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Measuring progress in the degrowth transition to a steady state economy

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ABSTRACT

In order to determine whether degrowth is occurring, or how close national economies are to the concept of a steady state economy, clear indicators are required. Within this paper I analyse four indicator approaches that could be used: (1) Gross Domestic Product, (2) the Index of Sustainable Economic Welfare, (3) biophysical and social indicators, and (4) a composite indicator. I conclude that separate biophysical and social indicators represent the best approach, but a unifying conceptual framework is required to choose appropriate indicators and interpret the relationships between them. I propose a framework based on ends and means, and a set of biophysical and social indicators within this framework. The biophysical indicators are derived from Herman Daly's definition of a steady state economy, and measure the major stocks and flows in the economy–environment system. The social indicators are based on the stated goals of the degrowth movement, and measure the functioning of the socio-economic system, and how effectively it delivers well-being. I discuss some potential applications of the indicators, including a method that allows national economies to be placed into one of five categories: desirable growth, undesirable growth, desirable degrowth, undesirable degrowth, and a steady state economy.

1. Introduction

The declaration from the first international degrowth conference, held in Paris in April, 2008, called for the "development of new, non-monetary indicators (including subjective indicators)… to assess whether changes in economic activity contribute to or undermine the fulfilment of social and environmental objectives" (Research and Degrowth, 2010, p. 524). The purpose of this paper is to determine the best indicator approach to apply.

In order to speak of how best to measure degrowth, or whether it is even desirable to do so, it is first necessary to have a clear definition of the concept. Van den Bergh (2011) identifies five main interpretations of degrowth within the literature, which he labels as (1) GDP degrowth, (2) consumption degrowth, (3) work-time degrowth, (4) radical degrowth, and (5) physical degrowth. Although these multiple interpretations suggest a certain ambiguity about the concept, I see no reason that degrowth cannot imply several things, so long as they are not contradictory. The most detailed definition of degrowth published to date is probably the one contained in the declaration from the Paris conference. The declaration is the result of a workshop entitled "Toward a Declaration on Degrowth", whose goal was to produce a statement that would not only reflect the points of view of conference participants, but also articulate their shared vision of the degrowth movement (Research and Degrowth, 2010). The following excerpts from the declaration provide a succinct definition of degrowth:

> We define degrowth as a voluntary transition towards a just, participatory, and ecologically sustainable society… The objectives of degrowth are to meet basic human needs and ensure a high quality of life, while reducing the ecological impact of the global economy to a sustainable level, equitably distributed between nations… Once right-sizing has been achieved through the process of degrowth, the aim should be to maintain a "steady state economy" with a relatively stable, mildly fluctuating level of consumption. (Research and Degrowth, 2010, p. 524).

The full text of the declaration includes elements from all of van den Bergh's interpretations, with the notable exception of "GDP degrowth". The declaration is in agreement with other degrowth literature (e.g. Kallis, 2011; Martínez-Alier et al., 2010; Schneider et al., 2010) which sees a decrease in GDP as a likely *result* of degrowth, but not as one of its goals.

An important outcome of the conference, which is reflected in the declaration and other recent literature (e.g. Kallis, 2011; Kerschner, 2010; Martínez-Alier, 2009; Schneider et al., 2010), is that degrowth is a *process* whose end goal is a steady state economy. This message is elaborated on by Kerschner (2010), who explores the relationship between the ideas of degrowth and a steady state economy in detail,

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and concludes that the two concepts are complementary. He argues that degrowth in the global North provides a way to achieve the goal of a globally equitable steady state economy, by providing the environmental space needed for a certain amount of economic growth in the global South. Broadly speaking, countries in the global North must follow a degrowth path to reach a steady state economy (Fig. 1), whilst countries in the global South must follow a path of decelerating growth.

The term "social metabolism" may be used to describe the flow of materials and energy that are necessary to sustain economic activity. Haberl et al. (2011) describe two major transitions that have occurred (and are still occurring) in the social metabolism of human societies. The first is the transition from a hunter-gatherer regime to an agrarian regime, and the second is the transition from an agrarian regime to an industrial one. The authors also describe the need for a third great transition towards sustainability — a notion that has much in common with the concept of a degrowth transition to a steady state economy. Degrowth may be seen as an attempt to envision this third transition, and a steady state economy an attempt to operationalise the new regime.

Given the complementary relationship between degrowth and a steady state economy (SSE), it is important to define the latter concept as well. In a recent report to the UK Sustainable Development Commission, Herman Daly provides a clear definition:

> Following Mill we might define a SSE as an economy with constant population and constant stock of capital, maintained by a low rate of throughput that is within the regenerative and assimilative capacities of the ecosystem. This means low birth equal to low death rates, and low production equal to low depreciation rates. Low throughput means high life expectancy for people and high durability for goods. Alternatively, and more operationally, we might define the SSE in terms of a constant flow of throughput at a sustainable (low) level, with population and capital stock free to adjust to whatever size can be maintained by the constant throughput beginning with depletion and ending with pollution. (Daly, 2008, p. 3).

This is a purely biophysical definition; it does not mention monetary indicators like GDP, or social goals for that matter. In this definition, there is an emphasis on *constant throughput* (i.e. flows of matter and energy). Although earlier definitions of a steady state economy (e.g. Daly, 1977) tend to place more of an emphasis on *constant stocks*, both are important aspects of a steady state economy (a topic I will return to in Section 4.2).

An important point to emphasise from the definition is that a steady state economy is not just an economy where throughput is kept constant; it is also an economy where throughput is maintained within ecological limits. If flows of matter or energy exceed ecological limits, then degrowth is required before a steady state economy can be established (Fig. 1). An economy with constant throughput that exceeded the regenerative and/or assimilative capacities of the containing ecosystem would not, by definition, be a steady state economy.

A steady state economy operationalises the concept of *strong sustainability*.[1] According to the strong sustainability view, natural capital and built capital are complements (as opposed to substitutes), and only by maintaining both stocks intact can long-term economic welfare be guaranteed (Neumayer, 2010). By definition, a steady state economy is an economy in which the stock of built capital is held constant, largely to preserve the stock of natural capital, which is assumed to be complementary (and necessary).

Although a steady state economy is defined in biophysical terms, Daly and other steady state economists often claim that certain progressive social policies would be needed in order to actually achieve a steady state economy. For example, the report of the Steady State Economy Conference, held in Leeds, UK in 2010, describes ten key areas where change would be needed to achieve a steady state economy. Amongst others, the report includes policies to reduce income inequality, reform the monetary system, secure full employment, and change consumer behaviour (O'Neill et al., 2010). In this way the concept of a steady state economy is increasingly becoming associated with certain social goals as well, such as fair distribution of income and a high quality of life.

In general, though, more emphasis is placed on social goals by proponents of degrowth than by steady state economists. For example, the Paris Declaration states that degrowth is to be characterised by an emphasis on quality of life, the fulfilment of basic human needs, equity, increased free time, conviviality, sense of community, individual and collective health, participatory democracy, and a variety of other positive social outcomes (Research and Degrowth, 2010).

With these definitions in mind, this paper continues as follows. Section 2 discusses the general arguments for and against using quantitative indicators to measure progress. Section 3 presents four specific indicator approaches that could be used to determine how close countries are to a steady state economy: (1) GDP, (2) the Index of Sustainable Economic Welfare, (3) biophysical and social indicators, and (4) a composite indicator. Section 4 recommends using separate biophysical and social indicators, and proposes a unifying conceptual framework for indicators based on ends and means. Section 5 discusses the full set of proposed indicators, and presents a method of analysis that allows national economies to be placed into one of five categories (desirable growth, undesirable growth, desirable degrowth, undesirable degrowth, and a steady state economy). Section 6 concludes.

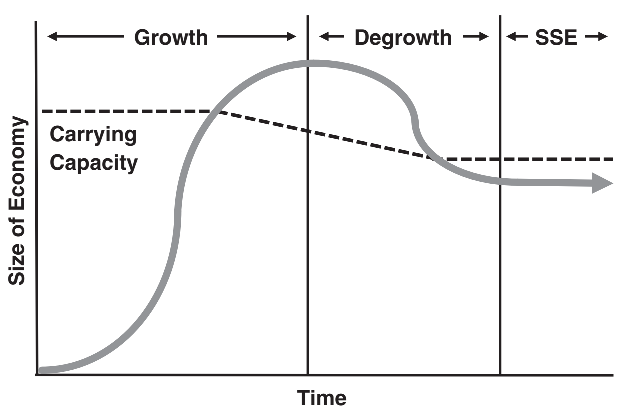

Fig. 1. The degrowth transition to a steady state economy. The figure illustrates the transition that wealthy nations must go through to arrive at a steady state economy (SSE). The figure also represents the overall global transition that must occur.

2. To Measure or Not to Measure?

2.1. Against Measuring

There are two reasons why we might consider *not* measuring progress in the degrowth transition to a steady state economy. The first of these is that the current state of global ecological overshoot was at least partially caused by our focus on, and attempt to maximise, a narrow set of economic indicators. It is arguable whether economic growth would have become such a high priority had indicators such as GDP not been invented. GDP has undermined the goal of economic welfare that it was supposed to support because people have ended up serving the abstract (but quantitative) indicator instead of the concrete (but qualitative) goal. We have fallen victim to what Alfred North Whitehead termed the "fallacy of misplaced concreteness"

[1] Neumayer (2010, p. 23) suggests that the publication of Daly's (1977) book *Steady-State Economics* may in fact mark the foundation of strong sustainability. Kerschner (2010) claims that a steady state economy and strong sustainability could be regarded as identical concepts.

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(Daly and Cobb, 1994) — the error of treating an abstraction as if it were reality. This might make members of the degrowth community wary of promoting new indicators, even if they represent a significant improvement on GDP, due to their potential to be misinterpreted or misused.

The second reason is that it may turn out to be impossible to measure what the degrowth movement is trying to achieve. Many of the characteristics of degrowth that are listed in the declaration from the Paris conference – items such as conviviality, sense of community, self-reflection, balance, creativity, flexibility, diversity, and good citizenship – are of a qualitative and subjective nature and do not lend themselves easily to measurement. There are other characteristics of degrowth from the declaration that are simpler to measure, such as reduced consumption of resources, an increase in free time, equity, and individual and collective health, but there is the danger that because these things are simpler to measure, too much attention could be focused on them. We may end up measuring, and therefore managing, what is easy, instead of what is important.

2.2. In Favour of Measuring

Whilst the above are important concerns, I believe they can be addressed by choosing indicators carefully, and by keeping indicators in their rightful place as one tool in the decision-making process. Furthermore, the arguments against measurement are heavily outweighed by the arguments in favour of it.

The first of these arguments may be summed up by the popular phrase, “You can't manage what you don't measure.” The call for degrowth in wealthy nations has largely arisen because a number of environmental indicators show that levels of resource use and waste production are too high globally. Large-scale studies such as the Millennium Ecosystem Assessment (2005) and the reports of the Intergovernmental Panel on Climate Change (e.g. IPCC, 2007) indicate that human beings have changed ecosystems and altered the global climate at a profound rate over the past half century. Ecological footprint studies suggest that humanity is currently using resources faster than they can be regenerated, and producing wastes faster than they can be assimilated — a state of “ecological overshoot” (Ewing et al., 2010; Wackernagel et al., 2002). Rockstrom et al. (2009) estimate that humanity is transgressing three of nine “planetary boundaries” related to earth-system processes (climate change, biodiversity loss, and the nitrogen cycle). The authors warn that transgressing one or more of these boundaries could lead to catastrophic change at the continental to planetary scale. In short, measurement was necessary to demonstrate the need for degrowth, and it will be necessary to determine whether degrowth is being achieved. Reliable indicators give us the tools to determine whether we are making progress towards a more sustainable society, or are heading in the wrong direction — potentially being led astray by political rhetoric or greenwash.

The second reason is that “What gets measured tends to get done”, and what is not measured tends to get ignored (by policymakers at least). At the moment, what is measured is GDP growth, and what is not given enough attention is the environment and issues of social equity. If the degrowth movement wants to shift the agenda away from economic growth and towards degrowth, then creating and promoting indicators that measure what is meant by degrowth would be a very effective way of doing this. As Donella Meadows wrote:

> Indicators arise from values (we measure what we care about), and they create values (we care about what we measure)… [C]hanging indicators can be one of the most powerful and at the same time one of the easiest ways of making system changes — it does not require firing people, ripping up physical structures, inventing new technologies, or enforcing new regulations. It only requires delivering new information to new places. (Meadows, 1998, pp. viii, 5).

If, on the other hand, the degrowth movement does not decide how degrowth should be measured, then there is the danger that this decision could be made by others (either implicitly or explicitly), potentially resulting in a false characterisation of degrowth.

Finally, indicators are a useful communications tool. The ecological footprint, for example, has been very effective at communicating the idea that wealthy nations are consuming resources unsustainably. Clear indicators would help to raise awareness about the need for degrowth, and with appropriate targets, could help to create a concrete and positive vision of what a degrowth future might look like.

3. Four Possible Approaches

With these considerations in mind, I discuss four approaches that could be taken to measure degrowth towards a steady state economy at the national level.

3.1. Gross Domestic Product

The first approach would be to continue using GDP. Since rising real GDP is the standard measure of economic growth, declining GDP could be interpreted as an indicator of degrowth, and stable GDP an indicator of the steady state. GDP is strongly correlated with the use of many natural resources (energy in particular), but not well-correlated with quality of life measures such as happiness beyond a basic level of income (around $20,000 a year according to Layard, 2005). Given these relationships, a potential target for a degrowth transition in wealthy countries could be to reduce GDP by a certain amount each year (say 3%), until it reached this basic income level.

Whilst straightforward, this approach is problematic because it relies on a very poor indicator of progress. First, GDP does not distinguish between costs and benefits. It adds together all money spent on final goods and services, counting economic activity that diminishes well-being in the same way as activity that enhances it. It also fails to distinguish between increases in quantity (i.e. physical growth) and improvements in quality (i.e. development). These are critical distinctions for a steady state economy. Second, GDP only tracks monetary *flows*. It does not account for changes in *stocks*, in particular the stock of natural capital, whose depletion may be counted as income in the GDP calculation. Third, GDP only counts activities where money changes hands. It neglects informal activities that have no market value (but large social value) such as household and volunteer work. And fourth, whilst GDP measures total income, and per capita GDP measures average income, neither of these indicators provides any information about how that income is actually distributed. An unequal distribution of income implies unequal opportunities for personal development and well-being (Cobb et al., 1995; van den Bergh, 2009).

The growing recognition that GDP is a poor indicator of progress has led to a number of major initiatives around the world that are investigating alternatives to GDP. These include the European Commission's Beyond GDP initiative (http://www.beyond-gdp.eu/), the OECD's project on Measuring the Progress of Societies (http://www.oecd.org/progress/), and the Commission on the Measurement of Economic Performance and Social Progress launched by French president Nicolas Sarkozy, which recently released its report (Stiglitz et al., 2009). It would be ironic if, after finally having persuaded neoclassical economists and policy makers to reconsider using GDP as a measure of progress, ecological economists and others in the degrowth community began promoting GDP as an indicator of degrowth, albeit with a different target (−3% per year instead of +3%, for example). I would argue that it is not enough to change the target on a bad indicator. The indicator itself needs to be changed.

Finally, whilst the rate of change of GDP may be a good proxy for the rate of change of resource use, it says nothing about whether the

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actual level of resource use is ecologically sustainable, or whether what is happening is socially sustainable. Zero GDP growth could still be accompanied by declining stocks of natural capital or increasing inequality, both of which would be counter to the objectives of a steady state economy.

Recent writings in the degrowth literature also emphasise that the goal of degrowth is not a reduction in GDP. For instance, Schneider et al. (2010, p. 512) state that "what happens to GDP is of secondary importance; the goal is the pursuit of well-being, ecological sustainability and social equity." Van den Bergh carries the argument even further, claiming that we would be better off if we simply abolished GDP – even if we didn't replace it with another indicator – due to the huge information failure that would be removed by this action. In his view the current goal of unconditional GDP growth acts as a barrier to progress by preventing good policies in many areas. An unconditional requirement for GDP degrowth would be similarly flawed (van den Bergh, 2009, 2011).

3.2. The Index of Sustainable Economic Welfare

A second approach would be to use an improved indicator of economic welfare, such as the Index of Sustainable Economic Welfare (ISEW; Daly and Cobb, 1994) or the related Genuine Progress Indicator (GPI; Talberth et al., 2007). The ISEW and GPI are monetary indicators with a theoretical foundation based on Irving Fisher's definition of income and capital (Lawn, 2003a). They start with personal consumption expenditure as their base, but then make three main adjustments. First, personal consumption expenditure is weighted to account for inequality, based on the premise that a dollar of additional income brings less benefit to the rich than the poor. Second, additions are made to account for the value of non-market activity such as household and volunteer work, as well as the services provided by consumer durables and public infrastructure. And third, deductions are made to account for the costs of pollution, crime, automobile accidents, and other undesirable side-effects of economic growth, such as the depletion of natural capital (Talberth et al., 2007).[2]

The ISEW/GPI approach (hereafter ISEW for brevity) is a vast improvement on GDP as a measure of economic welfare because it separates costs and benefits, accounts for inequality, includes some forms of non-market activity, and counts the depletion of natural capital as a cost instead of a benefit. ISEW-like indicators have been calculated for a number of industrialised countries including Austria, Australia, Germany, the Netherlands, Sweden, the UK, and the U.S. These indicators generally show that whilst GDP has increased steadily in recent decades, the ISEW stopped increasing sometime in the 1970s or 1980s (depending on the country), and in many cases has decreased since then (Lawn, 2007). The results of ISEW studies have contributed to the formulation of a "threshold hypothesis" (Max-Neef, 1995) which posits that there is a level of economic activity beyond which the costs of further economic growth exceed the benefits.

Of course, the ISEW is not without its critics (e.g. Neumayer, 1999, 2010). Most criticisms relate to the specific valuation methods used in the calculation of the ISEW, and not to the conceptual approach itself. Assuming that it is possible to reach a consensus on the best valuation methods to use, there is still the question of whether the indicator would be useful for measuring progress in the transition to a steady state economy.

Theoretically, the point at which to establish a steady state economy would be the threshold point, where the benefits of additional personal consumption are just matched by the costs associated with this consumption (i.e. where economic welfare peaks and then begins to decline). This is generally also the point where the trajectories of the GDP and ISEW for a country diverge. Upon reaching this point, a country might decide to establish a steady state economy. In fact, Lawn (2006) suggests that Australia should have done exactly this in the mid-1970s when Fisherian income (which is related to the ISEW) peaked and then began to decline. The problem, however, is what happens next. Although a decline in the ISEW may signal the need to establish a steady state economy, it does not tell us whether such an economy is being achieved. Other indicators would still be required to determine whether resource use was stable and within ecological limits, and quality of life was high. Moreover, for industrialised countries that have already passed the threshold point, degrowth would presumably be required to reach a steady state economy. It is not obvious what effect degrowth would have on the ISEW. Would the indicator go up or down? If personal consumption were reduced, the ISEW would probably go down, since costs associated with long-term environmental damage (e.g. climate change) would still remain — at least in the short-term. Thus the indicator could show the same behaviour in a degrowing economy as in a growing economy. It is therefore hard to see how the ISEW could be used on its own to manage the transition to a steady state economy.

An additional problem is that the ISEW is an indicator of *weak sustainability* (Daly and Cobb, 2007; Neumayer, 1999), whilst a steady state economy operationalises the concept of strong sustainability. Weak sustainability allows for natural resources to be depleted, so long as this depletion is offset by increases in the stocks of other forms of capital (Neumayer, 2010). Since the ISEW translates the benefits and costs of economic activity into monetary values, its accounting framework allows reductions in natural capital to be offset by increases in personal consumption. As long as reductions in natural capital are smaller than gains in personal consumption, the ISEW indicates an increase in economic welfare.

In summary, the ISEW is a very useful indicator for exposing the flaws in GDP and showing where economic growth has become "uneconomic". However, it does not provide the biophysical data necessary to measure progress in the transition to a steady state economy. Nor, for that matter, does it provide the data on human well-being that would be needed to tell whether such a transition were socially sustainable.

3.3. Biophysical and Social Indicators

A third approach would be to dispense with monetary indicators, and measure progress more directly, with biophysical and social indicators. Given the definitions of degrowth and a steady state economy (which focus on biophysical quantities and social goals), this is arguably the logical approach. It is also the approach advocated in a recent article on degrowth by Martínez-Alier (2009, p. 1099), which states, "Now… is the moment to substitute GDP by social and environmental indicators at the macro-level and to trace progress towards a socio-ecological transition by the behaviour of such indicators".

The question, of course, is which indicators to use. Material Flow Accounting (MFA) provides one potential approach for generating biophysical indicators. MFA is a standardised methodology (see Eurostat, 2001, 2007) for tracking the overall material inputs to national economies, the changes in the stock of materials within the economic system, and the material outputs to other economies (via trade) or back to the environment. Material inputs to the economy can be grouped into five basic categories – biomass, minerals, fossil fuels, water, and air – of which MFA studies track the first three.

The main problem with using material flows data to measure progress towards a steady state economy is determining sustainable

[2] Interestingly, while the ISEW acknowledges that an unequal distribution of income detracts from welfare, it makes no adjustment for the declining marginal utility of *total* income. In other words, it equates higher personal consumption with higher welfare. This approach ignores the evidence from surveys of subjective well-being (e.g. Layard, 2005), which suggest that beyond a certain level, additional income does not make people any happier.

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levels for the flows. Whilst targets such as a "factor four" or "factor ten" reduction in material use for industrial economies have been proposed (e.g. Hinterberger et al., 1997), these are somewhat arbitrary. The best attempt to date to construct an aggregate indicator that compares the size of resource flows with the capacity of ecosystems to accommodate these flows is probably the ecological footprint (Wackernagel and Rees, 1996). The footprint measures the area of biologically productive land that a country needs to produce the biotic resources it consumes, and assimilate the wastes it generates. Although it does not account for the flow of non-renewable resources such as minerals, it does include fossil fuels in terms of the CO_2 emissions that are produced during their combustion. These emissions are translated into the area of forested land necessary to sequester the CO_2. The ecological footprint may be compared to biocapacity (the supply of biologically productive land) to arrive at a ratio of the scale of economic activity in relation to what the environment can sustain (Ewing et al., 2010).

Although widely used, the ecological footprint has also been widely criticised. A review of the footprint based on a survey of 34 internationally-recognised experts concluded that the indicator is a strong communications tool, but that it has a limited role within a policy context (Wiedmann and Barrett, 2010). As an aggregated indicator of resource use with a single sustainability threshold, the footprint provides no information on when specific ecological limits relating to key ecosystem services might be reached. The footprint has also been criticised for the method used to translate CO_2 emissions into land area. For example, Ayres (2000) claims that the forest-land method exaggerates the size of the footprint, as more land-efficient methods of sequestering CO_2 could be devised (e.g. pumping compressed CO_2 into empty oil and gas wells). In response, however, proponents of the ecological footprint argue that the method is valid because the footprint measures environmental impact under existing technology, and forests are the "best technology" currently available (and in use).

Other, arguably more scientific, measures of the scale of humanity's use of resources also exist, such as "human appropriation of net primary production" (HANPP; see Haberl et al., 2007; Vitousek et al., 1986). HANPP measures the amount of photosynthetically-captured energy (i.e. plant biomass) that human beings either (1) harvest, or (2) make unavailable through land cover change. Although HANPP provides a clear measure of the magnitude of human activity in a specific area with respect to available ecological energy flows, it currently lacks the clear sustainability threshold provided by the ecological footprint.

In addition to biophysical indicators, social indicators will also be needed to measure progress in the degrowth transition to a steady state economy. The great challenge of degrowth is how to maintain (or even enhance) the well-being of the planet's citizens whilst global resource use and waste production are being reduced to within ecological limits. Social indicators are needed to ensure that quality of life is maintained or improved by degrowth, and not diminished by it.

An important social indicator to consider using is subjective well-being (e.g. happiness). As Richard Layard (2005, p. 13) remarks, "The most obvious way to find out whether people are happy in general is to survey individuals in a random sample of households and to ask them." Although economists have traditionally avoided such measures due to their subjective nature, there is strong evidence that what people say about their state of well-being reflects reality. For example, measures of subjective well-being are correlated with at least five other relevant sets of variables: the reports of friends, the plausible causes of well-being, some plausible effects of well-being, physical functioning (such as blood pressure and levels of cortisol), and measures of activity in different parts of the brain (Layard, 2010).

There are a number of different approaches to defining and measuring well-being. The three most relevant ones to degrowth are probably (1) the flourishing approach, which relates well-being to positive functioning (i.e. "living well") and the realisation of potential; (2) the hedonic approach, which relates well-being to the balance between positive and negative feelings[3]; and (3) the evaluative approach, which relates well-being to an individual's subjective appraisal of how his life is going (Thompson and Marks, 2008). Whilst some authors (e.g. Michaelson et al., 2009) advocate using indicators based on all of these approaches in a system of national accounts, others (e.g. Layard, 2009) advocate using a single evaluative indicator like life satisfaction to measure progress.

Although I have described some of the indicators that could be used to measure progress in the degrowth transition to a steady state economy, there are clearly other indicators that would also be useful (e.g. inequality, energy use, leisure time, the unemployment rate). In fact, the problem is that it is possible to imagine quite a few indicators that are relevant. There is the danger of having too many indictors, and not being able to understand the complex relationships and trade-offs between them. This is largely what has happened with sustainable development indicators. For example, the UK uses a set of 68 indicators to measure progress towards its Sustainable Development Strategy (Defra, 2010). The EU uses an even larger set of over 100 indicators to measure progress towards the equivalent EU strategy (Eurostat, 2009).

Most countries that have developed sets of national sustainable development indicators have done so using a "theme-based" framework (United Nations, 2007). In such a framework, indicators are grouped according to the issue that they most closely relate to (e.g. health, governance, economic development). Theme-based frameworks are useful for monitoring performance on specific policy goals, but they provide no information on the relationship between indicators, or their relative importance. Without a unifying conceptual framework it is also difficult to know which indicators to include, and whether the collection of indicators is comprehensive. As Meadows (1998, p. ix) notes, "What is needed to inform sustainable development is not just indicators, but a coherent information system from which indicators can be derived."

3.4. A Composite Indicator

A fourth approach would be to combine a number of individual biophysical and social indicators to create a composite indicator (also known as an index). There are a number of reasons to consider this approach. First, a composite indicator allows a complex set of data to be compressed into a single indicator. Since a single indicator is easier to interpret than many separate indicators, an index facilitates communication, especially with policy makers and the general public. Second, an index allows countries to be directly compared against one another, and rankings to be constructed. This again can generate public interest, and draw attention to the issue that the index measures (OECD, 2008). An index showing how close various countries were to a steady state economy could be a useful tool to recognise those countries closest to this goal, and encourage better performance from those furthest away.

However, there are also some very serious reasons to question using a composite indicator. First, the aggregation of multiple indicators into a single number results in the loss of a tremendous amount of information. A single indicator may send misleading messages and invite overly simplistic policy conclusions. Second, composite indicators hide value judgements. In order to create a composite indicator, it is first necessary to normalise the data from the component indicators (to account for different measurement units), and then assign weights to the individual indicators so that they may be aggregated. A number of different weighting techniques exist, but regardless of which one is used, weights represent value judgements

[3] The hedonic approach to well-being, as described here, should not be confused with the hedonic pricing method used to value environmental amenities.

(OECD, 2008). These value judgements are often hidden by the quantitative and objective appearance of the index.

One of the best-known composite indicators is the Human Development Index (HDI). The HDI was created as an explicit alternative to monetary indicators like GDP, to show that development is about more than just increasing national income. The HDI, which was recently revised and updated for the 20th anniversary edition of the *Human Development Report* (UNDP, 2010), is calculated by taking the geometric mean of indicators of life expectancy, education, and standard of living. It is a strictly socio-economic indicator, and does not include environmental measures. As such, the HDI is arguably more informative (in its particular area of focus) than many other composite indicators that conflate social and environmental goals.

A key problem with many composite indicators is that they include both environmental and social indicators, and *add* the two together to form a single index. The Environmental Performance Index (Esty et al., 2008) and Sustainable Society Index (van de Kerk and Manuel, 2008) are good examples. By adding together scores on environmental and social indicators, these composite indicators make the implicit assumption that environmental and social objectives can be substituted for one another. They are, like the ISEW, weak sustainability indicators. To measure how close economies are to a steady state economy requires a strong sustainability approach which recognises that more society does not compensate for less environment, or vice versa. Each of these goals must be achieved on its own terms, and therefore measured on its own terms (and in its own units). The report of the Stiglitz Commission makes this point and provides a particularly good analogy:

> The assessment of sustainability is complementary to the question of current well-being or economic performance, and must be examined separately. This may sound trivial and yet it deserves emphasis, because some existing approaches fail to adopt this principle, leading to potentially confusing messages. For instance, confusion may arise when one tries to combine current well-being and sustainability into a single indicator. To take an analogy, when driving a car, a meter that added up in one single number the current speed of the vehicle and the remaining level of gasoline would not be of any help to the driver. Both pieces of information are critical and need to be displayed in distinct, clearly visible areas of the dashboard. (Stiglitz et al., 2009, p. 17).

This is not to say that there is no meaningful way to combine data on social and environmental performance. One aggregation procedure that may prove particularly useful is to take the *ratio* of social and environmental indicators. This ratio is a measure of the efficiency with which natural resources are translated into human well-being, and is the approach taken by the Happy Planet Index (Abdallah et al., 2009).

4. Recommended Approach

4.1. Conceptual Framework

The approach that I propose for measuring progress in the degrowth transition to a steady state economy is to construct a set of biophysical and social indicators that are based directly on the definition of a steady state economy and the goals of the degrowth movement. Although a number of biophysical and social indicators were discussed in Section 3.3, it was not obvious from this discussion which indicators should be included, or how to relate them to one another.

To solve this problem, and generate a meaningful set of indicators, requires a unifying conceptual framework. This framework should acknowledge that the economy is a subsystem of the environment, and its scope should include the full range of relations between natural resources and human well-being. Herman Daly's "Ends–Means Continuum" (Daly, 1977) provides such a framework, which Donella Meadows proposed using as the basis of an information system for sustainable development indicators (Meadows, 1998). The framework (Fig. 2) organises items in a hierarchy from *ultimate means* (the natural resources that sustain life and all economic transactions) to *intermediate means* (the factories, machines, and skilled labour that transform natural resources into products and services) to *intermediate ends* (the goals that the economy is expected to deliver) to *ultimate ends* (those goals that are desired only for themselves, and are not the means to achieve any other end).

The Ends–Means framework effectively divides the indicators into two separate accounts: biophysical and social. The biophysical accounts measure the use of means, whilst the social accounts measure progress towards ends. The framework also separates natural capital (the ultimate means) from built capital (an intermediate means). By organising the indicators in this way, the framework helps to deliver a set of indicators that measures strong sustainability.

It is important to state that the framework should *not* be interpreted as suggesting that the only purpose of nature is to fulfil human needs. The framework simply indicates that to fulfil human needs first requires healthy, functioning ecosystems (Meadows, 1998). The Ends–Means Continuum is a framework for understanding and managing the economy, not a hierarchy of values.

4.2. Biophysical Accounts

The indicators in the biophysical accounts should be based on Herman Daly's definition of a steady state economy (Daly, 1977, 1996, 2008). In general, Daly's definition contains three components: *stocks* (the absolute size of the economy), *flows* (the throughput required to support the economy), and *scale* (the size of the economy in relation to the environment). There are three stocks that are relevant to the definition: the stock of built capital (e.g. buildings, transportation infrastructure, cars, durable goods), the stock of people (i.e. the human population), and the stock of domesticated animals (i.e. livestock). There are three flows that are relevant: the flow of material inputs from the environment to the economy, the flow of material outputs from the economy back to the environment, and the energy used by the economy. And finally, there are two measures of scale that are relevant: the ratio of material inputs to the capacity of ecosystem sources to regenerate materials, and the ratio of material outflows to the capacity of ecosystem sinks to assimilate wastes (Fig. 3).

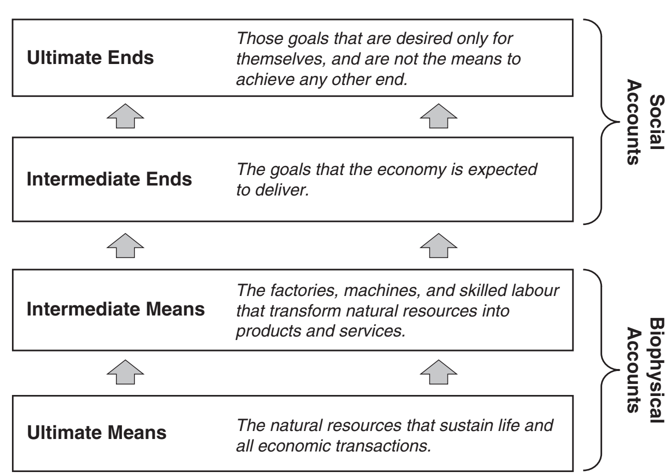

Fig. 2. The conceptual framework for a set of indicators to measure progress in the degrowth transition to a steady state economy.
Source: based on Daly (1977) and Meadows (1998).

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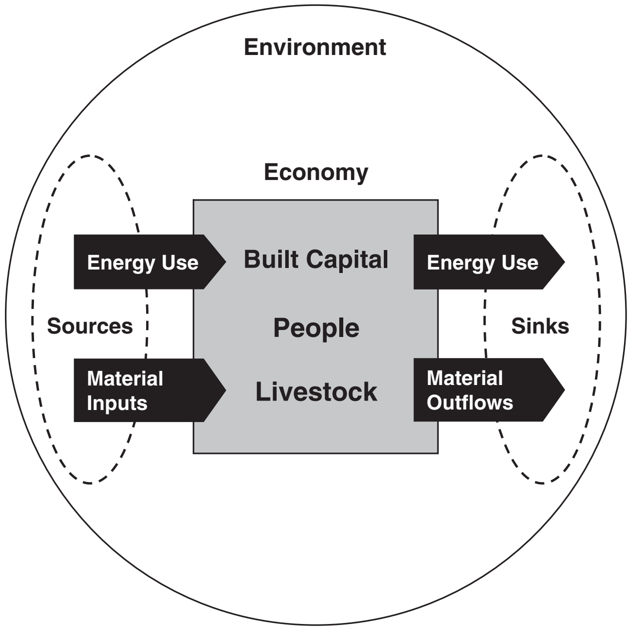

Fig. 3. The stocks, flows, and scale quantities that are included in Daly's definition of a steady state economy. Stocks are shown within the grey box representing the economy, flows are shown as arrows, and scale may be visualised as the relationship between arrows and dashed ovals.
Source: based on Goodland (1991, p. 17).

Although Daly focuses less on constant stocks, and more on constant flows in his more recent definition (Daly, 2008), I would argue that it is necessary to have both constant stocks and constant flows in order to achieve a steady state economy. There are three reasons that constant stocks are also important:

1. If built capital and natural capital are complements (as strong sustainability suggests), then an increase in the stock of built capital would likely lead to a reduction in the stock of natural capital, contrary to the goal of a steady state economy. As cities expand, for example, they generally do so at the expense of the surrounding natural landscape, eroding natural capital. This can happen without any change in material flows.
2. If the goal in a steady state economy were simply to stabilise flows, and no effort were made to stabilise stocks as well, then it would be very difficult to actually stabilise the flows. The stocks determine the standing demand for matter and energy, and therefore an increase in stocks creates a very strong pressure to increase flows. An increase in human population or built capital, for example, would likely drive an increase in the flows needed to maintain these stocks, despite attempts to prevent this from happening.
3. In order for stocks to increase whilst flows remain constant, efficiency improvements must be made. The human population could increase, whilst the harvest of food remained constant, if less food were wasted. The number of buildings in a city could grow, whilst the mining of construction materials remained stable, if buildings were designed to last longer. However, these trends could not continue forever as this would require efficiency to increase indefinitely, in defiance of the Second Law of Thermodynamics. Whilst it is possible to imagine some transitional phase characterised by increasing stocks, the end state for a steady state economy must still include a constant population of people, domesticated animals, and built capital.

Although Daly does not include domesticated animals in his definition of a steady state economy, I believe they should be included for two reasons. First, domesticated animals are a highly controlled form of "cultivated natural capital" (Daly, 1996, p. 80). They have been significantly modified from their natural state by human actions, and their production and reproduction are largely controlled by society (more so than other forms of cultivated natural capital such as plantation forests). Second, the flow of resources required to sustain the stock of domesticated animals is substantial. Globally, close to 60% of all harvested plant biomass is used as food for livestock (Krausmann et al., 2008).

Following Daly's definition and the stock–flow-scale categorisation, it is possible to construct a set of "idealised indicators" to measure how close various countries are to a steady state economy. I use the term idealised indicators to refer to the indicators that we would like to be able to measure, in contrast to what is necessarily measurable at the moment. The idealised indicators are:

- Stocks
  - o Built capital growth rate
  - o Human population growth rate
  - o Livestock population growth rate
- Flows
  - o Material inputs growth rate
  - o Material outflows growth rate
  - o Energy use growth rate
- Scale
  - o Ratio of material throughput to the capacity of ecosystems to:
    - ■ Regenerate materials
    - ■ Assimilate wastes

The first six indicators in the list (those relating to stocks and flows) are growth rates, i.e. the rate of change of a variable over time. To calculate these indicators would require time series data for a sufficiently long period to observe trends. The scale indicators, on the other hand, are ratios that could either be calculated as an average over this time period, or based on the final year in the period. The target for a steady state economy would be a growth rate of zero for the stock and flow indicators, and a ratio ≤ 1 for the scale indicators.

Of the eight idealised indicators listed above, the most difficult to measure in practice are probably the scale indicators. Although indicators such as the ecological footprint, HANPP, and the planetary boundaries approach provide a good first approximation of scale, further research is still required in order to accurately quantify ecological limits.

4.3. Social Accounts

The indicators in the social accounts should be chosen based on the goals of the degrowth movement. The indicators should measure the functioning of the socio-economic system, and how effectively it delivers well-being. A combination of subjective and objective indicators, with measures of personal and social well-being, is probably needed to accomplish this.

As a starting point, I have constructed a set of idealised indicators based on the social goals articulated in the Paris Declaration (Research and Degrowth, 2010). There are 24 social goal statements within the text of the declaration, which I have grouped and reduced to six general goals. These goals are human well-being, equity, fulfilment of basic needs, increased free time, sense of community, and participatory democracy. Of these six social goals, I have classified human well-being as the "ultimate end" of the economic system, and the others as intermediate ends in support of it.

The identification of an ultimate end, and even intermediate ends, clearly invites debate. The goals that the economy is expected to deliver should be decided democratically, based on a participatory process (not by one researcher's particular interpretation of the literature). That said, my identification of human well-being as the ultimate end for the economy largely follows from the happiness literature. As Layard (2005, p. 113) writes, "[W]e naturally look for one ultimate goal that enables us to judge other goals by how they contribute to it. Happiness is that ultimate goal because, unlike all other goals, it is self-evidently good. If we are asked why happiness matters, we can give no further, external reason. It just obviously does matter." Happiness is, in other words, a goal desired only for itself. It is not the means to any other end, and therefore satisfies the definition of "ultimate end" provided above.

I consider both subjective well-being (e.g. happiness) and physical health (often measured using life expectancy) to be important components of human well-being. Although good health could be seen as just one means to achieve a happy life, it is clearly better to have a long happy life than a short one. The importance of both components has led to the construction of indicators such as "happy life-expectancy" (Veenhoven, 1996) or "happy life-years" (Abdallah et al., 2009), which multiply the two measures together to form a single indicator.

Although Layard (2005) points to there being only *one* ultimate end, there could theoretically be more than one objective that is desired only for itself. Social equity is one possible candidate. Whilst steady state economists are probably more likely to promote greater equality as a means to an end, the degrowth community may view greater equality as an end in itself, as evidenced by the expression "degrowth *for* social equity" (Schneider et al., 2010; my emphasis).

To the six goals from the Paris Declaration, I would add one other intermediate end, and that is low unemployment. Low unemployment is an important goal to include for two reasons. First, there is a strong connection between employment and well-being (Clark and Oswald, 1994). As E.F. Schumacher (1974, p. 46) wrote, "If a man has no chance of obtaining work he is in a desperate position, not simply because he lacks an income but because he lacks this nourishing and enlivening factor of disciplined work which nothing can replace." Second, a strong critique of degrowth is that it will result in unemployment. Jackson (2009) describes the "dilemma of growth" in terms of two propositions: (1) growth is unsustainable due to rising resource use and environmental damage, and (2) degrowth is unstable, under present economic arrangements at least, because falling consumer demand leads to rising unemployment. Whilst proposals such as working time reduction and a job guarantee have been put forward to maintain full employment in a steady state economy (O'Neill et al., 2010), and even simulated using a low-growth model (Victor, 2008), the availability of meaningful work remains a critical indicator to monitor in any transition.

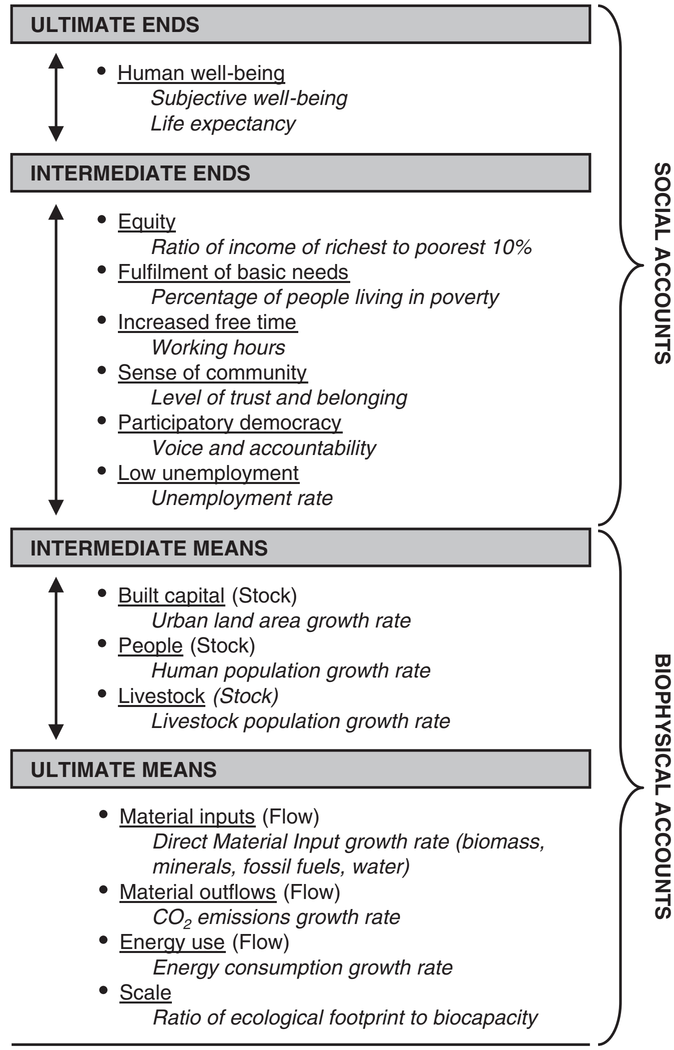

Fig. 4. A potential set of indicators to measure progress in the degrowth transition to a steady state economy. The indicators are divided into two accounts (social and biophysical) and are classified according to Daly's End–Means Continuum. Each of the accounts consists of a set of idealised indicators (underlined), and a potential proxy that could be used to measure each of these based on data that are currently available (*italics*).

5. Discussion

5.1. The Complete Set of Indicators

The complete set of idealised indicators proposed in the previous section is presented in Fig. 4. The indicators are divided into two separate accounts (biophysical and social), and organised using Daly's Ends–Means Continuum. Although a discussion of the best way to measure each idealised indicator is beyond the scope of this paper, the figure does provide an example of an existing indicator that could be used as a proxy for each idealised indicator (e.g. change in urban land area could be used as a proxy for change in the stock of built capital).

At this stage there are three important points to make. First, the idealised indicators that I have presented are largely intended to measure *sustainability* (this is the role of the biophysical indicators) and *sufficiency* (this is the role of the social indicators). However, the conceptual framework could also be used to derive a number of useful *efficiency* measures by taking the ratio of indicators in different levels of the hierarchy. For example, the Happy Planet Index (Abdallah et al., 2009), which takes the ratio of ultimate ends to ultimate means, is an efficiency indicator that could be derived from the framework. Whilst it is important not to conflate environmental and social goals, it is also important to look at how biophysical and social indicators affect each other in order to build a better understanding of complex economic systems.

Second, whilst the framework clearly separates between social and biophysical indicators, there is not a separate group for "economic indicators". Conventional economic indicators like the unemployment rate are included in the same group as social indicators like sense of community. The reason for this is that the conceptual framework takes a very broad view of the economy, seeing it as the system that translates ultimate means (i.e. natural resources) into ultimate ends (i.e. human well-being). Within this conceptual framework, all of the indicators are effectively economic indicators.

And finally, GDP is not included in the set of indicators. As discussed in Section 2.1, GDP is a poor indicator of social welfare, and its continued use represents a "serious information failure" (van den Bergh, 2009). Although some authors (e.g. Czech et al., 2005) have argued that GDP could be reinterpreted as an indicator of environmental stress (instead of social welfare), such an approach would be second-best in comparison to using actual environmental indicators. The approach that I am proposing is not to adjust, supplement, or reinterpret GDP, but to replace it with more relevant information.

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5.2. The Pathway to a Steady State Economy

A key research question to answer is which countries should pursue degrowth, which countries can still benefit from economic growth, and which countries are closest to a steady state economy. It seems likely that wealthy countries in Western Europe and North America need to degrow their economies before establishing a steady state. It seems equally likely that poor countries in sub-Saharan Africa can still benefit substantially from economic growth (provided that the benefits of growth are distributed equitably). However, this leaves a vast grey area in between where the appropriate development paths are unclear. Should China continue to pursue its policy of rapid growth, or has resource use already reached an undesirable level? What about India, South America, or Eastern European countries?

The set of indicators that I have proposed can help answer these questions. The three different categories of indicators in the biophysical accounts (i.e. change in stocks, change in flows, and scale) may be thought of as orthogonal dimensions that form a three-dimensional space (Fig. 5). In theory, a point for each country could be plotted in this space, based on the values of its individual indicators. This approach would provide a clear visualisation of how close a given country was to a steady state economy, and which issues (e.g. population growth, resource use) needed to be addressed in order to move it closer to this goal.

In practice, the data would probably be easier to interpret if only two dimensions were considered at a time. If data were plotted for scale and change in flows, for example, then each country would fall into one of four quadrants, which I label desirable growth, undesirable growth, desirable degrowth, and undesirable degrowth. Using this approach, the pathway for a given country to reach a steady state economy could be plotted (Fig. 6). For example, if an economy were experiencing *undesirable growth* (i.e. its resource use was too large and yet still increasing), then degrowth would be necessary before it could achieve a SSE. If an economy were experiencing *desirable degrowth* (i.e. its resource use was too large but decreasing) it would need to continue on this path until its resource use reached a sustainable level, at which point further degrowth would no longer be necessary, and it would have achieved a SSE. On the other hand, if an economy were experiencing *undesirable degrowth* (i.e. its resource use was below the optimal level and yet decreasing), then growth would be necessary before it could achieve a SSE. And finally, if an economy were experiencing *desirable growth* (i.e. its resource use was below the optimal level but increasing) it would need to continue on this path until its economy reached the optimal size, at which point growth would no longer be necessary, and it would have achieved a SSE.

The concept of optimal size is obviously important to define in such an analysis. The simplest option would be to define optimal size as the maximum sustainable size — in other words, to define it based solely on biophysical indicators related to the capacity of ecosystems to regenerate materials and assimilate wastes. If the ecological footprint were used as an indicator of scale, then optimal size might be defined as a "fair earthshare" (i.e. the biocapacity that would be available to each person if global biocapacity were equally divided amongst all people). A country that fell into either the desirable growth or desirable degrowth quadrant would be moving closer towards both its maximum sustainable size and international equity (in terms of resource use).

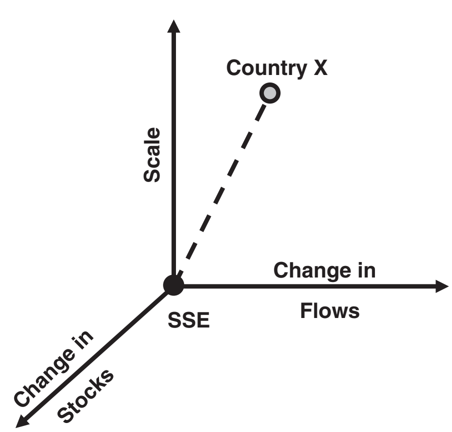

Fig. 5. A three-dimensional visualisation of the distance between a given country's performance and the goal of a steady state economy (SSE), based on the three indicator groups in the biophysical accounts.

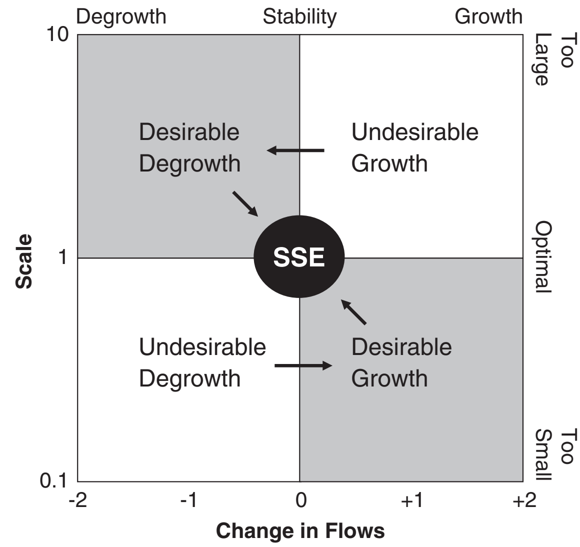

Fig. 6. A two-dimensional visualisation (with scale and change in flows) showing the pathway to a steady state economy.

Alternatively, optimal size might be defined somewhere below the maximum sustainable level to provide ecological space for other species. In fact, the indicators in the social accounts might even be used to help decide on the optimal size of the economy. For example, if an economy achieved a certain *sufficient* score on the indicators in the social accounts, and its resource use was still below the maximum sustainable level, then this lower level might be considered the optimal size for the economy. Or, following Lawn (2003b, 2006), a cost-benefit approach could also be used to define optimal size. Such an approach might use the ISEW in conjunction with biophysical indicators of scale, and define optimal size as the level of resource use corresponding to the peak in the ISEW. Although one would hope that optimal size defined in this way would be less than the maximum sustainable size, this might not happen in practice (e.g. due to the difficulties in accounting for environmental costs). Therefore, any alternative measure of optimal size would need to be checked against the maximum sustainable size.

5.3. The Importance of Targets

For indicators to be meaningful, they require targets. As Meadows (1998, p. 12) writes, "An environmental indicator becomes a sustainability indicator (or unsustainability indicator) with the addition of time, limit, or target." Without targets, indicators only provide contextual information.

The targets for two of the biophysical indicator groups – change in stocks and change in flows – are implicit in the proposed framework (the targets are zero). However, meeting these targets really only becomes a priority after the goal of sustainable scale is satisfied. This target should be decided based on the best scientific evidence available, applying the precautionary principle where there is uncertainty, and acknowledging that no target is value-free.

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The targets for the social indicators, on the other hand, should probably be chosen based on a democratic and participatory process. This process could be informed by looking at the "best performers" on individual social indicators. Such an approach would help people to envision what a successful steady state economy might look like (e.g. an economy that combined the low working hours of the Netherlands, the high happiness of Costa Rica, and the low inequality of Japan — all achieved using the modest material throughput of Cuba).

6. Conclusion

This paper proposes a common information system to measure what is meant by both degrowth and a steady state economy. In doing so it builds on Kerschner's (2010) work showing the complementary nature of the two ideas. The strength of the steady state concept is its focus on the biophysical resources that the economy depends on, and therefore the biophysical indicators proposed are largely drawn from the definition of a steady state economy. The strength of degrowth is its focus on social objectives, in particular human well-being and social equity. Hence the social indicators proposed are largely based on the stated goals of the degrowth movement.

If wealthy nations change their goal from economic growth to a steady state economy, then they will also need to change the way they measure progress, abandoning GDP and replacing it with more relevant information. The indicator framework that I have proposed would help guide any country that decided to pursue such a transition.

But there is also value in applying the indicators to other countries, regardless of their economic goals. The biophysical indicators could be used to determine which national economies are growing, which are degrowing, and which are closest to the steady state. Some countries are undoubtedly closer to a steady state economy than others, even if it is not their objective. Some may even be degrowing. Do these countries perform better or worse on the social indicators than their growing counterparts? To answer this question, I am working on translating the idealised indicators proposed in this paper into measurable quantities, to create what might be termed the "Degrowth Accounts". Such information will contribute to a better understanding of economic systems, and could provide valuable insights into the reforms needed to achieve – not just a biophysical steady state economy – but one that is socially sustainable as well.

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