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Humanosphere Potentiality Index

Many of the so-called developed countries have narrowly set production and increased productivity as societal goals. Under this production-centric worldview, per capita GDP (or GNP) has long been a *de facto* indicator of the wealth of citizens even though numerous problems have been pointed out.[1] Since the beginning of the 1990s, various organizations have become engaged in efforts to develop indices to take the place of GDP and to evaluate the state of the world from the standpoint of new concepts such as 'sustainability' or 'human development'. However, no index has been developed that attempts to place human activities within the context of global atmospheric-hydrological circulation or the capacities of the world's diverse life forms.

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RESPONDING TO THE CURRENT TREND of developing indices and concerned with how to read the state of the world, we have developed a Humanosphere Potentiality Index (HPI), with the aim of addressing the present and future welfare of human societies within a broader context of environmental sustainability. This perspective is derived from the concept of the 'humanosphere', as explained in the introduction of this focus issue, and expresses our dissatisfaction with the limits of measuring the status of human societies through the Human Development Index (HDI).

Humanosphere: an analytical framework to assess humanosphere potentiality

The humanosphere is chronologically made up of three spheres: the geosphere, biosphere and human society. These three spheres have historically interacted with each other and inform our current place in the world, and possess their own inherent logics. The geosphere in terms of 'circulation', the biosphere in terms of 'diversity' and human societies in terms of 'autonomy and empathy' (fig. 1). In working towards a sustainable humanosphere, we believe it is important for human societies to acknowledge two fundamental points: that human societies have developed through their interactions with both the geosphere and biosphere; and that there is a need to *reconstruct our relationships* with them by understanding how their logics influence the sustainable development of human societies.

For the sustainable development of our societies, we need to reconstruct our relationships with the three spheres with respect to their inherent logics.

Our strategic intention has been to offer an alternative to HDI. In 1990, the UNDP announced HDI with the intention to offer an alternative to GDP (GNP) . The index was founded on a theory known as the capability approach – what individuals are capable of – advocated by the economist Amartya K. Sen. HDI is the outcome of a calculation that involves simply averaging three functions of human development: capabilities in health, education and income. We offer a different viewpoint to HDI. HPI is neither a simple attempt to reverse the view of the world as seen through HDI, nor is it merely an 'additional perspective'. Rather, HPI attempts to evaluate the potentiality of the geosphere, biosphere and human societies to support our livelihood through a clearly defined logical framework. As a result, we are expanding the viewpoint of HDI.

If we consider HDI from the perspective of HPI we see that its focus is on an evaluation of the 'autonomic' achievement of 'better' livelihood. HDI is also founded on the idea that it is crucial for individuals to be able to gain access to fundamental services (health, education and income) and collectively create and pursue value in their own lives. The HPI extends the perspective of evaluation to include the potential for sustainable development. This approach was adopted to consider care practices of human societies and their fundamental ability to empathize. Ultimately, it makes an evaluation which acknowledges the core logics of circulation in the geosphere and diversity in the biosphere. As we will show, through considering HDI from this expanded perspective and based on the layered logics, unexpected correlations and differing viewpoints become apparent.

Calculating the Humanosphere Potentiality Index (HPI)

Through a research project that has run for over five years, a team of researchers working in Asia and Africa created the components of HPI (fig. 2). We created nine indices that are expressed as a three by three index to include potentiality indicators, availability indicators, and disturbance indicators in each sphere. Our potentiality indicator refers to the quantitative scale that each sphere possesses, while the availability indicator attempts to present the 'proper' relationships of the elements that compose each sphere. These two indicators are expressed using the value per unit of land area. The disturbance indicator presents human-induced negative effects that arise in the two spheres. We subtract this to adjust the potentiality of each sphere, keeping modern human society in mind. As such, the disturbance indicators are expressed using value per capita, and not value per unit of land area.

To represent the geosphere, we chose three indicators: solar energy, an atmospheric-hydrological circulation index (as a potentiality and availability indicator), and CO2 emissions to express the logic of circulation, which all have established accessible datasets.[2] Likewise, for the biosphere biomass, the biodiversity index and human appropriated net primary production (HANPP)[3] were included to express relations. Biomass is represented by forest biomass per unit area[4] because forests account for almost 90% of the total plant biomass in the world.[5] The biodiversity index estimates the biodiversity of terrestrial ecosystems based on the numbers of species of vascular plants, amphibians, reptiles, birds and mammals.[6] HANPP as a disturbance indicator explains the per capita appropriation of the net primary production of human activities.[7]

To create an index for human society, we adopted population, care relations and total unexpected deaths. These indicators reflect the idea that there are two fundamental logics that characterize human society, namely autonomy and empathy that form a basis to make possible care relations. We chose population[8] as a potentiality indicator as all human societies show tolerance and consideration towards each other. As such, population sizes represent the potential magnitudes of care relations. We have calculated care relations through two elements: the first one is the sharing of abodes,[9] which expresses potential care access in the household, and the female-to-male ratio, which expresses fundamental gender equality in household care relations.[10] Total unexpected deaths are the sum of the number of deaths resulting from the actions of the geosphere (disasters),[11] biosphere (infectious disease),[12] and human society (intentional injuries).[13]

In each sphere, the three figures that express potentiality, availability and disturbance are integrated into a composite index, creating a simple average of three indicators. The HPI is an integrated index averaging these three indices.

Humanosphere Potentiality Index (HPI) and the Human Development Index (HDI)

Figure 3 is a representation of the world from the perspective of HPI. Those countries that have a higher HPI value possess a higher potentiality of sustainable development than countries with lower scores. It shows that the indices for the tropical zones of South East Asia and Latin America are as high as those of South Asia, Central Africa and parts of the Middle East. In the countries with the highest HPI figures, the human society index is above average, in addition to the fact that the

Fig. 1: The logic of the three spheres

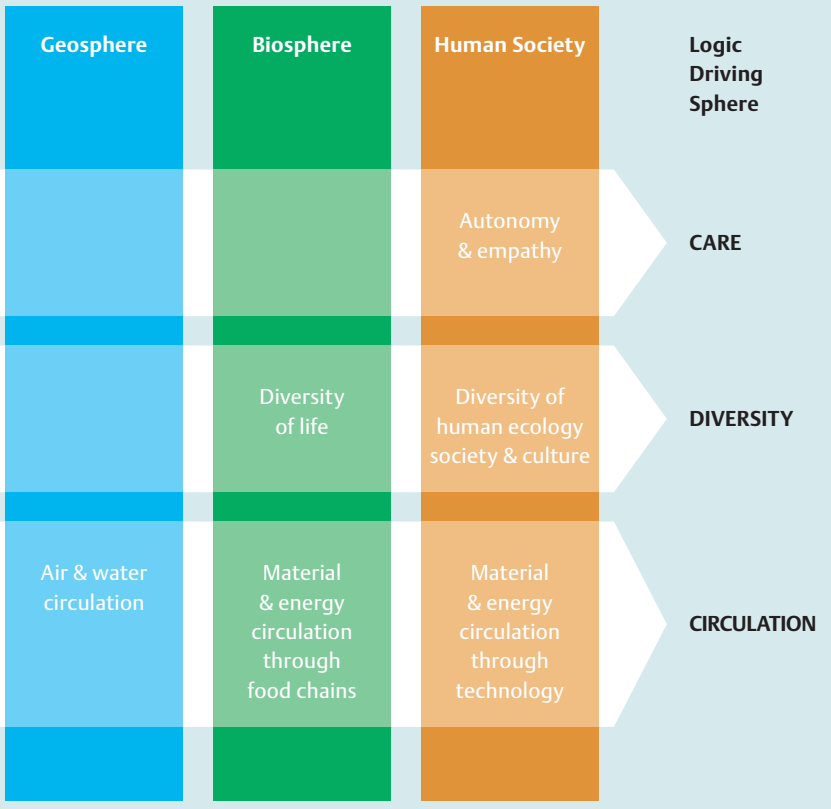
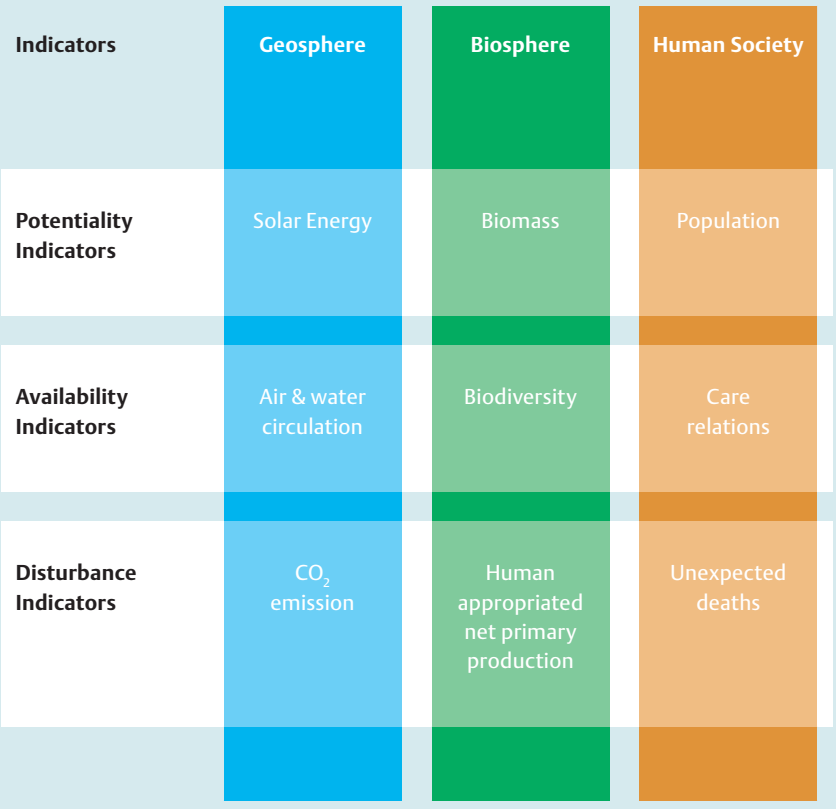


Fig. 2: Structure of the Humanosphere Potentiality Index



Understanding the sustainability of geosphere, biosphere and human society

indices for the geosphere and biosphere are also generally high. The human society index is the primary contributor to the high figures of HPI in certain Middle Eastern countries.

Figure 4 shows the world as viewed through HDI. Following HDI for 2005, Sub-Saharan African, South Asian and South East Asian countries are ranked low, while North America, Western Europe, Japan, Korea, Australia and New Zealand – which all display high economic development, long average life expectancy and long schooling years – are ranked high.

Comparing the two figures, there is a visible gap between our HPI and the HDI. In order to examine the relationship between these two indices through categorizing the world (115 countries) into temperate zones (60 countries) and tropical zones (55 countries), let us demonstrate the correlations that exist between HDI in 2005 and HPI (fig. 5). It is clear that there is a significant negative correlation between the two indices across the whole world. Nonetheless, when examining the correlation between HDI and HPI in both tropical and temperate zones, it becomes apparent that tropical zones show a significant positive correlation while the temperate zones indicate a negative correlation significant at the 0.01 level. To put it in plain terms, there are entirely converse correlations evident in these two zones. What does this difference signify? Firstly, with tropical zones – with a positive correlation between the HDI and HPI – we see that amongst the three composite indices there is a strong correlation between the biosphere composite index and the HDI ($r = 0.491^{**}$).[14] And when examining the constituent components individually, it becomes clear that the tropical areas with high HDI are areas that possess an abundance of biomass (0.351^{**}) and biodiversity (0.338^{**}); enough atmospheric-hydrological circulation (0.357^{**}); and produce less CO2 emissions (0.609^{**}). The Millennium Ecosystem Assessment, conducted by the United Nations from 2001 to 2005, employed the concept of 'ecosystem services', and the connection between the ecosystem and our well-being was evaluated.[15] The central component of this concept refers to the benefits that we obtain from ecosystems, including such benefits as provisioning services, regulating services, cultural services, and supporting services. The correlation observed between HDI and the constituent components of HPI in the tropical zones reflect these connections described as ecosystem services between the natural environment and human society.

Secondly, the temperate zones demonstrate a vivid negative correlation between HPI and HDI. Among the constituent components of HPI, the negative correlation between the geosphere (-0.582^{**}), the biosphere composite indices (-0.241^{**}) and HDI is significant. Examining the specific components of the composite index individually, the areas of temperate zones that demonstrate a high score of HDI also possess the characteristics of weak solar energy (-0.517^{**}), a low evaluation in biodiversity (-0.250^{*}), high atmospheric-hydrological circulation (0.426^{**}) and an abundance of biomass (0.399^{**}). The zones also have tendencies to display high CO2 emissions (0.612^{**}) and a high HANPP (0.386^{**}), which is indicative of high levels of disturbance in both the geosphere and biosphere.

There is a synchronizing elevated tendency between HPI and HDI in tropical zones but, its disappearance in temperate ones is an interesting finding. Nonetheless, we see a clearly observed correlation in countries between HDI and CO2 emissions in both tropical and temperate zones. Fundamentally, this means that the countries that have achieved a high level on HDI *have been contributing to the deterioration of the environment regardless of where the country is located.*

In search of a sustainable humanosphere

The aim of our work has been to construct and propose the establishment of HPI through the critical incorporation of existing indices such as HDI and others. The most central characteristic of HPI is that it offers a positive evaluation of tropical zones, such as Southeast Asia, where some of the world's richest ecosystems lie. By comparing HDI and HPI, it becomes clear that the evaluation reached for tropical zones stands out in stark contrast. This is derived from a difference of perspective in respective evaluations: HDI evaluates three dimensions that include health, education and income, with a focus on an 'autonomous' achievement of 'better' livelihood (i.e., human development) – while HPI focuses on values for livelihood that incorporate circulation and diversity, autonomy and empathy. With increased material prosperity, we tend to think that countries in the temperate zones, including Western nations and Japan, lead a life of abundance whereas the tropical countries located in South East Asia and Africa, exist in poverty. However, such an ingrained belief can be questioned by asking in what sense do we really have 'satisfying' lives? Will such lives ensure our livelihoods with sustainability? Our HPI casts this into question.

Our index provides only a snapshot of how things have progressed so far. We cannot predict any trend in the decrease of forested areas and we cannot propose or evaluate ideal technologies or specific structures for institutions in different regions to deal with changes. As such, HPI has its limitations in that ultimately, it is a crude index. However, what it enables us to do is to provide an *indication* of the world's current situation in a much more comprehensive manner by presenting an agenda that is neither included nor addressed by HDI.

The HPI underlines the crucial message that we must pay much more attention not only to development but also to our 'potentiality' from the perspective of the humanosphere, in order to promote a sustainable livelihood for all human societies. Ultimately, the world viewed through an index such as HPI, offers us a perspective that makes us rethink human development from within a much broader and deeper context, that of the 'sustainable humanosphere.'

Takahiro Sato, Team Leader of this project, Crop and Environmental Sciences Division, International Rice Research Institute (IRRI) (T.Sato@irri.org); Taizo Wada, Center for Southeast Asian Studies, Kyoto University (taizo@cseas.kyoto-u.ac.jp); Shiro Sato, Faculty of International Communication, Osaka International University (s-sato@oiu.jp); Nishi Makoto, Global Survivability Studies Unit, Kyoto University (nishi.makoto@gmail.com); Watanabe Kazuo, Research Institute for Humanity and Nature (RIHN) (isseiw@chikyu.ac.jp)

Notes

1 Stiglitz, J.E., Sen, A. & J.P. Fitoussi. 2010. *Mismeasuring Our Lives: Why GDP Doesn't Add Up: The Report by the Commission on the Measurement of Economic Performance and Social Progress.* New York: The New Press; United Nations Development Programme (UNDP). 1990. *Human Development Report 1990.* New York: Oxford University Press.

2 Data on solar energy was expressed by the net radiation flux coming down to the earth. National Aeronautics and Space Administration (NASA). 1999. 'ERBS total net radiation from Nasa ERBE (Earth Radiation Budget Experiment)'. http://tinyurl.com/lj5h34v (Last retrieved 8 October 2013) For the atmospheric-hydrological circulation index, the qualitative indicator of the geosphere was calculated by subtracting annual actual evapotranspiration (FAO, 2009) from annual precipitation (FAO, 2000) and we also selected CO2 emissions per capita (WRI, 2012). Food and Agriculture Organization of the United Nations (FAO). 2000. 'Global Map of Monthly Precipitation – 10 Arc Minutes'; Food and Agriculture Organization of the United Nations (FAO). 2009. 'Global Map of Yearly Actual Evapotranspiration – 5 arc minutes'. http://tinyurl.com/kdlxyve (last retrieved 23 February 2012); World Resource Institute (WRI). 2012. 'CO2 Emission per Capita'. http://tinyurl.com/p3tejse (last retrieved 1 December 2012)

3 HANPP, through the consumption of food, paper, wood and fiber, alters the composition of the atmosphere, levels of biodiversity, energy flows within food webs and the provisioning of important ecosystem services.

4 Food and Agriculture Organization of the United Nations (FAO). 2010. *Global Forest Resources Assessment 2010* (FRA 2010). Rome: FAO. http://tinyurl.com/kdlxyve (last retrieved 23 February 2012)

5 Whittaker, R.H. & G.E. Likens. 1973. 'Primary Production: The Biosphere and Man', *Human Ecology* 1:357-369.

6 Groombridge, B. & M.D. Jenkins. 2002. *World Atlas of Biodiversity: Earth's Living Resources in the 21st Century.* Barkley and Los Angeles, California: University of California Press.

7 Imhoff, M.L., et al. 2004. 'Global Patterns in Human Consumption of Net Primary Production', *Nature* 429 (24):870-873.

8 United Nations (UN). 2011. *World Population Prospects, the 2010 Revision.* http://tinyurl.com/3qrc4g2 (last retrieved 28 January 2013)

9 Worldmapper Team. 2011. http://tinyurl.com/pxq8p6a (last retrieved 5 December 2011)

10 U.N. 2011. ibid.

11 What we mean here is the annual average death toll that occurs from earthquakes, tsunamis, volcanic eruptions, storms and wet/dry mass movement from 1980 to 2011. See: International disaster database Center for Research on the Epidemiology of Disasters (CRED). 2011. http://www.emdat.be (last retrieved 5 February 2011)

12 WHO. 2004. Mortality rate from HIV/AIDS, Malaria and Tuberculosis. See *The Global Burden of Disease: Disease and Injury Country Estimates.* http://tinyurl.com/cq6yhx (last retrieved 7 June 2011)

13 See WHO. 2004. ibid., for mortality rate from conflicts, homicide and suicides.

14 ** and * indicate the level of significance correlation with 1% and 5%, respectively.

15 See Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Synthesis.* Washington: Island Press.

Fig. 3: Humanosphere Potentiality Index

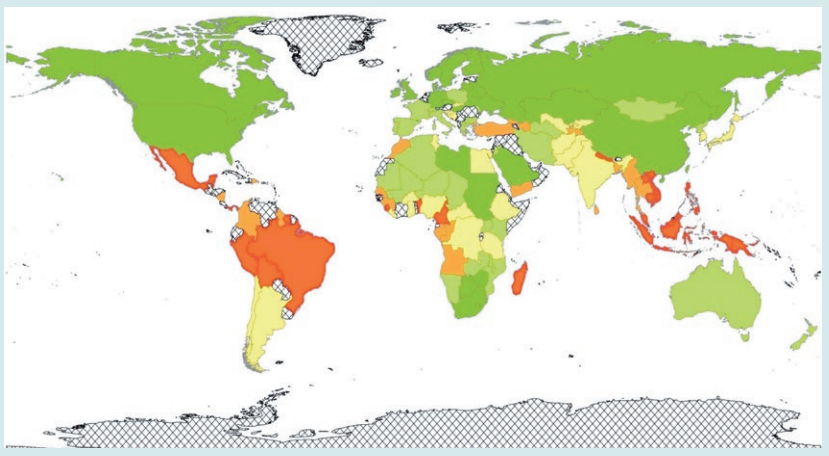
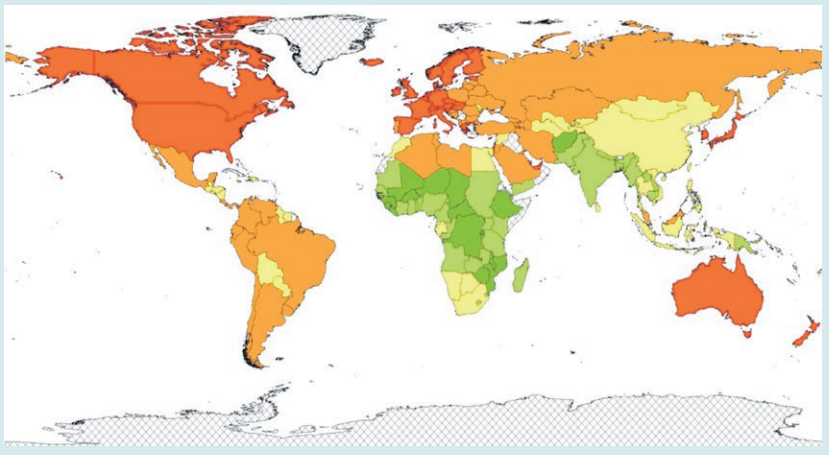


Fig. 4: Human development Index



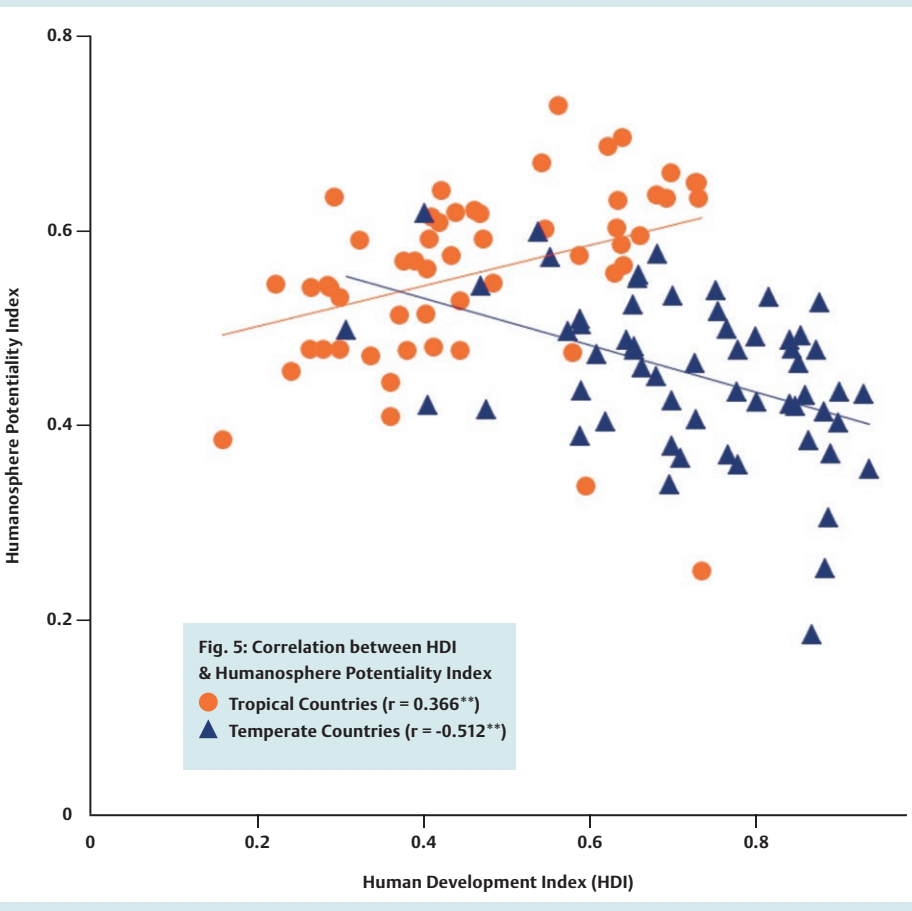


Fig. 5: Correlation between HDI & Humanosphere Potentiality Index