

Title: Measuring the Success of Sustainable Development Indices in Terms of Reporting by the Global Press.

Stephen Morse

Centre for Environmental Strategy,

University of Surrey

Guildford

Surrey GU2 7XH

Telephone +44 (0) 1483 686079

Fax +44 (0) 1483 686671

Email: s.morse@surrey.ac.uk

Abstract

A variety of indices have been applied to the performance of nation states, both for research and as aids to help guide policy and intervention. While the literature on indices is extensive, the focus to date has been almost entirely on technical issues of index creation. However the success of an index is arguably related at least in part to the use of that index by policy makers and managers. While cause-effect can be difficult to determine, one approach is to measure 'success' in terms of the reporting of indices by an intermediary group such as the media, and this paper assesses the reporting of 24 indices by newspapers worldwide until 2012. The results suggest that index success is influenced by a number of factors, including the time it has existed, its focus, extent and quality of publicity, adaptability in terms of the scope for others to change the content and methodology of the index and resonance in terms of the match with ideas/culture/behaviour of people. The paper makes a case for a new research field that seeks to investigate the meaning and factors involved in 'success' of indices and how these should help with index development.

Key words: Indices; country performance; newspapers; success

Introduction

Indicators and indices (where an index is an amalgam of indicators) are increasingly being developed and applied within a host of fields, including indices of development, poverty, deprivation, environmental quality, landscape, transport, education and health care. While useful as tools within research their value is increasingly being seen as ‘translation’ devices that allow complex datasets and concepts to be encapsulated in ways that allow their digestion by non-specialists, including policy makers and managers (Turnhout et al., 2007). There are, of course, dangers inherent with over-simplification of complex areas (Saltelli, 2007; Barnett et al., 2008; Klein, 2009) but the advantages of indices as tools to aid with decision making have tended to outweigh these disadvantages.

To date the academic discourse surrounding indices has tended to focus almost entirely upon technical issues such as decisions over what indicators to include in an index, how they are weighted relative to each other, the quality of the data and how data are transformed or manipulated. Typically these contributions have sought to create new or to modify existing indices so as to ‘improve’ upon them in some way, where ‘improve’ is largely seen in these technical terms. Understandably this literature has viewed success of the index almost solely in terms of its ability to best represent the underlying complexity which it is meant to encapsulate, although even here there is inevitably a significant degree of subjectivity (Niemeijer and De Groot, 2008). Indeed it can almost be said that there is as much art as science in indicator and index development. For example, probably one of the best known indices is the Human Development Index (HDI) created by the United Nations Development Programme (UNDP) and founded upon the work of the Nobel Prize winning economist

Amartya Sen and others (Böhringer and Jochem, 2007; Wilson et al., 2007) and first published in 1990. The HDI is a relatively simple index, having just three components, and since its first release has been the subject of much critical discussion in the academic literature in terms of the simplifying assumptions upon which it is based. For example, there is the assumption that the HDI should have just 3 components and that these be weighted equally, thereby allowing a degree of ‘trade off’ between them. A second source of contention is the absence of any environmental cost element to the HDI; in effect one can achieve progress in all 3 components of the HDI at the expense of degrading the environment. While good reasons can be given for all of these decisions, for example the need to keep the HDI as simple and as transparent as possible, they are still largely subjective.

In contrast to the extensive literature focussed on more technical aspects of index development there have been relatively few attempts to assess the success of indices in terms of their influence over policy or indeed interventions in general (Bell and Morse, 2011). Part of this is no doubt due to the fact that dissecting a presumed cause-effect link between an index and a specific policy or intervention is by no means a straightforward matter. The index may be just one element amongst many influences that have an impact upon a decision, and separating out this contribution from all the others could be challenging. Indeed some have suggested that the simplifying assumptions behind all indices means that they will inevitably have a low utility for decision making although they may have some value in terms of communication (Hinkel, 2011; Preston et al., 2011). Another factor to consider is a potential divergence between the choice of indicators and indices based upon a more theoretically-founded conceptual framework (and this is something that is often called for in

indicator/index development; Pissourios, 2013) and what policy makers may be looking for in terms of trying to achieve practical objectives (Steurer and Hametner, 2013).

A literature on the use of indices is beginning to emerge, both in terms of theory and empirical evidence. Some of the earlier work set out typologies for index use alongside empirical work typically focussed on use within the policy domain by government departments and agencies (Gudmundsson, 2003; Eckerberg and Mineur, 2003; Hezri, 2004, 2005; Hezri and Hasan, 2004; Hezri and Dovers, 2006; Lyytimäki et al., 2013) and more recent work has seen the emergence of evaluation frameworks to allow the utility of indices to be analysed (for example that of Ramos and Caeiro, 2010). The assumption often made in the policy domain is that indices should primarily have an instrumental-type of use, whereby they are used to make decisions and measure impacts of those decisions (Rinne et al., 2013). However, indices can also be used as communication tools or even to help with conceptualisation of complex issues and learning. Thus while sustainable development is a complex subject to articulate it can be more grounded if it is expressed in terms of a suite of defined and measurable indicators (Rydin, 2007). Exploring the communication value of indices is less well-explored in the literature than their use in policy, but as a first step one could look at the reporting of an index by the media; a group that can be presumed to have some influence over the general public and indeed civil servants, politicians etc. (Holt and Barkemeyer, 2012; Mekelberg, 2012; Schmidt et al., 2013). This is admittedly something of a complex two-way relationship as the media is in turn influenced by these same groups (Barabas and Jerit, 2009), but it seems reasonable to assume that if the media 'uses' an index in its reporting then that is a measure of 'success' for that index even if a rather limited one. After all, given that indices are tools that aid with the communication of what can be very

complex concepts then one would expect them to be very useful within the media; evidence suggests that is indeed the case (Saltelli, 2007).

The empirical literature on the ‘use’ of indices by the press is small but growing, and Morse (2011a, 2011b) explored the reporting of three indices (HDI, Ecological Footprint and the Corruption Perception Index) by a number of UK national newspapers. He found that a range of factors influenced reporting (as measured by variables such as the number of articles and number of mentions per article), but that study was limited in the sense that it only looked at three indices and, more importantly, it was focussed solely on reporting in a group of UK national newspapers. Hence while patterns could be discerned it was not possible to produce more generalisable insights. The aim of this paper is to address these limitations by exploring the reporting of a much larger and more diverse set of indices (24 in total) spanning concerns of relevance to those involved in sustainable development and by exploring their reporting in newspapers from across the globe. Are these indices used by the newspaper journalists and, if so, do they differ in terms of the extent of their use? What are the factors that may influence the extent of usage of indices by such a group?

Methodology

(a) Choice of indices

Selecting a sample of indices so to assess their reporting by the press is a challenging task in itself, not least because many exist and each of them has its own set of ‘champions’. Hence any attempt to select a sample of indices is inevitably going to involve rejecting some that are

highly cherished by their creators and proponents for what they regard as good reasons and they will no doubt be highly critical of exclusion. Nonetheless given the substantial number of indices that exist it was necessary to select a sample for analysis, and the decision was taken to select as large a sample as possible (in this case 24) using a set of defined criteria. The latter will be subjective to a degree, and thus open to criticism, but they are set out here. As a starting point the indices included in the analysis were taken from a survey undertaken by the UNDP on indices that apply at country scales (Bandura, 2008). The report lists a total of 178 'measures' (spanning indices as well as suites of separate indicators and scores) designed to assess country performance across various aspects of development, but here it was decided to focus only on measures that are discrete (single number) indices (others listed in the report are suites of indicators) and only on those indices that had been updated over a number of years (many indices are just 'once off' creations). In some cases the indices are updated annually while others are updated on a biannual or even longer basis. Each index chosen for the sample had to have a minimum of 6 reported values up to the 31st December 2012 (i.e. had to have been published at least 6 times). The choice of 6 values for each index was admittedly somewhat arbitrary and the decision was primarily driven by the need for enough points to allow for a regression analysis of the index over time. A further selection criterion was to focus on those indices that are relevant at global rather than regional scales (e.g. to the European Union or the 'Middle East'). However, this criterion is not straightforward and here it was interpreted in two ways:

1. By the number of countries receiving a value of the index. For example the HDI and its UNDP-created relatives cover almost every country.
2. An index that might apply to relatively few countries but which is anticipated to be of wider relevance. An example is the Commitment to Development Index which is only

applied to some of the more developed countries but would be expected to be picked up and reported upon by the press in many of the less developed countries given its relevance to them.

Hence there was no 'minimum threshold' for the number of countries that had to be covered by an index for it to be globally relevant.

While all the indices are designed to have a 'reach' into the media the emphasis was placed upon those created and promoted by major organisations, such as international Non Governmental Organisations (NGOs; e.g. World Wildlife Fund, Save the Children, Transparency International), publishers (Economist magazine) and groupings (World Economic Forum) as well international agencies such as the UNDP. It was assumed that such organisations would have a strong ability to promote their respective indices.

Finally a decision was made to exclude indices that are known to have an extremely wide coverage in the media such as the Gross Domestic Product (GDP) and its family of related indices such as the Gross National Product (GNP). The reporting of such indices on a global basis would no doubt run into the tens of thousands of articles each year.

A total of 24 indices from the Bandura (2008) report matched these criteria and they are listed in Table 1. The time series were different for the various indices; some are relatively long-lived (such as the HDI) while others are newer (such as the Global Hunger Index). The final year for inclusion for each index was 2012 and the starting year was the first year that the index was reported upon in at least one newspaper article; a year that might not necessarily correspond with the year in which the index was created. Thus while the Big Mac Index was

first published by the Economist magazine in 1986 the first time it was reported in a newspaper article was 1988. Thus there can be a lag effect between creation and first reporting. Secondly, in some cases the fact that the index is being developed, perhaps allied with the release of a pilot study as a short report or even a preliminary technical or academic paper, can be picked up by the press before there is a first release of an official version. Thirdly, it should be noted that even if an index is 'officially' no longer updated, often because it has been superseded by another index, it is possible for the index to continue to be reported in the press. An example here is the Human Poverty Index (HPI) produced by the UNDP and which was discontinued in 2010 in favour of the Multidimensional Poverty Index (MPI). In both cases the idea was to represent poverty in a much broader sense than just monetary and the HPI was a pioneer for the MPI. Another reason for continued reporting of discontinued indices is that press articles may be making historical comparisons or perhaps because the ideas inherent in the initial index have been picked up by other organisations and variants of the index continue to be published. An example of the latter is the Environmental Sustainability Index (ESI) produced by the Universities of Colombia and Yale in the USA (under the auspices of the World Economic Forum) and which was discontinued in 2005, although a number of countries and organisations continued with variants of the ESI and often use the same name. The author interpreted this reporting as a continued influence of the initial index, even if the format and owner had changed. The periods in Table 1 represent the years of reporting of the index included in the analysis.

<Table 1 near here>

(b) Press reporting

Two aspects of reporting were considered to be important in this research for assessing success of each index:

1. The number of articles published each year that mentioned the index at least once.
2. The diversity of reporting across newspapers.

Under the first measure it is possible to have a high degree of reporting by just one newspaper. This is significant, of course, but readership may be limited. Hence the second measure was designed to assess the spread of reporting. It was assumed that the higher the diversity then the better the exposure of the index. Therefore the 'success' of an index was regarded as being related to both of these aspects - number of articles/year and diversity. This is a very limited vision of 'success', of course, in the sense that it does not take into account whether the indices were reported correctly or indeed what they were used for in the articles, but it does provide a starting point.

The number of articles reporting each index up until 2012 was found using the subscription-based Nexis database and search tools available via LexisNexis (internationalsales.lexisnexis.com/english-is/home.page). The sources selected were 'All news, All languages' and at the time of the search this spanned a total of 6760 newspapers in countries from across the globe in the following languages; Arabic, Danish, Dutch, English, Finnish, French, German, Italian, Malay, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish and Turkish. Given these numbers it is not possible to provide a full list of all the newspapers held in the Nexis database. It should be noted that even in non-English publications the index is often reported using its English name, but this may not always be the case and hence the search returns are likely to under-represent the true reporting. The

Nexis database was set to return a list of newspapers and number of articles per newspaper reporting the index in that year, and these data were entered into Excel for processing. Other categories of print media such as magazines and trade journals were not included. Hence the definition of a ‘newspaper’ was that employed de facto within the Nexis database. No formal definition is presented by Nexis, but the following as set out in the Oxford Dictionary is appropriate:

"A printed publication (usually issued daily or weekly) consisting of folded unstapled sheets and containing news, articles, advertisements, and correspondence "

For each index the number of article counts per year were summed across all the newspapers and converted to a logarithm ($Z = \text{LN } X + 1$). In order to calculate the diversity of reporting for each index and year a modification of the Shannon equation was adopted:

$$H = - \sum_{i=1}^{i=S} p_i \log_2 p_i$$

Σ = ‘sum of’ (sum over all newspapers from 1 to S)

S = the number of newspapers carrying a story on the index in that year

\log_2 = logarithm to the base 2

p_i = the proportion of the total sample of newspaper stories mentioning the index for the i th newspaper such that:

$$p_i = \frac{n_i}{N}$$

Where n_i is the number of stories mentioning the index in a year for newspaper i and N is the total number of stories mentioning the same index for that year. The greater the value of H (the Diversity Index) then the greater the diversity of reporting.

Trends in the logarithm of articles count and the values of H over the period of reporting were determined using regression analysis.

Results

It is not necessary to present all of the data here but Table 2 presents the mean and standard deviations of the article count and diversity index per year for the 24 indices.

<Table 2 near here>

The picture set out in Table 2 is somewhat limited as it does not show the pattern of change in terms of press reporting of the indices over time. Rather than present graphs for all of the indices a summary of attempts to fit regressions to the data for the 24 indices is shown as Table 3. For both measures of 'success' exactly half of the 24 indices had no statistically significant trend over time while the other half did. Of those that did have a significant trend over time the majority (7 out of 12) were quadratic in nature, with a gradual increase in the measure of success to a peak followed by a decline. The remainder either had a linear trend with time (suggestive of a flattening of the variable over time) or cubic (suggestive of an increase followed by decline followed by an increase).

<Table 3 near here>

Given that the number of articles per year and the diversity of reporting across the newspapers are two ways of assessing success of the indices, at least in terms of their uptake by newspapers, then it is instructive to explore the placement of indices within a two dimensional space represented by these two measures. Figure 1 is a plot of the means in Table 2 in graphical form, with the logarithm of the number of articles/year as the horizontal axis and average diversity/year as the vertical. Interestingly these two measures of success have a statistically significant relationship, although this is most apparent if Carbon Footprint (CF) is omitted from the analysis as an outlier. The regression line in Figure 1 suggests that much of the increase in the number of articles is driven by a broadening of the reporting amongst newspapers (i.e. as diversity increases then so does the number of articles). This makes sense as it seems unlikely that any one newspaper or perhaps just a few will continue to report an index within a single year and thus increase the article count. It is far more likely that indices with high articles counts will have them spread amongst a number of different publications. Therefore in Figure 1 the successful indices are those to the right hand side of the graph while the least successful are those towards the left hand side.

<Figure 1 near here>

The index having the greatest degree of 'success' by far was the Carbon Footprint (CF; average article count per year of 5541.83) and in Figure 1 it does seem to be something of an outlier. This was followed by the HDI, Ecological Footprint (EF) and Corruption Perception Index (CPI).

Discussion

Drawing some general lessons from these findings to help enhance the success of indices is a challenge. Firstly, it should be noted that all of the indices analysed were used by newspaper journalists albeit to varying degrees. It is often said that the use of indicators and indices tends to be restricted to those in the ‘indicator circuit’ comprising those who create and modify them and those who have to use them (Rinne et al., 2013) but here at least there is evidence of some use outside of that circuit even if it is limited to communication of wider topics (environmental impact, corruption, quality of life etc.). Secondly, it needs to be reiterated that success of the indices was assessed in a narrow sense of reporting by newspaper journalists, with no assessment made as to whether they were used correctly. Indeed by the definition employed here, an index could be misused by a journalist (i.e. used to portray something that the index was not necessarily designed to do) yet this would still form part of the article count. Hence in the analysis reported here the apparent ‘misuse’ of an index still forms part of the ‘success’ of that index. Clearly there is a need for careful definition of terms when trying to assess the success of indices, and indeed one persons ‘use’ can be another’s ‘misuse’.

If success of an index is seen in terms of both the number of articles and diversity of reporting by the press then the three that stand out are the HDI, CPI and footprint indices. Indeed these were the three indices (HDI, CPI and Ecological Footprint) that Morse (2011a, 2011b) focussed on in his analysis of reporting in UK national newspapers. The fact that they also emerged as the most reported indices amongst global newspapers is interesting and not

necessarily anticipated (especially in the case of the CPI). The popularity of the footprint indices is perhaps related to the indices being very adaptable. They have no single owner and their methodology varies, but this flexibility may well aid their reporting by newspapers. A second factor is that with the CF and EF the notion of 'footprint' has become synonymous with a general sense of environment impact; the names have almost become vernacular in a way that one does not see with any of the other indices in the sample.

The HDI is certainly one of the most strongly promoted indices in the sense that new versions have been released each year since 1990 with accompanying fanfare from the UNDP; a global institution with offices in many countries. HDI is an index that attempts to assess a very broad concept – human development – and this has in turn become synonymous with 'quality of life' in the eyes of many and hence may have some attraction for the newspaper readership of developed countries. While the extent of reporting of the HDI was much less than that of the EF in the UK national newspapers employed by Morse (2011a, 2011b) in the global set employed here it is on a par. This is reasonable given that the HDI would probably have a great deal of resonance in many developing and transitional economies and perhaps less so in the press of the developed world

The apparent popularity of the CPI in newspapers is perhaps less understandable given that it is a more specialised index than the HDI which focuses on development and the footprint indices on the environment. The CPI shares some aspects of the HDI in terms of its promotion by a major international organisation, although in this case it is an NGO (Transparency International), and is focussed on corruption, an aspect of life that is important for business and indeed is one that many people face each day. The CPI certainly seems to be achieving greater exposure than the other corruption index included in the research – the

Bribe Payers Index (BPI). Both indices are produced by Transparency International but the CPI seems to have had a greater degree of success.

The success of the HDI, CPI and footprints contrasts markedly with some of the less successful indices at the other end of the scale. The relatively low reporting of the 'Democracy Score' is perhaps more understandable as this is specifically focussed on the states of the old Soviet Union and thus may perhaps be regarded as quite specialised. Two of the indices from the Human Development Reports – the GrDI and the GEM – have a relatively low 'success' as indeed do the ESI and its relative the EPI. The low 'success' of the ESI and EPI is perhaps related to their being complex indices focused primarily on the environment, although that is more the case for the EPI than the ESI, and they may appear to be more abstract than the two footprint indices. The GrDI and GEM are of the same UNDP-stable as the HDI and are provided within the Human Development Reports and backed by the same extensive network of UNDP offices. Both are focussed on gender equality and this has been a major theme in development. Yet these two indices are well behind the HDI and indeed that other index contained within the HDRs – the Human Poverty Index.

The LPI is quite specialised in the sense that it tries to capture biodiversity, albeit in a limited sense. The focus of the LPI on vertebrate species probably helps enhance its success as this is the group of species with greatest public appeal. Some other surprises towards the left hand side of Figure 1, at least for the author, are the Genuine Progress Indicator and the Mothers Index. Given their foci one would perhaps have expected a greater degree of success for these two. The Mothers Index is supported by Save the Children, a major international NGO, and has existed since 2000. The GPI is presented as an alternative to the GDP, one of the most widely reported indices by some orders of magnitude compared to even those at the top end

of the scale in this analysis, and given that attempts to quantify in financial terms factors such as social and environmental 'costs' one would have expected a higher level of reporting.

The pattern in Figure 1 suggests that while the focus of the index is clearly important it is not necessarily the major determinant of success. Also, it is not necessarily the case that backing from a major international organisation guarantees success, as shown by the presence of the Mothers Index and gender indices at the lower end of the success scale. No doubt 'promotion' is a complex element comprising factors such as availability of local personnel to promote the index, presentation style, use of 'league tables' etc. Neither does age of the index appear to be a sole requirement for success although it does seem to have some influence. The HDI was first published in 1990 and the EF was also born in the early 1990s. However, the gender indices have been around since 1997 and the LPI since 1998, but the CF originated at much the same time as these and the GPI was born at much the same time as the HDI although it has had nothing like the same degree of success in terms of its use by newspaper journalists. But there is a special factor which perhaps helps to explain the success of the footprint indices. These indices have managed to weave their way into language in a way that none of the other indices, not even the HDI, have managed to achieve. The reasons for this may be partly because of 'adaptability' as many groups and organisations have been able to generate variation on the 'footprint' theme and thus have a sense of ownership, but also because the term has a resonance in the lay mind; footprint is readily synonymous with impact and does resonate with the human sense of greed.

It should also be noted that there is no evidence here to suggest that an index necessarily needs to be technically excellent to be successful. All of the 24 indices, including those that were most successful by the criteria employed here, have certainly had their critics over the

years. There are subjective elements to all of them even if their proponents have made a strong effort to set out and rationalise their methods and assumptions. Index creation is an amalgam of concerns, and some of these are inevitably rather subjective given that the aim is to simplify complexity (Saltelli, 2007). It is certainly true that anyone creating an index or modifying an existing one has a duty of transparency - to set out the methodology and assumptions in a way that others can follow - but it should be noted that acceptance of all of these assumptions by other experts in the field while important may also be mixed (Saltelli, 2007). Indeed, transparency may only go so far and while decisions are explained their ramifications may not be. Examples of the latter with regard to weighting of components are provided by Paruolo et al. (2013) for a number of indices, including the HDI. In fairness it should be noted that some of the indices (e.g. the HDI) have evolved as a result of feedback. However the important point to make here is that the users of the index, and here it is newspaper reporters, will not necessarily be familiar with these details or indeed make any effort to seek them out and this generates something of a conundrum. The *raison d'être* of many indices is to allow non-specialists to digest and use what can be highly complex data and ideas. They are thus presented as de facto 'black boxes' and understandably the consumers treat them in that way and take it on trust that they 'work'. This, of course, puts a great deal of responsibility on the shoulders of the index creators, and the dangers inherent with simplification do not go away (Barnett et al., 2008; Klein, 2009).

The results reported here help to reinforce calls for index creators to move beyond thinking about technical issues of indices and indeed indicators and to consider 'success' in terms of whether these tools are used and have an influence. An important aspect of this is for index creators to consider the needs of those that are meant to use the tools (Blancas et al., 2011; Shen et al., 2011). Admittedly this can be a challenge for indices that are meant to be used by

a variety of groups, including the media, but this concern should be at the very core of any attempt to develop or evolve indicators and indices.

Conclusions

Index success has received relatively little attention despite the fact that many of these tools were meant to be used to help influence policy and intervention instigated by others. This is probably due in part to the significant challenges involved in dissecting any cause-effect with indices. But nonetheless this is a topic which needs investigation. Defining 'success' in order to assess it is, of course, an issue and in this paper it has been taken very narrowly as the degree and diversity of reporting by newspapers. While this is a limited vision of 'success' it does provide a starting point to help with assessment. The results suggest that success can be assessed, and there is plenty of scope to refine the visions and means of doing this that go beyond what has been used in this paper, and this leads to a conclusion that such information can be and indeed should be used as an input into index development. Given that all indices exist to be used then it may seem odd that this aspect has received relatively little attention in the academic literature.

Acknowledgements

The author would like to thank the anonymous reviewers for their useful comments in the improvement of this paper. The views expressed are solely those of the author.

References

Bandura, R. (2008). Survey of Composite Indices Measuring Country Performance: 2008 Update. UNDP/ODS Working Paper. Office of Development Studies, United Nations Development Programme, New York.

Barabas, J. and Jerit, J. (2009), Estimating the Causal Effects of Media Coverage on Policy-Specific Knowledge. *American Journal of Political Science* 53(1), 73–89.

Barnett, J., Lambert, S., and Fry, I. (2008). The hazards of indicators: insights from the environmental vulnerability index. *Annals of the Association of American Geographers*, 98(1), 102-119.

Bell S and Morse S. (2011). An analysis of factors influencing use of indicators in the European Union. *Local Environment: The International Journal of Justice and Sustainability* 16(3), 281 - 302

Blancas FJ, Lozano-Oyola M, González M, Guerrero FM and Caballero R (2011). How to use sustainability indicators for tourism planning: The case of rural tourism in Andalusia (Spain). *Science of the Total Environment* 412-413, 28–45

Böhringer C and Jochem PEP (2007). Measuring the immeasurable — A survey of sustainability indices. *Ecological Economics* 63(1), 1–8

Eckerberg K and Mineur, E (2003). The use of local sustainability indicators: Case studies in two Swedish municipalities. *Local Environment: The International Journal of Justice and Sustainability* 8(6), 591-614

Gudmundsson H (2003). The Policy Use of Environmental Indicators - Learning from Evaluation Research. *The Journal of Transdisciplinary Environmental Studies* 2(2), 1-12.

Herzi, AA (2004). Sustainability indicators system and policy process in Malaysia: a framework for utilisation and learning. *Journal of Environmental Management* 73(4), 357-371.

Hezri AA (2005). Utilisation of sustainability indicators and impact through policy learning in the Malaysian policy processes. *Journal of Environmental Assessment Policy and Management* 7(4), 575-595.

Hezri AA, Hasan MN (2004). Management framework for sustainable development indicators in the state of Selangor, Malaysia. *Ecological Indicators* 4, 287-304.

Hezri AA, Dovers SR (2006). Sustainability indicators, policy and governance: Issues for ecological economics. *Ecological Economics* 60, 86-99.

Hinkel, J. (2011). Indicators of vulnerability and adaptive capacity: Towards a clarification of the science-policy interface. *Global Environmental Change* 21(1), 198-208.

Holt, D. and Barkemeyer, R. (2012), Media coverage of sustainable development issues – attention cycles or punctuated equilibrium? *Sustainable Development* 20(1), 1–17

Klein, R J (2009). Identifying countries that are particularly vulnerable to the adverse effects of climate change: an academic or political challenge. *Carbon & Climate Law Review* 3(3), 284–291.

Lyytimäki J, Tapio P, Varho V and Söderman T (2013). The use, non-use and misuse of indicators in sustainability assessment and communication. *International Journal of Sustainable Development & World Ecology* 20(5), 385-393

Mekelberg D (2012). The influences of global news messages on national governability: An environmental case study. *Israel Affairs* 18(2), 268-285

Morse S (2011a). Harnessing the power of the press with indices. *Ecological Indicators* 11(6), 1681-1688.

Morse S. (2011b). Attracting attention for the cause. The reporting of three indices in the UK national press. *Social Indicators Research* 101(1), 17-35.

Niemeijer D and De Groot RS (2008). A conceptual framework for selecting environmental indicators sets. *Ecological Indicators* 8, 14–25

Paruolo P, Saisana M and Saltelli A (2013). Ratings and rankings: voodoo or science? *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 176(3), 609–634

Pissourios IA (2013). An interdisciplinary study on indicators: A comparative review of quality-of-life, macroeconomic, environmental, welfare and sustainability indicators.

Ecological Indicators 34, 420–427

Preston, B. L., Yuen, E. J., and Westaway, R. M. (2011). Putting vulnerability to climate change on the map: a review of approaches, benefits, and risks. *Sustainability Science* 6(2), 177-202.

Ramos TB and Caeiro S (2010). Meta-performance evaluation of sustainability indicators.

Ecological Indicators 10(2), 157–166

Rinne J, Lyytimäki J and Kautto P (2013). From sustainability to well-being: Lessons learned from the use of sustainable development indicators at national and EU level. *Ecological*

Indicators 35, 35– 42

Rydin Y (2007). Indicators as a governmental technology? The lessons of community-based sustainability indicator projects. *Environment and Planning D: Society and Space* 25 610-624

Saltelli A (2007). Composite indicators: between analysis and advocacy. *Social Indicators Research*, 81(1) 65-77.

Schmidt A, Ivanova A and Schafer MS (2013). Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries. *Global Environmental*

Change. Pre-publication paper available online at

www.sciencedirect.com/science/article/pii/S095937801300126X#

Shen L-Y, Ochoa JJ, Shah MN and Zhang X (2011). The application of urban sustainability indicators – A comparison between various practices. *Habitat International* 35(1), 17–29

Steurer R and Hametner M (2013). Objectives and Indicators in Sustainable Development Strategies: Similarities and Variances across Europe. *Sustainable Development* 21, 224–241

Turnhout E, Hisschemoller M and Eijsackers H (2007). Ecological indicators: Between the two fires of science and policy. *Ecological Indicators* 7, 215–228

Wilson J, Tyedmers P and Pelot R (2007). Contrasting and comparing sustainable development indicator metrics. *Ecological Indicators* 7(2), 299–314

Table 1. Summary of indices included in the analysis.

	Notes	Period (number of years)
Big Mac Index(BMI)	Introduced in the 'Economist' magazine in 1986. The BMI Seeks to explain the notion of 'Purchasing Price Parity' in economics by using the local prices of the 'Big Mac' hamburger - a product having much the same constituents worldwide.	1988 - 2012 (25)
Bribe Payers Index (BPI)	First published by the pressure group 'Transparency International' in 1999. The BPI (in essence a measure of corruption) is based upon answers given to a series of questions completed by 'businessmen'.	1999 - 2012 (14)
Carbon Footprint (CF)	Carbon Footprint is a measure of the 'greenhouse' gas emission by various units such as individuals, households, companies and countries. Various gases such as methane have a green house effect and the 'carbon footprint' is often measured in terms of equivalent CO ₂ . The origin of the term is uncertain and many methodologies exist for its estimation in practice. The surge in usage of the term is probably related to the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) in 1997.	2001-2012 (12)
Climate Change Performance Index (CCPI)	Published annually by the NGOs Germanwatch and Climate Action Network Europe since 2005. The latest version evaluates the 'climate protection performance' of 58 countries.	2006-2012 (7)
Commitment to Development Index (CDI)	Published annually by the Centre for Global Development the CDI measures the commitment of more developed states towards poorer nations. It was first published in 2003 and in 2012 the rankings included 27 countries.	2003-2012 (10)
Corruption Perception Index (CPI)	Published annually since 1995 by Transparency International (the group that also produced the BPI). The CPI assesses the perception of corruption experienced by businessmen.	1996-2012 (17)
Democracy Score (DS)	Produced by Freedom House, a US based NGO, the first value of the Democracy Score was released in 2004 as part of the 'Nations in Transit' reports and is applied to former	2004-2012 (9)

	communist countries.	
Ecological Footprint (EF)	The EF is a measure of demand placed by people on the Earth's resources. The first version was created in 1992 but many methodological variants on that initial theme have been developed since then - spanning every scale from the individual to the nation..	1993-2012 (20)
Environmental Performance Index (EPI)	The most widely reported EPI is that produced by Columbia and Yale Universities in the US under the auspices of the World Economic Forum. Versions of the EPI have been released by them since 2006 on a biennial basis and a pilot version of the EPI was published in 2002. The same name has been used for other indices prior to the development of the most cited version by Columbia and Yale. For example an index with the same name was developed by a company called PT Caltex Pacific Indonesia.	1996-2012 (17)
Environmental Sustainability Index (ESI)	Another index produced by Columbia and Yale Universities under the auspices of the World Economic Forum. Versions of the ESI were published between 1999 (a pilot study) and 2005, after which it gave way to the EPI. However some countries continue to use the ideas behind the ESI and produce their own versions of the index.	2000-2012 (13)
Failed States Index (FSI)	The FSI is produced by the US-based group 'Fund for Peace' and appears on an annual basis (since 2005) in the magazine 'Foreign Policy'.	2005-2012 (8)
Gender Empowerment Measure (GEM)	An index introduced by the UNDP alongside the more famous Human development Index. GEM is a measure of gender equality/inequality across the globe and was first published in the Human Development Report of 1995.	1995-2012 (18)
Gender-related Development Index (GrDI)	Another of the HDI-related indices produced by the UNDP in the mid-1990s. The GrDI is a version of the HDI sub-divided in terms of gender. It was first published in the Human Development Report of 1995.	1995-2012 (18)
Genuine Progress Indicator (GPI)	The GPI is intended to be an alternative measure of national wealth that takes into account factors not normally included in the Gross Domestic Product – such as voluntary work, housework and the cost of negative impacts on society arising from factors such as crime, family breakdown, degrading of	1994-2012 (19)

	environment and pollution. Various versions of the GPI exist depending upon assumptions as to what to include in the calculation. The ideas behind the GPI originate in the 1980s in parallel with the rise of human development and the term started to be used in the early 1990s.	
Global Competitiveness Index (GCI)	The GCI is published annually in the Global Competitiveness Report (GCR) produced by the World Economic Forum. The first country rankings using the GCI were published in 2004 but global competitiveness indices existed before that year.	1996-2012 (17)
Global Hunger Index (GHI)	The GHI was developed by the International Food Policy Research Institute (IFPRI) and was first published in 2006 in conjunction with Welthungerhilfe, a German NGO. The GHI is produced annually for developing and transitional economies. Countries such as India have also produced their own 'intra-state' version of the GHI.	2007-2012 (6)
Global Peace Index (GPI)	The GPI attempts to assess the relative 'peacefulness' of nation states. It has been published by the magazine 'Economist' on an annual basis since 2007.	2007-2012 (6)
Happiness Index (HI)	Various version of a 'Happiness Index' have been produced over many years at international and national scales. Its origins are linked to the 'World Database of Happiness' in the late 1960s which attempted to accumulate knowledge on 'happiness' with one intention being to provide data for metrics.	1987-2012 (26)
Happy Planet Index (HPII)	The Happy Planet Index combines measures of human well-being and environmental impact into a single index. It was introduced in 2006 by the New Economics Foundation (NEF), a UK-based NGO, and values are published every 3 years (2006, 2009 and 2012).	2006-2012 (7)
Human Development Index (HDI)	The HDI was created by the UNDP and first published in its Human Development Report of 1990. It attempts to combine measure of education, life expectancy and per capita income into a single index.	1990-2012 (23)
Human Poverty Index (HPI)	The HPI is another index from the UNDP stable. It was first published in the Human Development Report of 2007 but was dropped in 2010 in favour of the Multidimensional Poverty Index.	1997-2012 (16)

Living Planet Index (LPI)	The LPI was designed by the World Wildlife Fund to assess the degree of biodiversity in the world, although its focus is on vertebrate species. The LPI is published in the biannual Living Planet Report (since 1998) – a document that also includes a version of the Ecological Footprint for nation states.	1998-2012 (15)
Mothers Index (MI)	The Mothers Index appears in the Save the Children State of the World's Mothers report published annually since 2000. The methodology has changed since 2000 but the latest version combines elements such as the lifetime risk of maternal death and the under 5 mortality rate.	2001-2012 (12)
Press Freedom Index (PFI)	The PFI is produced by the France-based NGO 'Reporters Without Borders' and is based on their assessment of press freedom in countries across the globe. The first assessment was published in 2002.	2002-2012 (11)

Table 2. Mean and standard deviation (SD) of number of articles/year and diversity index/year for the 24 indices over the years of press reporting.

	Article count/year Mean (SD)	Diversity/year Mean (SD)
Big Mac Index	35.44 (32.3)	3.77 (1.78)
Bribe Payers Index	16.50 (15.78)	3.10 (1.33)
Carbon Footprint	5541.83 (5833.28)	5.04 (3.17)
Climate Change Performance Index	11.14 (4.81)	3.07 (0.84)
Commitment to Development Index	10.10 (10.56)	2.39 (1.45)
Corruption Perception Index	177.24 (200.99)	4.99 (1.15)
Democracy Score	3.00 (1.73)	1.27 (0.84)
Ecological Footprint	216.9 (252.82)	4.79 (1.91)
Environmental Performance Index	14.53 (22.22)	1.88 (2.14)
Environmental Sustainability Index	7.92 (8.75)	1.85 (0.86)
Failed states Index	49.13 (36.55)	4.19 (1.78)
Gender Empowerment Measure	5.78 (5.61)	1.57 (1.27)
Gender related Development Index	3.78 (4.88)	1.10 (1.26)
Genuine Progress Indicator	13.16 (6.77)	2.87 (0.81)
Global Competitiveness Index	48.82 (70.6)	2.68 (2.66)
Global Hunger Index	33.17 (24.16)	3.82 (1.36)
Global Peace Index	81.00 (31.43)	4.86 (0.45)
Happiness Index	54.50 (96.22)	2.74 (2.37)
Happy Planet Index	53.00 (21.66)	5.15 (0.59)
Human Development Index	221.48 (283.64)	5.11 (1.12)
Human Poverty Index	11.69 (8.75)	2.58 (0.91)
Living Planet Index	15.40 (28.56)	2.31 (1.66)
Mothers Index	8.25 (4.9)	2.62 (0.95)
Press Freedom Index	56.73 (50.99)	3.90 (1.9)

Table 3. 'Best fit' regression models for the 24 indices in Table 2.

	Best fit model (LN article count)	Best fit model (Diversity)
Big Mac Index	LN Articles = $-0.043 + 0.368 \text{ Year} - 0.00777 \text{ Year}^2$ Error df = 22 Adjusted R ² = 90% (P<0.001)	Diversity = $-0.394 + 0.505 \text{ Year} - 0.0109 \text{ Year}^2$ Error df = 22 Adjusted R ² = 92.6% (P<0.001)
Bribe Payers Index	No statistically significant fit to the data	No statistically significant fit to the data
Carbon Footprint	LN Articles = $1.55 - 1.32 \text{ Year} + 0.534 \text{ Year}^2 - 0.0315 \text{ Year}^3$ Error df = 8 Adjusted R ² = 94.3% (P<0.001)	Diversity = $0.79 - 0.604 \text{ Year} + 0.338 \text{ Year}^2 - 0.0200 \text{ Year}^3$ Error df = 8 Adjusted R ² = 95.9% (P < 0.001)
Climate Change Performance Index	LN Articles = $-0.813 + 3.15 \text{ Year} - 0.831 \text{ Year}^2 + 0.0646 \text{ Year}^3$ Error df = 3 Adjusted R ² = 84.2% (P<0.05)	No statistically significant fit to the data
Commitment to Development Index	No statistically significant fit to the data	No statistically significant fit to the data
Corruption Perception Index	LN Articles = $2.63 + 0.219 \text{ Year}$ Error df = 15 Adjusted R ² = 94.2% (P<0.001)	Diversity = $3.07 + 0.213 \text{ Year}$ Error df = 15 Adjusted R ² = 87% (P<0.001)
Democracy Score	No statistically significant fit to the data	No statistically significant fit to the data
Ecological Footprint	LN Articles = $0.887 + 0.438 \text{ Year} - 0.00779 \text{ Year}^2$ Error df = 17 Adjusted R ² = 90.3% (P<0.001)	Diversity = $0.756 + 0.529 \text{ Year} - 0.0105 \text{ Year}^2$ Error df = 17 Adjusted R ² = 92.6% (P<0.001)
Environmental Performance Index	LN Articles = $-0.741 + 0.272 \text{ Year}$ Error df = 15 Adjusted R ² = 79.2% (P<0.001)	Diversity = $-1.45 + 0.370 \text{ Year}$ Error df = 15 Adjusted R ² = 74.9% (P<0.001)
Environmental Sustainability Index	No statistically significant fit to the data	No statistically significant fit to the data
Failed States Index	LN Articles = $0.37 + 1.18 \text{ Year} - 0.0850 \text{ Year}^2$ Error df = 5	Diversity = $-0.67 + 1.95 \text{ Year} - 0.153 \text{ Year}^2$ Error df = 5

	Adjusted R ² = 66.8% (P<0.05)	Adjusted R ² = 70.5% (P<0.05)
Gender Empowerment Measure	No statistically significant fit to the data	No statistically significant fit to the data
Gender-related Development Index	No statistically significant fit to the data	No statistically significant fit to the data
Genuine Progress Indicator	No statistically significant fit to the data	No statistically significant fit to the data
Global Competitiveness Index	LN Articles = 0.352 + 0.033 Year + 0.0178 Year ² Error df = 14 Adjusted R ² = 89% (P<0.001)	Diversity = - 1.81 + 0.499 Year Error df = 15 Adjusted R ² = 88.7% (P<0.001)
Global Hunger Index	LN Articles = - 0.104 + 1.58 Year - 0.148 Years ² Error df = 3 Adjusted R ² = 95.8% (P<0.01)	Diversity = 0.287 + 1.52 Year - 0.117 Years ² Error df = 3 Adjusted R ² = 95.1% (P<0.01)
Global Peace Index	No statistically significant fit to the data	Diversity = 5.82 - 0.872 Year + 0.138 Year ² Error df = 3 Adjusted R ² = 77% (P=0.051)
Happiness Index	LN Articles = 0.441 + 0.0031 Year + 0.00828 Year ² Error df = 23 Adjusted R ² = 89.2% (P<0.001)	Diversity = - 0.311 + 0.107 Year + 0.00673 Year ² Error df = 23 Adjusted R ² = 87.7% (P<0.001)
Happy Planet Index	No statistically significant fit to the data	No statistically significant fit to the data
Human Development Index	LN Articles = 2.97 + 0.153 Year Error df = 21 Adjusted R ² = 88% (P<0.001)	Diversity = 3.20 + 0.160 Year Error df = 21 Adjusted R ² = 92.6% (P<0.001)
Human Poverty Index	No statistically significant fit to the data	No statistically significant fit to the data
Living Planet Index	No statistically significant fit to the data	No statistically significant fit to the data
Mothers Index	No statistically significant fit to the data	No statistically significant fit to the data
Press Freedom Index	LN Articles = - 0.062 + 0.926 Year - 0.0442 Year ² Error df = 8 Adjusted R ² = 90.9% (P<0.001)	Diversity = - 1.04 + 1.39 Year - 0.0742 Year ² Error df = 8 Adjusted R ² = 87.8% (P<0.001)
No trend	12	12
Linear trend	3	4

Quadratic trend

7

7

Cubic trend

2

1

Figure 1. Logarithm of the average number of articles per year for the 24 indices as a function of newspaper diversity.

Best fit regression line has been fitted to 23 of the 24 indices; carbon footprint has been excluded from the regression as an ‘outlier’.

