Journal of Cleaner Production 102 (2015) 333–341

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Linking Daly's Proposition to policymaking for sustainable development: indicators and pathways

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ARTICLE INFO

Article history:
Received 9 November 2014
Received in revised form
4 March 2015
Accepted 20 April 2015
Available online 28 April 2015

Keywords:
Daly's Proposition
Ecological well-being Performance
Sustainable development transition
G20 countries

ABSTRACT

The statement that in the full world, increasing the ultimate efficiency, expressed as *service/throughput*, is the necessary condition for humanity to achieve high levels of well-being within ecological limits is honoured as Daly's Proposition in this paper. The purpose of this paper is to make Daly's Proposition effective guidance for policymaking related to sustainable development. For this aim, this paper puts forward the indicator Ecological Well-being Performance, which is composed of the Human Development Index and the Ecological Footprint, to measure the ultimate efficiency. Furthermore, by means of matrix analysis and factor decomposition analysis, the respective pathways for countries at different stages of development to make the sustainable development transition were discussed. The G20 countries were taken as the cases to conduct the research. The empirical results show that improvements in well-being and increases in throughput level are not necessarily positively related. The relationship between the two depends on how countries control throughput levels and improve the Ecological Well-being Performance, which also explains different performances on the sustainable development transition. In a simple way, this contribution provides new methods and criteria to track and evaluate national performance on sustainable development by referring to Daly's original theories.

1. Introduction

In a steady-state economy, which is defined by constant and sufficient stocks of physical wealth and a constant population, achieving progress depends on increasing the ultimate efficiency, expressed as *service/throughput* (Daly, 1974a, 1974b, 2010). The uncontestable fact is that we are not yet living in or even approaching a steady-state economy, but rather are already dwelling in a full world (Daly, 1987, 2005, 2010). Putting the ultimate efficiency in the context of the full world, we can form a new statement: in the full world, increasing the ultimate efficiency, expressed as *service/throughput*, is the necessary condition for humanity to achieve high levels of well-being within ecological limits (Daly, 1974a, 1974b, 2005, 2013). In view of Professor Herman Daly's original contribution to developing the discipline of ecological economics, this paper honours the above statement as Daly's Proposition.

The ultimate efficiency needs to be elaborated: the service is want satisfaction and the ultimate benefit of economic activity, which can also be understood as human well-being; the throughput is the one-way material flow beginning with the extraction of low-entropy resources at the input end and terminating with an equal quantity of high-entropy waste at the output end (Daly, 1974a). Daly (1974a, 1974b, 2010) stressed that the throughput flow has to remain within the environment's regenerative and waste-assimilative capacities, beyond which the remaining natural capital would be further depleted and the throughput flow generated cannot be sustained into the distant future. It has to be recognized that in the full world, which is relatively full of humans and their built capital infrastructure, absolutely scarce natural capital has already been the limiting factor to improving human welfare (Daly, 2005, 2013).[1] It could be inferred that Daly's Proposition is inherently consistent with the implications of the strong sustainability paradigm, which emphasizes that human well-

[1] Humanity lives in a finite, nongrowing and materially closed biophysical system, in which natural capital and man-made capital are related more as complements than substitutes (Daly, 1997, 2010, 2013). The complementary nature between the two makes possible the existence of a limiting factor to human well-being improvement. In yesterday's “empty world”, since natural capital was abundant and the scale of human presence in the ecological system was low, the limiting factor to improving human well-being was relatively scarce man-made capital.

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http://dx.doi.org/10.1016/j.jclepro.2015.04.070
0959-6526/

being improvement should not be achieved at the expense of the depletion of the remaining natural capital (Daly, 2005).

Although Daly's Proposition is well discussed in the field of ecological economics, it is far from effective guidance for policymakers when discussing sustainable development issues. To link Daly's Proposition to policymaking for sustainable development, a publicly acceptable indicator to measure the ultimate efficiency is urgently needed because what is not measured tends to get ignored (O'Neill, 2012). To measure the ultimate efficiency, Common (2007) proposed three indicators, the ratios of Happy Life Years (HLY, life satisfaction multiplied by life expectancy at birth) to energy use, the Ecological Footprint (EF) and greenhouse gas emissions. Abdallah et al. (2009) made an adjustment to the above ratio of HLY to the EF and called the new indicator the Happy Planet Index (HPI). The adjustment was conducted by adding a constant to the denominator to match its coefficient of variance across the entire dataset with the numerator. Knight and Rosa (2011) employed unstandardized residuals, which are obtained by regressing life satisfaction on the EF, as the indicator of the ultimate efficiency. A country with a larger residual has relatively higher efficiency, and vice versa. The indicator is called the environmental efficiency of well-being (EWEB).

All of the above indicators of the ultimate efficiency involve subjective well-being. Subjective well-being indicators, such as self-reported life satisfaction and happiness, measure how individual need fulfilment is perceived and assessed (Costanza et al., 2007; Steinberger and Roberts, 2010). Although there is common consensus about the rationality of subjective well-being indicators as intra-nation measures of human well-being, it is tricky and problematic to compare absolute values of subjective well-being indicators across societies and cultures (Barford et al., 2010; Costanza et al., 2014). Subjective well-being assessments are easily affected by cultural differences, governmental propaganda, religious beliefs, hedonistic adaptation, relative status, information asymmetry, and the like, often in quite complicated ways (Abdallah et al., 2008; Barford et al., 2010; Bartolini and Sarracino, 2014; Daly, 1987; Ferrer-i-Carbonell, 2005; Knight and Rosa, 2011; Steinberger and Roberts, 2010). For example, because of cultural differences in expressing happiness, in China and Japan, it is much less common to report that one is happy than in the US (Abdallah et al., 2008; Barford et al., 2010). This also explains why subjective well-being indicators have less credibility within fields of international policy.

To make the ultimate efficiency comparable among countries and more relevant to policymaking, this paper puts forward one indicator called Ecological Well-being Performance (EWP). It is expressed as the ratio of the Human Development Index (HDI) to a standardized form of the EF. The HDI, a widely referenced and globally available proxy metric, is employed as an indicator of objective well-being. In addition to constructing the EWP, to further build the link, matrix analysis and factor decomposition analysis were used to discuss the respective pathways for countries at different stages of development to make the sustainable development transition. The G20 countries, which consist of the most influential developed and developing countries in the contemporary era,[2] were taken as the cases for the research.

The remainder of this paper is set out as follows. Section 2 introduces the indicators and methods to construct the EWP. Section 3 empirically analyses the EWP performance of the G20 countries during the study period (1995–2008). Section 4 discusses the respective pathways for developed and developing countries to transitioning toward sustainable development. Discussion and conclusions are presented in Section 5 and Section 6, respectively.

2. Indicators, data and methods to construct the EWP

Based on the Capability Approach and the Ecological Footprint Approach and in view of data availability, we choose the HDI to measure human well-being and the EF as a proxy of the throughput flow. In the HDI sub-section, an HDI threshold of high-level well-being is highlighted. In the EF sub-section, a global criterion is presented to judge national ecological sustainability. The data sources and preliminary data description are included in the subsequent sub-section. Finally, the methods to construct the EWP are illustrated.

2.1. Human Development Index

Since its inception in the first Human Development Report in 1990, the HDI, as the yardstick of human development, has been very popular in policy and academic circles. It is theoretically based on the Capability Approach developed by Sen and others, who consider that well-being must be evaluated in terms of the freedom and capability to reach valuable states of being and to do valuable acts (Ballet et al., 2013; Demals and Hyard, 2014; UNDP, 2010). The HDI measures the average achievement in a country in three basic dimensions, a long and healthy life (measured by life expectancy at birth), access to knowledge (measured by years of schooling) and a decent standard of living (measured by Gross National Income per capita) (Klugman et al., 2011; UNDP, 2010). Because of what it measures, the HDI could also be treated as an indicator of economic and social dimensions of sustainable development (Frugoli et al., 2015; Vemuri and Costanza, 2006). Following Moran et al. (2008), an HDI of no less than 0.80 represents the minimum requirement for “high human development”, or “high well-being”. Another reason for this paper to prefer the HDI to subjective well-being indicators is that unlike the HDI, subjective well-being indicators often lack reliable time series data to be used for empirical analysis. A standardized world-wide program of surveys with the same questions asked at regular intervals is still not underway (Abdallah et al., 2008, 2009; Common, 2007).

2.2. Ecological Footprint

Even though there is some criticism against the Ecological Footprint approach, the EF is still the most frequently cited indicator to measure the throughput flow (Moran et al., 2008). The EF addresses human demands on the ecosystem by calculating the amount of biologically productive land and water area required to provide all of the resources a population consumes and to absorb the corresponding waste, employing prevalent technology and management practices (Niccolucci et al., 2007; Teixido-Figueras and Duro, 2014; Wackernagel and Rees, 1997). As a comprehensive consumption-based measure of the throughput flow, the EF avoids the measurement bias induced by the separation of consumption and production due to international trade.

The counterpart of the EF is Biocapacity (BIO), which represents the theoretical maximum supply capability of the ecological system to cope with human demands (Moran et al., 2008; Niccolucci et al., 2007). The units of both the EF and the BIO are global hectares (gha) per capita. A global hectare denotes a hectare of planetary surface with world average biological productivity to provide ecological service to humanity (Niccolucci et al., 2007). Because ecological heritage and population density vary vastly amongst countries, it is not surprising to find that nationally available BIO values differ

[2] This paper categorizes the high income countries, which are defined by the World Bank, as developed countries. Among the G20 group, Australia, Canada, France, Germany, Italy, Japan, the Republic of Korea, Russia, Saudi Arabia, the UK and the US belong to developed countries while the others belong to developing countries.