A critical analysis of sustainability indicators and their applicability on the regional level

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Abstract

The ecologically unsustainability and the potentially self-destructive character of the current socioeconomic processes have become a problem considered by public opinion, politics and researchers of many different disciplines. It is a scientific fact that these processes can restrict the socioeconomic options in the near future by irreversibly ruining certain unsubstitutable ecosystem services. As a result, the concepts of ecological sustainability and well-being have become interrelated to a high extent. Therefore, a new wave of sustainability and well-being indicators try to measure economic, environmental and social changes integrated.

In our study we examine these indicators and analyze their strengths and shortcomings. Beside the aforementioned thematic "pillars", sustainability is a multi-scale concept in space. Taken very strictly, the concept of ecological sustainability can only be interpreted on a global scale because of the global interdependencies of the biosphere and the global nature of today's environmental problems. However, examining sustainability on different spatial levels does make sense for at least three reasons. Firstly, the social and economic pillars of sustainability differ spatially. Secondly, regions diverge in the extent they contribute to the (un)sustainability of local, regional and global processes. Thirdly, different spatial units may apply different adaptation strategies regarding future environmental changes.

Therefore, beside our general discussion regarding the measures of sustainability and well-being we also examine their applicability on a regional level since regional sustainability indicators may provide useful information for strategic planners for implementing regional strategies enhancing future well-being and sustainability.

Key words: sustainability, well-being, regional sustainability
JEL Classification: O18, R00.

1 Introduction

In our study we emphasize the theory of well-being and sustainability. Considering that both theories need interdisciplinary approach and have countless literature separately, our literature overview cannot be complete. Furthermore these two concepts and related approaches cannot be split clearly from each other. The concept of sustainability is strongly attached to well-being since it sets out from intergenerational justness. The most unambiguous evidence for the connection between the two concepts is that the literature defines sustainability through three (environmental, social, and economic) or four (the former plus institutional context) pillars, thus involving environmental conditions and well-being conditions.

Not only the well-being and sustainability theories are manifold but also the attempts for their operationalization and measurement. Based on these former attempts one can clearly see that operationalizing measuring such complex concepts is not an easy task.

In our study we first briefly outline the theories of well-being. Afterwards we outline some basic dilemmas regarding sustainability. Thereafter based on the theories of well-being and the dilemmas outlined regarding sustainability we critically analyze several former measurement attempts and outline our model of (sub)regional sustainability. We limit our analysis to the one-dimensional measures of sustainability and well-being.

2 Body of Paper

Well-being

The definition of well-being has several classifications. For our point of view the formal and substantive theories are suitable [1]. The common characteristic of substantive approaches is that they state precisely what has self-value for humans. A distinction can be made among three formal approaches: happiness utilitarism, preference utilitarism and material utilitarism. Happiness utilitarism refers to some kind of positive mental position – happiness – as a criterion for utility. Preference utilitarism considers the satisfaction of individual preferences. Material utilitarism examines how much money humans would pay for the realization of certain preferences.

Substantive theories precisely define the constituents of human well-being and things having "universal value" regarding it. The first remarkable theory is the one of **basic goods coming from John Rawls.** According to it **w**ell-being is to be measured in basic goods, which are basic assets for the individuals to live a full life in society. The second substantive theory (developed by **Amartya Sen**) is the **capabilities approach**. For Sen, the concept of capabilities covers the actual freedom enjoyed by people. The third substantive theory worth mentioning is the **theory of Dasgupta** [2]. According to this, well-being has to be viewed from two aspects. One of these relates to the **constituents of well-being,** while the other one to the **tools of well-being**. The common characteristic of substantive theories is that they are interdisciplinary and pluralist. They approach well-being from several aspects, consequently they also consider viewpoints that cannot be measured – or only with much difficulty – in money.

Sustainability

The economic theories of sustainability can be grouped by several dichotomies. One of the frequently used distinctions is the strong sustainability (SS) and the weak sustainability (WS) one. Another is the distinction between the ecological economic and environmental economic approaches to sustainability.
In economics we basically find two kinds of attempt to define sustainability [3]:

- aim-based definitions, defining sustainability as non-decreasing utility, and
- stock-based definitions, defining sustainability as non-decreasing resource stock, from which future generations can create well-being for themselves. Within the stock-based definitions there are ones which concentrate on the whole amount of capital, and ones which concentrate on the amount of natural capital.

In connection with the preservation of capital as a sustainability criterion we face a basic dilemma. It is related to the substitutability/complementary relationship among the certain types of capital. When assuming a substitutability, we talk about weak sustainability (WS). In case of assuming complementary relationship we talk about strong or strict sustainability (SS).

Another dilemma is connected to t*he homogenous or heterogeneous nature of natural capital.* In connection with the strong form of sustainability the aim is to preserve natural capital. The dilemma arises whether natural capital should be divided into "subunits" or it should be evaluated as an aggregate. The latter case is problematic because in doing so we indirectly assume substitutability among the different types of natural capital.
A third dilemma refers to the *monetary evaluation of nature.* In order to evaluate nature in monetary terms several economic methods are available [4]. At the same time, monetary evaluation of nature can be strongly criticized. To be able to evaluate changes in natural capital monetary, it is necessary to know the long-term biophysical and social effects of these changes [5]. The problem with it is that based on our current ecological knowledge, the nature of global biodiversity, its destruction as well as the most efficient means to cease this destruction are surrounded by intense *uncertainty* [6],[5].

Criteria for evaluation

In our paper we aim to show certain "paradigmatic" components regarding the selected indicators and also to evaluate them from the point of their information base – that is what an extent can they be regarded as valid in measuring well-being and sustainability. For this, based on the aforementioned well-being theories and sustainability dilemmas we use the following criteria for evaluation:

- Does the indicator aim to define well-being and changes in natural capital in monetary terms or other units of measurement?
- Does the indicator apply cost-benefit analysis in the course of aggregation or does it also emphasize social differences? Does it consider any kinds of ethical values (justness, right)?
- Does the indicator consider the constituents of or the tools for well-being?
- Does the indicator set out from the utility- or the capital-oriented approach of sustainability?
- Can the indicator be regarded as strong or weak sustainability measure?
- What aggregation level does the indicator apply in handling the natural capital?

Indicators and their relation to well-being and sustainability paradigms

Despite the fact that almost uncountable projects deal with developing even newer well-being and sustainability indicators and indicator sets, it is possible to identify sustainability and well-being indicators most commonly used in environmental and ecological economic analysis. In the following we analyse four such indicators based on the aspects defined previously.

Genuine Savings (GS)

The theoretical model serving as the base of GS is based on the maximization of social welfare function assuming constant discount rate, constant population and perfect substitutability among the different kinds of capital. Consequently, GS is a weak sustainability indicator based on the Hartwick-rule [7], [8]. The strength of GS indicator is that it is a stock-based sustainability indicator. At the same time, since it contains the possibility of substitutability in an implicit way, its relevance can be seriously questioned because it may only a measure of weak sustainability. GS is also heavily criticized because

the methodology calculating monetary values of using up natural resources and the damage caused by pollution.

Environmentally Adjusted Net National Product

The theoretical base of the Environmentally Adjusted Net National Product – EANP – is Hicksian income. According to it the maximum income is the income that can be consumed in a certain period without decreasing the consumption possibilities of future periods by e.g. depleting the capital stock [3]. One of the dilemmas related to the indicator is the calculation of changes in well-being coming from the changes in natural capital. In the course of aggregation the index applies cost-benefit analysis (because the sustainability criterion is non-decreasing consumption in time), **it does not validate aspects of justness** (merely between generations), so it basically stands on the grounds of the material theory of utilitarism. It also ignores ethical values. In addition, it focuses on the tolls of well-being (income), and not on its aims, so its informational basis can be considered rather narrow. The relevance of the indicator is even more questioned by that it starts out from the utility-centred approach of sustainability.

Index of Sustainable Economic Welfare (ISEW)

The ISEW aims to quantify the momentary well-being enjoyed by a given nation, including the effects of certain past and future activities. [9]. According to Neumayer [10], the results of ISEW calculations greatly depend on certain occasional key assumptions: the weighting of income distribution, the depletion of non-renewable resources and the estimation of the damage caused by long-term environmental pollutants. The weight of these factors compared to the entirety of the indicator is so big that changing their – highly disputed – calculation method determines the value of the index to a large extent. From ethic values ISEW considers justness through tendency of income distribution. Furthermore ISEW is a weak-sustainability indicator. Further critical remarks in connection with ISEW are related to the neglect of technological development and increase in human capital.

Ecological Footprint (EF)

The EF aims to measure humanity's demand on the biosphere in terms of the area of biologically productive land and sea required to provide the resources we use and to absorb our waste (in global hectare – gha)[11]. It is worth noting that nowadays the ecological footprint of humanity exceeds the biocapacity of the Earth (1,8 gha) with 25 % (this is the so called global ecological deficit). *This means that humanity's demand on the biosphere exceeds the carrying capacity of the biosphere* [11]. For this reason, the ecological footprint of humanity has to be reduced below the present world-average. According to present estimations, *by 2050, an overshoot of 200%* will be reached if humans do not change their lifestyles and initiate new, environment-friendly technologies.
There are several criticisms regarding EF because the measure has some weaknesses, but presently there is no tool for sustainability which is complete and none will satisfy everyone perfectly. Furthermore, the ecological sustainability is not absolutely measurable, especially not with a one-dimensional indicator [12], [13], [14].

A model of (sub)regional sustainability

Although it was not in the focus of our former analysis but and measures of sustainability handling present well-being and the preservation of stocks (in order to be able to provide future well-being) together is quite problematic [8].
Thus any operationalization and measurement attempts of sustainability of any spatial level has to have at least two major parts: measures of present well-being and measures of the ability to provide future well-being. Present well-being is essential, because the present position is not sustainable if basic needs (e.g. healthy water, appropriate quality and quantity of food, fundamental human rights etc.) of many millions of people are not satisfied. That is in the case of the majority of humanity we cannot talk of sustainability since the lack of well-being at the present.
Future well-being is influenced by decisions regarding the capital stock left to future generations by present ones. That is we consider a stock-based approach more appropriate when thinking about sustainability.
According to the preservation of the capital stock there are several dilemmas. The first refers to weak and strong sustainability. Supporters of weak sustainability consider man-made and natural capital substitutable with each other. Thus the sustainability rule is that the stock, that is the joint value of the natural and man-made capital, cannot decrease. In the case of strong sustainability one of the main criteria is that the natural capital stock should not sink below a certain level, irrespectively of the stock of man-made capital. Considering the unsatisfying evidence of the substitutability between natural and artificial capital [16] we concentrate on strong sustainability during selection in or model.
If we set out from strong sustainability we meet some dilemmas in connection with the preservation of the natural stock as well. One of them is the monetary evaluation of nature. Since its extreme reductionism and huge information demand we refuse it during our examinations. Another dilemma is the level of aggregation regarding stock change. The non-monetary indicators generally use some physical amount (e.g. kg, ha) to measure the change in stocks. But considering the difficulties of aggregation and the substitutability among the different elements of natural capital it assumes we think it is essential to divide natural capital into subparts. However, it also raises dilemmas. On the one hand, it is not clear weather it is possible to define “universal” sub elements or sub elements largely depend on regional conditions. On the other hand, it also not obvious what is the correct level of aggregation within natural capital or how exactly to use ecosystem-level indicators which may be necessary.
Furthermore, the preservation of stock depends on two factors. The first one is direct quantity and quality decisions regarding the stock (to what extent do we depreciate and pollute our own capital and how much do we invest in it). The second one is the effect of future environmental changes on the stock. Regarding the pollution of the environment and global direct or indirect trade of natural capitals there is a contradictory situation. On the one hand, certain areas are sustainable regarding the depreciation of their own resources but they have a significant negative sustainability impact on other areas of the world by production or consumption externalities. In such a case their external trade is not in balance in ecological terms.

Conclusions

When measuring sustainability and well-being researchers face several issues. A basic one is the choice regarding the well-being and sustainability paradigm they aim to measure. The paradigm chosen determines our judgment regarding the development and sustainability of the chosen spatial unit. Regarding regional sustainability indicator sets one faces several dilemmas (also highly connected to the underlying paradigms). These are the common or

separated handling of present and future well-being, the relationship of the different capital stocks (substitability/complementarity), the valuation method, the level of aggregation and the handling of interspatial effects.

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