CSS, AS; Research Center for Environmental Changes, AS; and Future Earth, Taipei. The main local organizers were Academician Dr. Chao Han LIU, Dr. Pao K. WANG, and Dr. Shih-Chun Candice LUNG.

During this event, it was emphasized that air pollution is getting worse (Fig. 2) in spite of the scientific publications in Asia focusing on air pollution is increasing (Fig. 3). Therefore, new type of air pollution research needs to take place, i.e. air pollution transdisciplinary collaboration. It was identified that air pollution transdisciplinary collaboration could include scientists in environmental sciences, medical sciences and public health, engineering, sociology, education, history, media, public policy science, energy engineering, urban design/urban planning (focus on transport), information technology people, and lawyers or who knows better political governances. And out of SDBs (Fig. 1), 3. good health & well-being, 4. quality education, 7. affordable and clean energy, 9. industry, innovation and infrastructure, 11. sustainable cities and communities, 12. responsible consumption and production, 13.

climate action, and 17. partnerships for the goals could be reached under such collaborations.

Potential mechanisms to contribute to Future Earth in Asia

During the participation of Future Earth visioning, preparation, and implementation stages, Taiwanese scientists led by AS have been thinking about potential ways to contribute to Future Earth in Asia. Establishing a regional thematic center is one of the options. This thematic center should be built on existing organization to avoid repetition. There are several key functions of this thematic center, a. engage stakeholders, b. accumulate knowledge and effective practices of "co-design, co-production and co-delivery", c. coordinate research and serve as a domestic platform for scientific knowledge synthesis, d. share experience regionally and internationally, and e. support capacity building domestically and regionally.

For example, AS may establish a regional thematic center, Co-benefit Strategy for Sustainable Living (tentative title), to promote sustainability science in Asia. The aim is to identify co-benefit strategy to meet SDGs considering Asian distinct characteristics. In the past, Taiwanese scientists have participated in IGBP, IHDP, and Diversitas for various global environmental change studies. However, as shown in Fig. 4, the research was conducted by individual researchers whom were supported by the funding from National Science Council (NSC, later changed to Ministry of Science of Technology, MOST). The major findings of these global environmental change researches may be provided to National Sustainability Development Plan via individual scientists. There were no official channels to facilitate interaction among different research teams and between research teams and stakeholders (in this case, central or local governments). As Future Earth promoting co-design, co-production, and co-delivery during the research formulation and production, a new structure has to establish in order to carry out new type of transdisciplinary research.

Based on the foundation of global environmental change researches in the past 20+ years, currently, the sustainability research sponsored by the MOST including topics in land resources, water resources, ecosystem service management, urbanization and climate change, climate change and health adaptation, climate change and disaster risk management, and land-sea interaction and coast zone. In addition to those, AS also allocates certain funding to support sustainability research including earth system studies, climate change modeling, adaptation, climate change and health, natural hazards and disaster risk reduction, energy security, food security and agricultural policy, green economy models, governance models related to sustainable development policies, and population and aging society. Nevertheless, under the old structure (Figure 4), these research works do not fit with the requirement of co-design, co-production, and co-delivery promoted by Future Earth. Thus, a new structure is conceptualized as in Figure 5. A thematic center could serve as a platform for interaction among different research teams of different disciplines, among researchers and stakeholders, and among domestic and international scientists, and between Future Earth Regional Office in Asia and local scientific communities. Not only it can engage stakeholders but also accumulate knowledge and effective practices of "co-design, co-production and co-delivery". Thus, it can coordinate research and serve as a domestic platform for scientific knowledge synthesis and also share experience regionally and internationally. In addition, it can support capacity building domestically and regionally in order to cultivate young generation of scientists for transdisciplinary research. This thematic center can carry out regional capacity building programs such as sponsoring visiting scholars, planning training workshops, and organizing symposiums and conferences to promote Future Earth activities.

Conclusion

Built on long-term participation of global environmental change programs and Future Earth, Future Earth, Taipei is prepared to lead Taiwanese scientists to engage in transdisciplinary research. We are eager to participate in activities organized by Future Earth Regional Office in Asia. Most importantly, we would like to actively contribute to Future Earth by establishing a thematic center as a platform linking scientific community and stakeholders domestically, regionally, and globally.

Reference

1. W. Steffen, K. Richardson, J. Rockström[1], S. E. Cornell, I. Fetzer, E. M. Bennett, R. Biggs, S. R. Carpenter, W. de Vries, C. A. de Wit, C. Folke, D. Gerten, J. Heinke, G. M. Mace, L. M. Persson, V. Ramanathan, B. Reyers and S, Sorlin, Planetary boundaries: Guiding human development on a changing planet, 2015 *Science*,, DOI: 10.1126/science 1259855

Fig. 1. Seventeen Sustainable Development Goals (SDGs) [UN, 2015] https://sustainabledevelopment.un.org/?page=view&nr=1021&type=230&menu=2059

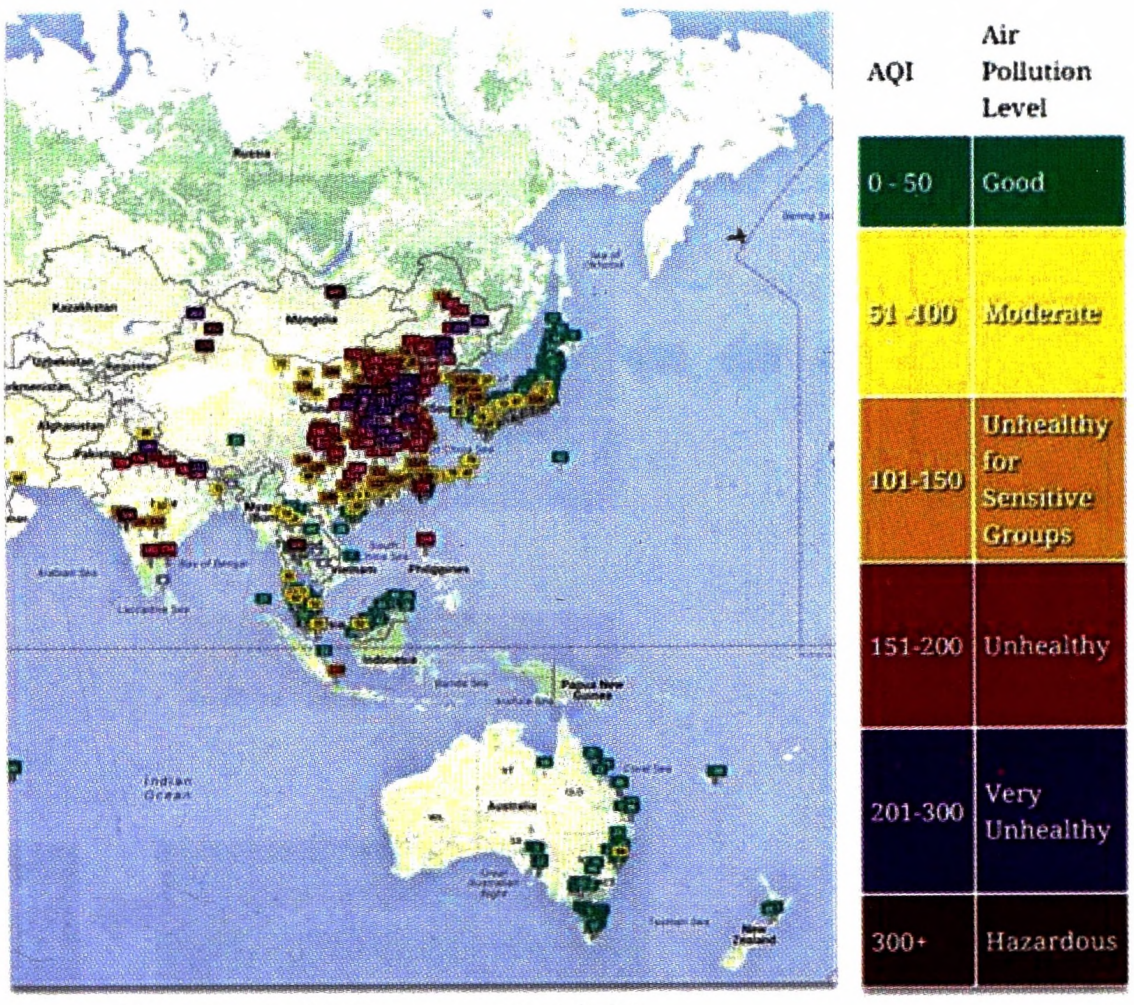

Fig. 2. Air Quality Index (AQI) presented from a social enterprise project, collaboration of scientists, agencies and NGOs

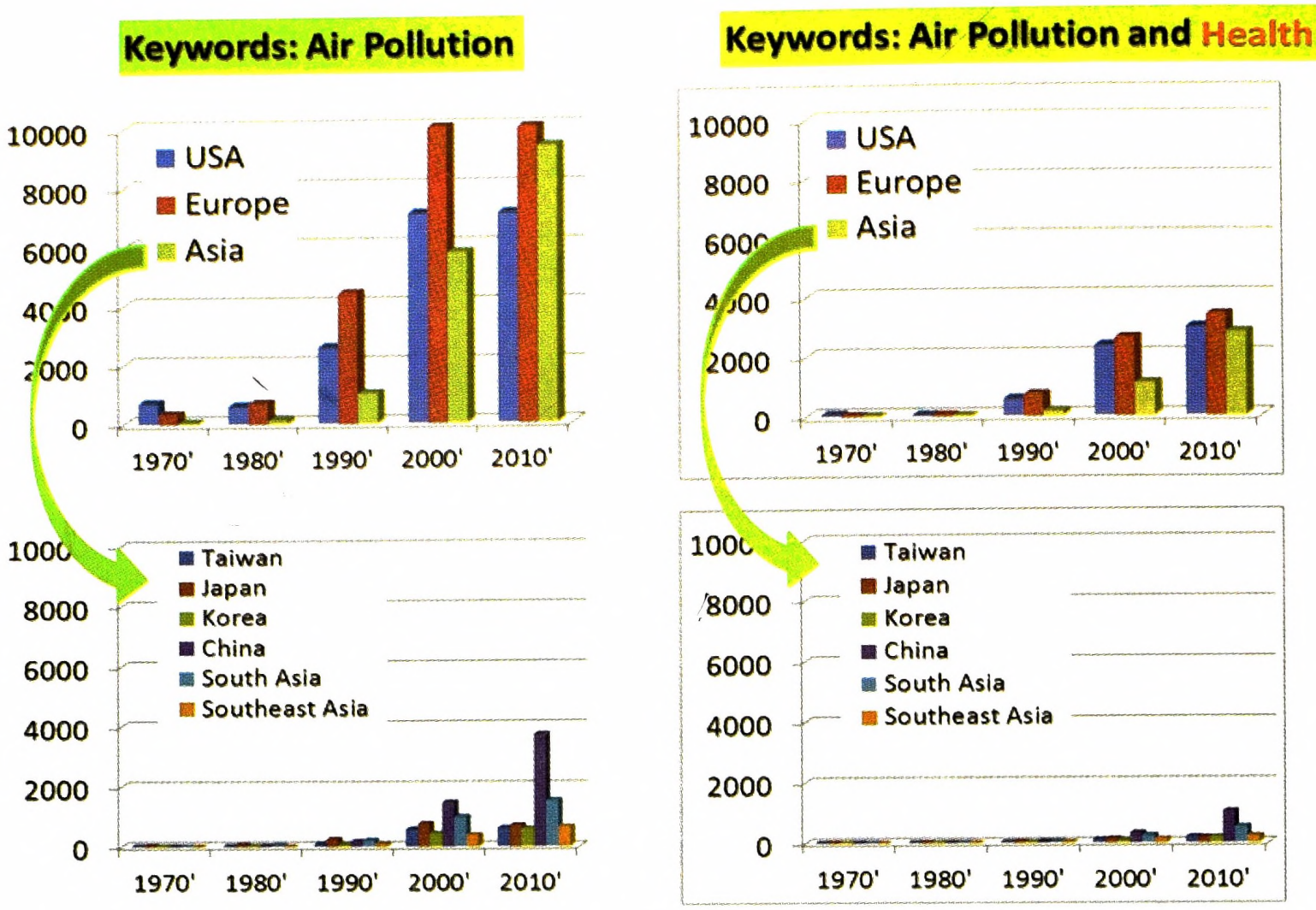

Fig. 3. Numbers of publications focusing on air pollution (left panel) and air pollution and health (right panel)

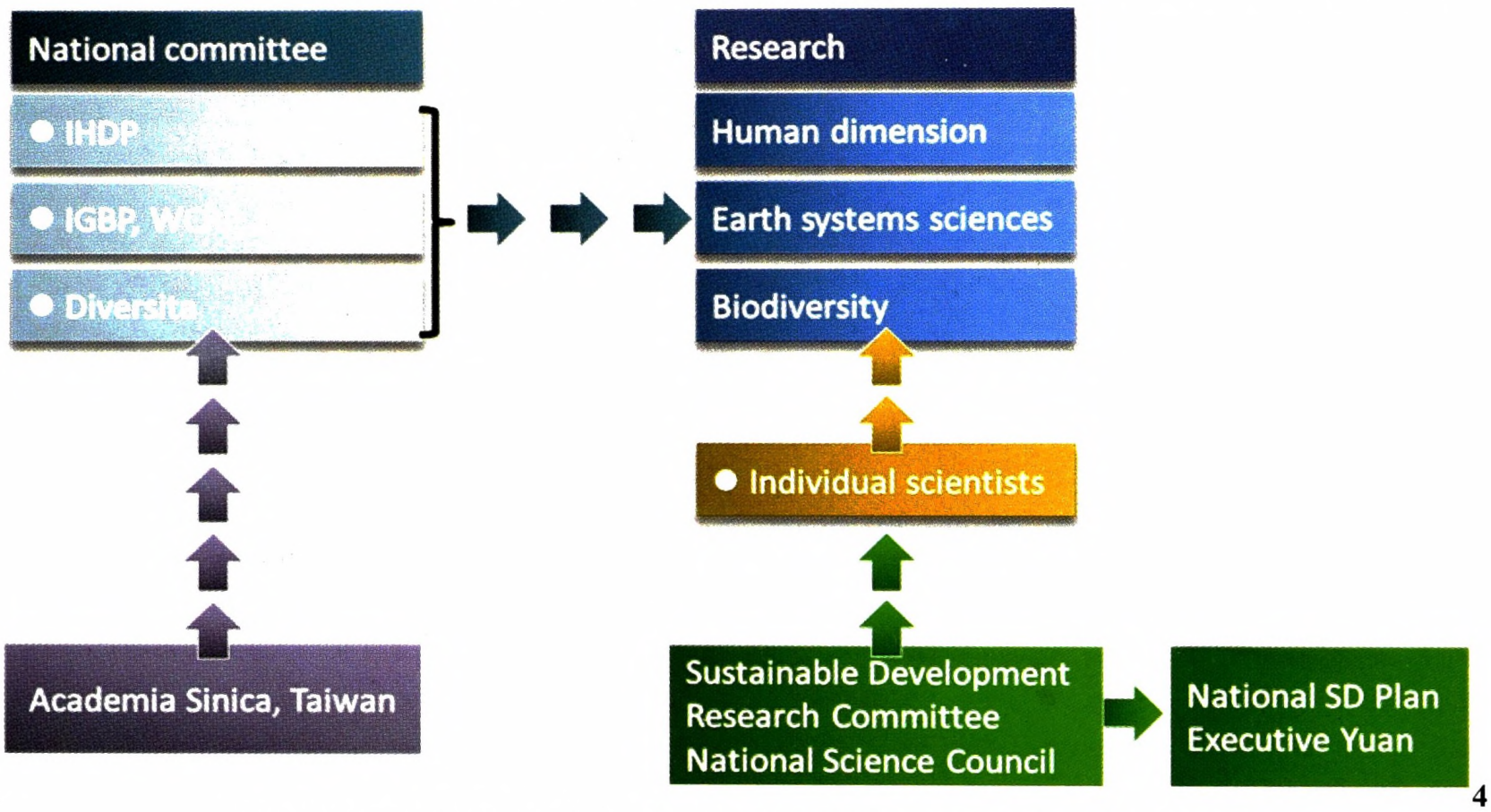

Fig. 4. Past structure of Global Environmental Change researches in Taiwan

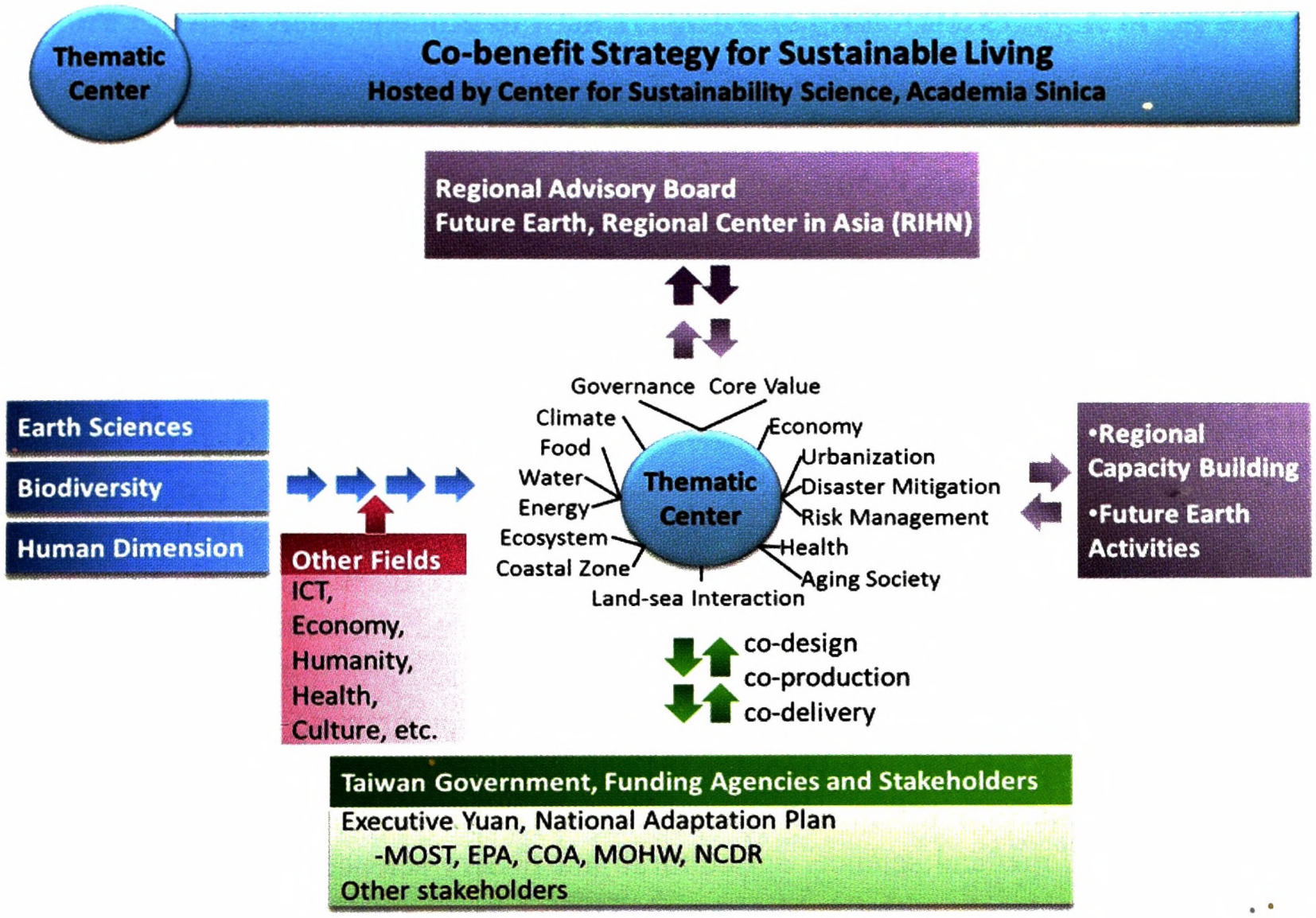

Fig. 5. New Structure Conceptualized for Transdisciplinary Research Emphasized in Multidisciplinary, Co-Design, Co-Delivery, and Solution-Oriented Research