INDICATORS AND THE QUEST FOR SUSTAINABLE DEVELOPMENT: LOCAL GEOGRAPHIC NEEDS…ANYONE?

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Abstract. As we embark through the beginning stages of the 21st century, we have already seen the earth stretched beyond its bio-capacity. The future of the earth and humanity is, and will continue to be, directly affected by the way we interact and behave within our landscapes. To combat the ills humanity has caused, and projected to continue to cause, sustainable development (SD) was created as a focal remedy, despite discrepancies. To investigate the applicability and applied usefulness of SD indicators for regional planning, this research reviews six common multi-metric indicators (MMI) used in measuring sustainability. Because of their usefulness for planning decisions and policy making, it is crucial to understanding strengths, weaknesses, and applicability of SD indicators. It has recently been stated that indicator research is "voluminous" and "not very well focused"; albeit, SD indicators have addressed environmental needs, while skimping on the social and economic. This research exposes the overarching quantitative theory behind SD indicators and their lack of usefulness at the operational scale. The author suggests simple MMI methods for use with existing datasets, rather than elaborate SD indicators that require unattainable data, for moving SD theory into practice.

Rezumat. **Indicatori şi preocupări pentru dezvoltarea durabilă : ceva pentru nevoile locale geografice?** De la începutul secolului XXI, am văzut deja că pământul se află dincolo de bio-capacitatea sa. Viitorul Pamantului si a umanitatii este şi va continua să fie afectat în mod direct de modul în care interacționăm şi ne comportăm pe termen lung cu peisajele noastre. Pentru a combate dezechilibrele provocate de omenire a fost creată dezvoltarea durabilă (DD) ca un remediu focalizat, în ciuda unor discrepanţe evidente. Pentru a investiga aplicabilitatea şi utilitatea aplicării de indicatori DD pentru planificarea regională, această cercetare analizează şase indicatori comuni multi-metrici (MMI) utilizați in masurarea durabilitatii. Datorită utilității lor pentru planificarea deciziilor şi elaborarea politicilor, este esențial să se înțeleagă punctele slabe, şi aplicabilitatea indicatorilor SD. Recent s-a declarat că indicatorul de cercetare este "voluminos" şi "nu foarte bine concentrat"; deşi, indicatorii SD s-au adresat nevoilor mediului, ei s-au bazat pe drămuirea nevoilor sociale şi economice. Această cercetare expune teoria generală din spatele indicatorilor cantitativi SD şi lipsa lor de utilitate la scara operațională. Autorul propune metode simple MMI pentru utilizarea lor la seturile de date existente, mai degrabă decât indicatorii elaborați ai SD care necesită date de neatins, pentru deplasarea SD din teorie în practică.

Keywords: *Sustainable development; Indicators; Scale; Regional planning, Urban planning*
Cuvinte cheie: *dezvoltare durabilă. indicatori, scală, planificare regional, planificare urbană*

1. INTRODUCTION

We live on a planet with finite resources. Its ability to support a thriving diversity of species, including humans, is large but fundamentally limited (WWF 2008). As we embark though the beginning stages of the 21st century, it is imperative that we come to terms with the effects the *expansionist* worldview is having on the Earth. As the dominant social paradigm, it views humans as cure-all capable (Rees 1995). Ultimately, new technologies and human ingenuity will improve human life and planet conditions (Simon 1995). However, due to the size and complexity of the Earth, the spatial and temporal effects of the *expansionist* worldview are seldom seen in a human lifetime. Because of this mechanism, it makes it possible for humanity to "tune out long-term trends over which (we) have no control" (White 1994) and let our preferences guide our decisions, rather than facts (Jones 1996). Despite the instinctual underpinnings of the expansionist worldview, an alternative *ecological* worldview has emerged. This perspective suggests that there are limits to the ability of the planet to support humanity; albeit, that human activity must be tempered to their long-term effects on natural resources and related services (Rees 1995; Wackernagel and Rees 1996). That if we are to avoid self-destruction, human behavior and use of our planet, needs to be changed immediately (Ehrlich and Ehrlich 1992). The *ecological* worldview recognizes that unconstrained consumption of limited resources will ultimately lead to Garrett Hardin's (1968) "tragedy of the commons" and social chaos (Ruckelshaus 1989).

The current integrity of the planet is being stressed beyond its biological capacity. The Living Planet Index (LPI) of global biodiversity has declined by roughly 30 percent since the 1970s, showing a loss of total vertebrate species throughout the world (WWF 2008). In 1998, the global population exceeded the Earth's carrying capacity, defined by the largest number of any given species (in this case, humankind) that a habitat (in this case, earth) can support indefinitely (Keiner 2004). Humanity's demands, measured by Ecological Footprint (EF), now exceed the planet's natural regenerative capacity by roughly a 30 percent overshoot; furthermore, it has been projected that humanity will require the bio-capacity equal to two planet Earths by the 2030s (WWF 2008). Anthropogenic stressors are projected to continue to increase as global population increases. It has been estimated that the global population will range between 9 and 13 billion by 2050 (UNDP 2005).

We are now reaching a landmark in human history. Until recently, more people have lived in rural areas than urban (UNEP 2005). In 1900, the population of cities worldwide was only 224 million people; by 1999, urban population had increased to 2.9 billion (UNPD 2001). Scientists have stated that urban populations are expected to increase (Figure 1). A study by the United Nations showed that global urban population rose from 29% in 1950 to 49% in 2000 (UNEP 2005). It has been projected by 2030 that 81% of Europeans and 85% of North Americans will live in urban settings (UNDP 2001). Overall, it has been projected that developed countries urban population will total roughly 84% by 2030 (UNDP 2005). It has been projected that by 2030 developing countries urban population will increase by 20%; suggesting that 80% of global growth of urban population will take place in poorer countries from 2000 to 2030 (UNPD 2005). According to a United Nations Population Division report (2001), by the year 2015 there will be 58 cities with more than five million in population, that number up from 39 in 2000, and foresee 27 so-called 'Maga-Cities' with more than 10 million inhabitants. The amount of urban occupied land area on Earth is projected to increase from 0.3% in 2000 to 0.9% by 2030 (UNPD 2001).

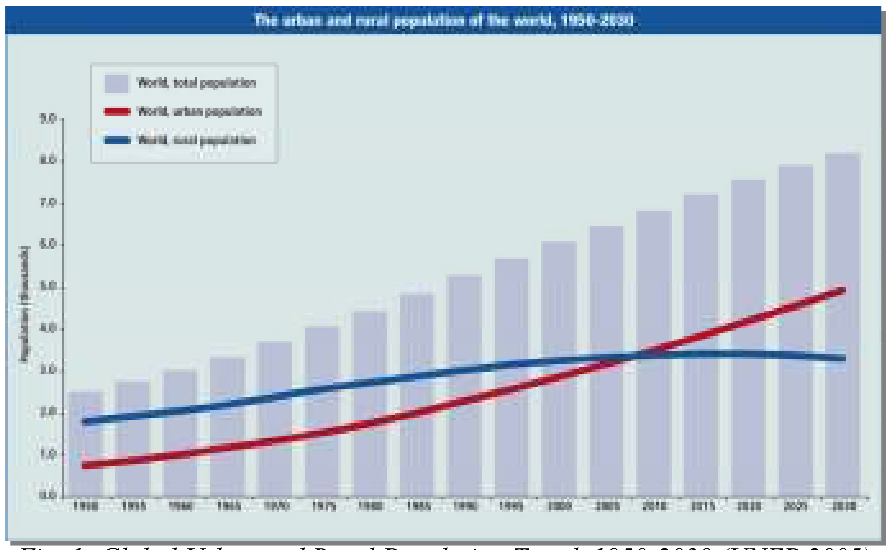

Fig. 1: Global Urban and Rural Population Trend, 1950-2030 (UNEP 2005)

As the world becomes more and more urbanized, it is imperative that there is better understanding of systems underway. Pervasive social, economic, and ecological changes have occurred as a result of human activities (Alberti 2005). A change in land cover through the appropriation of natural landscapes to provide for human needs is one of the most pervasive alterations resulting from human activity (Vitousek 1994). Specifically, the change from the natural/native landscapes to urban landscapes is having the greatest impact on earth.

Paralleling global urban expansion, there is a necessity for a sustainable transition toward a stable human population with a rise in living standards and the establishment of long-term balances between human development needs and the planet's environmental limits (Kates et al. 2001; Parris and Kates 2003). Besides the environmental ramifications of urbanization, a major challenge worldwide is to understand how changes in social organization and dynamics will impact the interactions between nature and society (Kates et al. 2001; Parris and Kates 2003).

To combat the problems associated with human population growth, and their affects on global evolution, a paradigm of international awareness was started. Sustainable development (SD), conceptually rooted to the era of early 'European Enlightenment' in the 16th century (Grober 2007), was popularized during the 1987 World Commission on Environment and Development (WCED). The coined definition found within the Brundtland Commission's report, *Our Common Future* stated "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987).

Now more than 20 years later, SD has been implemented into many global policies and planning programs, however we have yet to make the term operational at local scales. One large movement in SD research has come through the development of indicators. Since the industrial revolution of the 18th and 19th centuries, due to increasing anthropogenic stressors, there has been a greater push to monitor the environment in which we live (Harris and Browning 2005). By the early 1970s, environmental indicators started to gain popularity. In the United States, through the formation of the President's Council on Environmental Quality, indicators were in demand to measure progress towards environmental goals and pollution control targets (Rogers et al. 1997). The foundations of indicator development can be linked back to Herbert Inhaber's (1976) work: *Environmental Indicators* and Wayne Ott's (1978) work *Environmental Indicators: Theory and Practice*. After a lull in indicator research through the early 1980s, a renaissance came after their applicability became apparent at the UNCED meeting and Agenda 21 (Rogers et al. 1997).

By accepting the sustainability challenge, countries have accepted the need for indicators as a measuring tool for sustainable development (Moran et al. 2008). Sets of sustainability indicators, and manipulation of these indicators into indices, are increasingly used to make policy decisions (Oras 2005; Hezri and Dovers 2006), and it is critical to understand strengths, weaknesses, scale dependence, etc. when using them (Parris and Kates 2003; Morse and Fraser 2005; Ness et al. 2007). Hundreds of different indices have been suggested and more are under development by a growing number of institutions. The International Institute of Sustainable Development (IISDnet) compiled a list of SD indicators in 1995. However, it has been stated, that the results of that list is "voluminous" and "not very well focused" (Rogers et al. 2008). The UN Department of Economic and Social Affairs- Division for Sustainable Development- finalized a list of 96 indicators, including a subset of 50 core indicators, in their report: *Indicators of Sustainable Development: Guidelines and Methodologies* (2007) to be used as a reference for countries. It is said that there have been over 140 different indicators proposed for the OECD countries (Moffatt 2008).

There is a lack of indicator use at the operational level of urban and regional planning. This phenomenon can be attributed to unrealistic data needs and lack of understanding because of their complex development. Further, many of the sustainability indices were created with similar methods and from similar data sources (e.g., UN, WB) and therefore provide similar results. "The degree to which these indices differ in their results using the same data is due to their assumptions, biases, and methodological disparities, creating confusion for sustainability efforts" (Mayer 2008). This research aims to circumvent ambiguity about SD indicators by investigating their needs for local applied practice. Specifically, six common multi-metric indicators (MMI) of SD: Gross Domestic Product (GDP), Well-being (WB), Happiness (H), Human Development Index (HDI), Environmental Performance Index (EPI), and Ecological Footprint (EF) (Mayer 2008; Moffatt 2008; Rogers et at. 2008) will be analyzed for their applicability in local spatial analysis.

2. APPROACH

In the following, I will conduct a simple local strengths analysis on the MMI of SD: GDP, WB, H, HDI, EPI, and EF. In order to incorporate SD indicators into local and regional planning, further understanding of their quantitative and spatial data needs is required.

Just like a regular indicator, a composite indicator or MMI, should be taken literally, because it only provides an indication of conditions or problems (Whorton and Morgan 1975; Clarke and Wilson 1994). Traditionally, it has been thought to employ a wide range of indicators to characterize the different dimensions or aspects of the situation being studied (Maclaren 1996). However, by using more indicators, and more data inputs, there is a greater likelihood for autocorrelation between input data and different MMI results. Further, it has been acknowledged that more complex indicators face a number of methodological problems, including such issues as weighting individual indicators, how to standardize, different measurement units, and whether to choose a multiplicative or additive aggregation technique (Ott 1978; Innes 1990; Karr and Chu 1999).

To help set the criteria for the local strengths analysis, we look to Maclaren (1996). Maclaren stated that 'sustainability development' indicators set themselves apart from simple environmental, economic, and social indicators by the fact that they are: integrating, forward-looking, distributional, and include multiple stakeholders. Good sustainability indicators are considered: "scientifically valid, representative of a broad range of conditions, responsive to change, relevant to the needs of potential users, based on accurate and accessible data, based on data that are available over time, comprehensive, understandable by potential users, comparable with indicators developed in other jurisdictions, cost-effective to collect and use, attractive to the media, and unambiguous" (Maclaren 1996). Additional support for the local strengths analysis came from Karr and Chu's Index of Biotic Integrity (IBI) work: *Restoring Life in Running Waters: Better Biological Monitoring* (1999). The six selected SD MMI are evaluated by the following eight locally relevant criteria: 1) accessibility (private/public); 2) last published date; 3) number of data inputs required; 4) consistency between data inputs; 5) most current local scale; 6) scientific popularity (based on web of science search); 7) global popularity (based on Google search); and 8) possibility for household (point) evaluation.

3. RESULTS

3.1. Gross Domestic Product (GDP)

GDP is one of the most well known sustainability indicators and its global popularity reveals this (Table 1). Some economists and scientists think that GDP doesn't equal progress in sustainability, and that progress comes from improvements in human development and environmental needs. Although GDP requires few inputs, it is hard to calculate without governmental data making aggregation at local scales unlikely. GDP per capita provides a surrogate for GDP at the personal level, but this index is just a simple deduction of adding population into the equation. All-in-all, this popular indicator is highly recognized globally, but remains almost insignificant for use at the scale of local planning and policy making.

3.2. Well-being (WB)

The WB index is based on the assumption that a biological sound ecosystem is necessary for healthy humans. The WB index is comprises of 36 indicators addressing health and population, welfare, knowledge, culture, society, and an equity index (Böhringer and Patrick 2007). Although this index is somewhat popular in the scientific community, it remains less known globally (Table 1). Because of its many inputs, this index is relatively hard to put into action at the local level; albeit, it can be presumed that there is some multicollinearity issues associated with its input data. Attractive as the name may be, this index currently lacks the versatility for use at the local scale of urban and regional planning.

3.3. Happiness (H)

The H index is based on the socially relevant concept that a happy human comes from a sound environment. The least known, and studied, of all selected MMI's in this research (Table 1), H index posses a very media attractive name. With that said, an extensive amount of input data are required to calculate this index. Some progress has been made in local H survey techniques; however, due to mass quantities of input data, this index falls short of a fast and reliable index for operationalizing SD at local scales.

Tab. 1. Evaluation results of six multi-metric indices for measuring sustainability

Sustainable Development MMI	(1) Accessibility	(2) Last Published Date	(3) # of Data Inputs	(4) Consistency Data Inputs
GDP	Public	2009	5	Yes
WB	Public	2000	36	Yes
H	Public	2009	46	Yes
HDI	Public	2009	9	Yes
EPI	Public	2010	25	Yes
EF	Public	2008	60+	Yes
Sustainable Development MMI	(5) Scale Used	(6) Scientific Popularity	(7) Global Popularity	(8) Possible HH Evaluation
GDP	Country	1,558	4,070,000	No
WB	Country	304	67,800	No
H	Country	183	56,400	Yes
HDI	Country	3,226	446,000	No
EPI	Country	1,005	360,000	No
EF	Country	420	514,000	Yes

3.4. Human Development Index (HDI)

HDI is the most popular index in this study based on scientific popularity (Table 1), and its incorporation into the annual Human Development Report of the United Nations Development Programme solidifies its SD importance. HDI consists of three equally weighted sub-indices: Life Expectancy Index, Education Index (decomposed into an Adult literacy Index and a Gross Enrollment Ration Index), and GNP per capita (Böhringer and Patrick 2007). With a strong focus on the social dimension of SD, HDI requires governmental data hard data to acquire and incorporate at the local scale of urban and regional planning.

3.5. Environmental Performance Index (EPI)

EPI addresses the need for policy performance in reducing environmental stresses on human health while promoting sound ecosystem vitality and natural resources. The EPI is based on a proximity-to-target approach which measures a countries performance against an absolute target (Böhringer and Patrick 2007). Unfortunately, do to its many inputs (Table 1), this index is relatively hard to put into action at the local level; albeit, it can also be presumed that there is some multicollinearity issues associated with its many inputs.

3.6. Ecological Footprint (EF)

EF is based on the quantitative land and water requirements to sustain a national living standard into infinity thereby assuming certain efficiency improvements (Wackernagel and Rees 1996). Calculation of EF is based on data from national consumption statistics (Böhringer and Patrick 2007); however, much work has been done to bring EF into practice to the individual/household scale. With its popular reputation (Table 1) and attractive name, EF requires a lot of input data that may continue to limit its applicability at the scale of urban and regional planning.

4. DISCUSSION

Planners and planning academics have been exploring the role of sustainability in planning theory and practice (Beatley 1995; McDonald 1996; Godschalk 2004; Jepson 2004). Despite a plethora of definitions and debates, and uncertainty about implementation techniques, the field of planning increasingly acknowledges sustainable development as an influential concept (Godschalk 2004; Jepson 2004).

Planning needs to anticipate future conditions- where we want to go and where we can go. Spatial planning is the core discipline that steers the development of our present and future living space through social, economic, and environmental structures (Keiner 2006). To be successful at planning, at any scale, appropriate methods, procedures, and instruments are required (Keiner 2006); furthermore, the proper choice of indicators is essential for monitoring progress towards sustainable spatial development (Presscott-Allen 1997; Bossel 1999). In terms of SD, the planning community sees a need for implementation, but struggles at putting the concepts into action. "Along with the questions 'should we?' or 'can we implement sustainable development?' more and more the question 'how can we apply this concept?' dominates the literature" (Chifos 2007). To date, there exist no 'ideal' planning instruments for achieving sustainability neither on the regional nor the local level (Keiner 2006). At present, policy makers are encouraging scientists to improve models, and develop new techniques, for the integration of quantitative and qualitative analysis for regional sustainable development planning (Grosskurth 2007).

Currently, SD indicators are too complex and do not provide a means for application at the operational level of land planning. Most current SD indicators require ample amounts of input data which are only aggregated to national and international scales. Further, the few SD indicators that can be applied at the "point" scale, have yet to be incorporated into local census and would required a large amount of resources (e.g., money, time) to gather independently. While several existing SD indicators would provide much needed information at the local scale, until they are incorporated into governmental funded surveys, SD lack the chance for progress at the scale of urban and regional planning. Additionally, many local datasets already exist and provide the opportunity for intermediary SD indicator creation. In conclusion, until well known indicators are incorporated into local census, it is here that progress lies in operationalizing SD.

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