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REVIEW ARTICLE

A critique of the European Green City Index

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In 2009, Siemens (Germany) sponsored the research by the Economist Intelligence Unit (London), which resulted in the publication of the European Green City Index report, in which the environmental performance of 30 large cities in Europe was analysed. It provided city administrations with an idea of where they stood *vis-à-vis* their European counterparts. However, while adopting such performance evaluation methodologies, it is important to set targets and goals, and to be aware of pitfalls that may exist in the course of a blind pursuit of a higher Green Score. City administrations are usually segmented into different divisions and departments; often each division strives towards its own set of targets and goals, without being aware (or without being concerned, even if it is aware) of the overlaps, conflicts and synergies that may exist with the targets and goals of the others. The Green City Index needs to be considered together with an Urban Socio-Economic Index, which can be suitably structured with the inter-linkages with the indicators of the Green City Index explicitly described.

Keywords: Green City Index; qualitative indicators; quantitative indicators; Urban Socio-Economic Index

1. Introduction

In 2009, the Economist Intelligence Unit (London, UK), sponsored by Siemens (Germany), published the European Green City Index report (Economist Intelligence Unit, London 2009). A total of 30 cities (most of them capital cities of European countries) were studied under eight different categories (see Table 1 and Figure 1): Carbon dioxide; Energy; Transport; Water; Environmental Governance; Waste and land use; Air quality; and Buildings. In total, these eight categories were composed of 30 indicators (see Table 1). The categories were weighted equally, and within most categories (except Transport), the indicators were also weighted equally. The scores were given on a scale of 1 to 10 for each of the indicators, based on upper or lower benchmarks. In the absence of any existing benchmarks, the min-max method was adopted. Figure 1 shows the total scores of the 30 cities out of a maximum of 80 points. These aggregate scores were subsequently scaled up and expressed on a scale of 0 to 100. The Danish capital city Copenhagen topped the list, while the Ukrainian capital Kiev was last. The Scandinavian capitals – Copenhagen, Oslo and Stockholm – clearly stood out as top performers, as shown in Figure 1. The

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Table 1. The weights (in percentages) of the indicators forming the Green City Index.

Category	Indicator	Weighting (%)
Environmental governance	Green action plan	4.163
Environmental governance	Green management	4.163
Environmental governance	Public participation in green policy	4.163
Carbon dioxide	Emissions	4.163
Carbon dioxide	Intensity	4.163
Carbon dioxide	Reduction strategy	4.163
Buildings	Energy consumption of residential buildings	4.163
Buildings	Energy-efficient building standards	4.163
Buildings	Energy-efficient building initiatives	4.163
Transport	Use of non-car transport	3.625
Transport	Green transport promotion	3.625
Transport	Size of non-car transport network	1.625
Transport	Congestion reduction policies	3.625
Water	Water consumption	3.125
Water	Water system leakage	3.125
Water	Wastewater treatment	3.125
Water	Water efficiency and treatment policies	3.125
Waste and land use	Municipal waste production	3.125
Waste and land use	Waste recycling	3.125
Waste and land use	Waste reduction policies	3.125
Waste and land use	Green land use policies	3.125
Energy	Consumption	3.125
Energy	Intensity	3.125
Energy	Renewable energy consumption	3.125
Energy	Clean and efficient energy policies	3.125
Air quality	Nitrogen dioxide	2.500
Air quality	Ozone	2.500
Air quality	PM	2.500
Air quality	Sulphur dioxide	2.500
Air quality	Clean air policies	2.500

average scores for the different categories (out of a maximum of 10) were 5.78 (Carbon dioxide), 4.9 (Energy), 5.91 (Buildings), 6.08 (Transport), 6.95 (Water), 6.27 (Waste and Land use), 6.75 (Air quality) and 7.23 (Environmental Governance). The respective standard deviations were 2.06, 1.97, 2.71, 1.43, 1.89, 1.81, 1.53 and 2.26.

Most importantly, the publication of this report might have activated various dormant ambitions in some countries which they would then have pursued with much greater vigour and zeal, if only to improve their Green Score and rise up the rankings; for others, it may have given warning signs. However, while adopting such performance evaluation methodologies it is important to set targets and goals, and to be aware of pitfalls that may exist in the course of a blind pursuit of a higher Green Score.

Complementarities and offsets exist among the indicators defined for the purpose of calculating the Green Score. City administrations are often segmented into different divisions and departments; often each division strives towards its own set of targets and goals, without being aware (or without being concerned, even if it is aware) of the overlaps, conflicts and synergies that may exist with the targets and goals of the others.

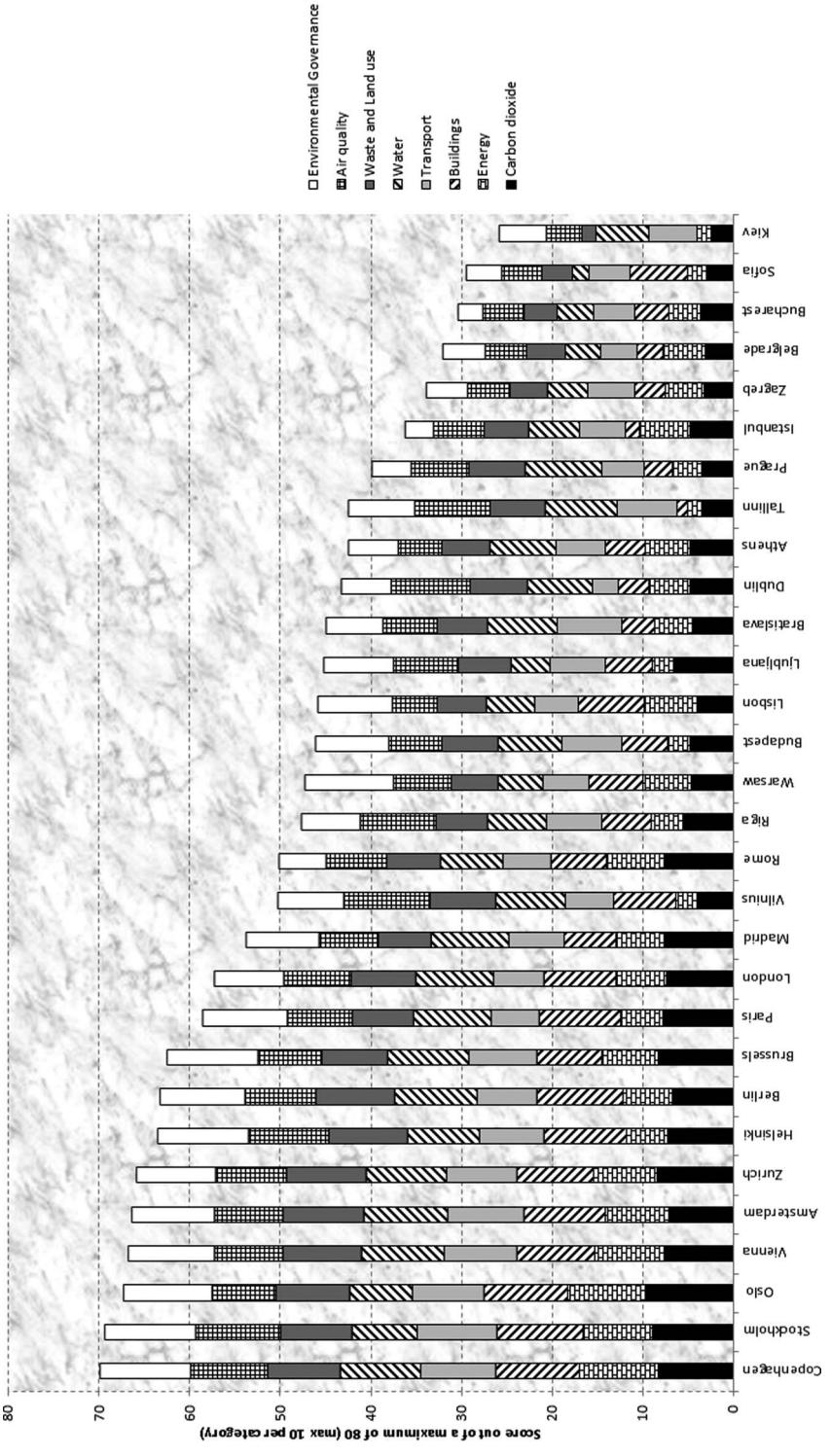

Figure 1. Green City Index values for the 30 European cities.

This short paper presents a critique of the Green City Index, inspired by comments and observations made in the literature about sustainability indicators in general and environmental sustainability indicators in particular (some of which are referred to in the Literature review section that follows). The critique is structured in the Discussion section under four headings:

(1) Adequacy;
(2) Appropriateness;
(3) Acknowledgement of inter-linkages; and
(4) Awareness of conflicts/synergies with non-environmental goals.

2. Literature review

Dyllick and Hockerts (2002) considered eco-efficiency, eco-effectiveness, socio-efficiency, socio-effectiveness, sufficiency and ecological equity as the six criteria of corporate sustainability (see Figure 2), and advised future researchers in this field to address the fact that the triple-bottom-line integration (people, planet and profit) will continue to have many doubters. (The term 'triple bottom line' was coined by John Elkington in 1994.) The criteria defined for corporate sustainability can very well be extended to sustainability in general and urban sustainability in particular, with the Business case being replaced by the Economic case. Palme and Tillman (2009), while referring to this triple bottom line, considered the planet/ environment/natural capital to be the foundation of sustainable development, the profit/economic aspect/ technologies as the means, and the people/social aspects/human well-being as the aim.

The abstractness associated with sustainability (the elusive goal) and sustainable development (the process) can be concretised to some extent by identifying and defining certain indicators, by following the processes of conceptualisation and operationalisation commonly used in the social sciences (Singhirunnusorn and Stenstrom 2009). An indicator, as defined in an OECD report, (Keirstead and Leach 2008) is a parameter or a value derived from parameters, which points to, provides information about, and describes the state of a phenomenon/environment/area, with

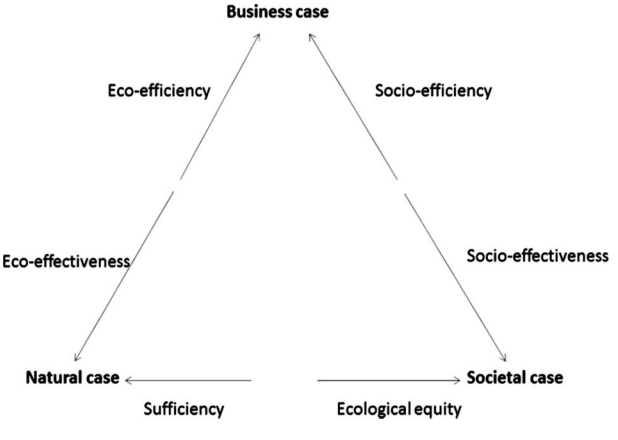

Figure 2. Overview of the six criteria of corporate sustainability.

a significance extending beyond that directly associated with the parameter value. The overarching purpose of sustainable development indicators is to function as tools in planning, to help steer development away from unsustainable trajectories towards more sustainable ones, while auxiliary purposes include facilitating easier communication and structuring understanding of issues in a better way, as noted in Palme and Tillman (2009). It should be mentioned that the degree of urbanisation has been increasing rapidly over the last few decades and, at the time of writing, over half of the global population now live in cities of varying sizes. The total percentage of the urban global population may increase in the near future. Needless to say, cities are centres of consumption, triggering money flows and are responsible for direct and indirect environmental impacts. Hence, when there is a reference to sustainable development indicators, it implies, to a large extent, sustainable urban systems indicators. Lundin and Morrison (2002) listed 15 environmental sustainability indicators for urban water systems. Mitchell (1996) categorised sustainability indicators as simple (intended for communication to laypersons), specific (for scientists analysing systems) and composite (for policy makers in government). Keirstead and Leach (2008) identified the urban water and sanitation system as a service niche in which sustainability indicators can be tested before transiting to urban sustainability as a whole. An urban water system, in its capacity as a component of urban infrastructure, performs the vital functions of water supply and sanitation and thereby fulfils an indispensable social need. Due to its backward and forward linkages with the environment and other sectors of society and the economy, it is well-poised to be a testing ground for a triple bottom line sustainability analysis, whereby economic efficiency and environmental-friendliness are balanced with the aforesaid social imperative.

Hajkowicz and Collins (2007) reviewed the applications of multiple criteria analysis in water supply management and discussed the subjectivity of the choices of the criteria on the one hand, and the relative importance given to the chosen criteria on the other. However, Nistor (2008) reported that in Moldova the indicators proved to be very useful warning signs of deterioration of performance.

As Lundin and Morrison (2002) stated, optimisation is a political process rather than a scientific one. If the indicators have to be ranked in the order of importance, this very often falls outside the realm of scientific methodologies. The choice of the criteria and the weighting factors are greatly influenced by the so-called 'macro-landscape' (Hajkowicz and Collins 2007) – deeply-embedded social and cultural traits (which often remain constant in the medium to long-term), the broad legal framework (which is subject to changes in the short-to-medium term, depending on the changes in the governing entities in charge) and the environmental variability (which, at the time of writing, is a serious concern with the repercussions of climate change introducing a great degree of uncertainty and unpredictability). Lindholm and Nordeide (2000) pointed out that weighting factors could be assigned on the basis of political goals, the seriousness of the problem viewed in terms of the 'distance' to the critical level or the willingness to pay to avoid problems. While observing that the political definition of weighting can easily turn into political debates and that the exercise is sometimes carried out by experts who are not legitimised to do so, Starkl *et al.* (2005) even recommended that the aggregation of criteria must be avoided. As Lindholm and Nordeide (2000) stated that, while choosing the indicators and the weighting factors thereof, the following should be borne in mind:

- How important or relevant is the indicator for the environment, the economy or society?
- How well does the indicator describe the annual trends?
- How much money and effort would be needed to retrieve the necessary data?
- How large is the degree of uncertainty in the calculations?
- How good is the indicator as a decision-making aid, in other words, as part of the basis for actions and plans?
- How well does the indicator perform to provide a basis for comparison across time and for different geographical areas?

These are some of the publications which have inspired and bolstered the critique which follows in the next section.

3. Discussion

The critique is structured around the four 'A's listed in the Introduction. The questions under each of the four aspects are answered, and by doing so I present the strengths and weaknesses of the European Green City Index in particular, and indeed of any such sustainability Index.

3.1. Adequacy

Do the categories and indicators encompass everything that is relevant to environmental sustainability, both in the short term and the long term? Is there a need to add to the list of indicators?

First, there is a clear need to separate the qualitative and quantitative indicators. While there is a great deal of subjectivity associated with the measures of the qualitative ones, it is also understood that these form the Causes behind the quantitative indicators which are, in essence, the Effects. Consideration may be given to splitting up the Green City Index into a Cause Index and an Effect Index. The qualitative indicators could be weighted (based on the relative importance of each set of policies to the environmental sustainability of the city) and aggregated to form the Cause Index. A city may also wish to assign equal importance to all the different policies and thereby equally weight the qualitative indicators related to policy making/governance/strategising. By separating out the 12 qualitative indicators, there will be scope to add to the list of the measurable quantitative indicators. For example, the two quantitative indicators for the Water category – Consumption and Leakages – are inadequate. Just as the indicator Energy Consumption in Residential Buildings is included, Energy Consumption in the Urban Water Sector (on a per-cubic-metre-of-urban-water-demand basis) can also be included – the water-energy-carbon nexus (Venkatesh and Dhakal 2012) is attracting a great deal of attention at present. Indeed, Energy consumed in Transportation (perhaps on a per-passenger-kilometre basis) could also be a useful indicator in the Transport category. While the indicator Energy Consumption in the Energy category is measured on a per-capita basis, Energy Consumption in Residential Buildings is measured on a per-square-metre-of-floor-area basis. The suggested units for Energy Consumption in the Water Sector and Energy Consumption in Transport would ensure that the last three are not subsets of the first one *per se* based on the knowledge of the Effects of the Causes. In other words, using the inter-linkages among the policy-related 'cause'

indicators and the implementation-related 'effect' indicators, city authorities could devise strategies and actions which, by virtue of their complementarity, would yield more from less, harnessing all the synergies that exist.

Each department or division in the city administration may wish to have its own long list of indicators – both specific (for scientists analysing systems) and composite (for policy makers in government), as noted in Mitchell (1996), and they may be expected to provide a few of these as inputs to the Green City Index.

The quantitative indicators can be weighted and aggregated to produce the Effect Index. (The subject of weighting is discussed in one of the following paragraphs.)

3.2. *Appropriateness*

Have the correct indicators been defined for the city in question? Should indicators be tailor-made to different city-types?

If indicators are tailor-made to city-types, there is obviously no means by which two cities of different types can be compared to each other using the Green City Index. However, cities can be compared to others of the same city type. Of course, if the paradigm of continuous improvement by comparing a city's performance only with how well it has performed in the past becomes entrenched, there will not be any hurdle in the path of tailor-making indicators for different city-types. However, cities need not be compared to each other using the aggregated Green City Index or indeed even for individual category scores. Common indicators (with the same methods of measurement) may be compared, and benchmarks may be set accordingly.

For the 30 cities included in the report being analysed, the GDP-per-capita could be used, for example, to define the cut-off between two city-types. While acknowledging the need for socio-economic development in the group with the lower GDP-per-capita values, and also realising the inability of garnering funds for investments in costly eco-friendly technologies, indicators which may be relevant for the other cohort may be considered inapplicable. Of course, as the cities develop economically and the GDP rises (and with it the GDP-per-capita also rises), they would automatically be promoted to the higher class and would then have to consider the indicators that are considered inapplicable to the cohort they belonged to previously. Defining city-types in this fashion would ensure that the city keeps the bigger picture in mind. The evaluation carried out would then respect the rights of different cities – with possibly varying historical and cultural backgrounds – ensuring important aspects are considered first.

What about the weighting factors? Once again, must cities be allowed to define their own factors based on what is considered critical for a given period of time?

As Table 1 shows, all the eight categories have been weighted equally. However, all the 30 indicators are not. Each of the Air Quality Indicators are less weighted than those of the Water, Waste and Land use and Energy Indicators. Within the category Transport, the Size of Non-Car Transport has been given less weighting than the Actual Use of Non-Car Transport. This seems rather difficult to justify, as one would intuitively suppose that the Size of Non-Car Transport Network would have to be larger for the Use of Non-Car Transport to increase. Energy Consumption of Residential Buildings carries a higher weighting than Energy Consumption (total), and evidently the former is a part of the latter. The Carbon

dioxide reduction strategy which carries a weighting of 4.16% would essentially include strategies for the different categories – Energy, Transport etc., and these may well be parts of the policies in these other categories. It is not clear how the weights of these policy indicators are related to the weighting of the Carbon dioxide reduction strategy. In addition, it is not clear how the indicator Green Action Plan (weighting of 4.16%) in the category Environmental Governance is different from the policy-related qualitative indicators in the other categories (which have weighting factors ranging from 2.5% to 4.16%).

It is acknowledged that the purpose of the Green City Index was (and is) for the selected cities to make comparisons between themselves and to provide an impetus to compete and improve. However, it would be better still for each city to use this as a mere framework, and to critically examine whether the weighting factors suggested in the Economist Intelligence Unit (2009) apply to them. Depending on a plethora of factors, external and otherwise, the priorities and thereby the weightings would differ from city to city. Suffice to say, it would not only vary from city to city, but perhaps even from different times for a given city, as some challenges are surmounted while others assume greater importance. It is apt to reiterate from Lindholm and Nordeide (2000) – weighting factors could be assigned on the basis of political goals, with the seriousness of the problem viewed in terms of the 'distance' to the critical level or the willingness to pay to avoid problems.

As mentioned under the heading Adequacy, having split the indicators into two sets, and determined the Cause Index and the Effect Index, these two indices can now be weighted and aggregated to give the Green City Index. Here, it should be mentioned that the ends (the effects or desirable changes in the quantitative indicators) justify the means (the causes or the policies implemented by the governance). Having clear-cut policies is the first step, but what matters more is how these are implemented, and still more importantly, what the end results are (as measured by the quantitative indicators). The Cause Index thereby could be given a relatively lower weight *vis-à-vis* the Effect Index. The actual implementation of the policies has to be given a much higher priority and weighting than the policies themselves. The Deed has to be rated higher than the Thought and the Word.

3.3. *Acknowledgement of inter-linkages*

Is there realisation of complementarities and offsets when defining indicators?

As far as possible, care must be taken to define indicators which are distinct and independent from each other. However, while this is difficult, the second-best position is to be aware of the fact that indicators are often related to each other, and the correlations may be either positive or negative, and the degree of such correlations high or low. (It is, of course, not possible to quantify these correlations, as the degrees would vary within a very wide range.) Interventions and strategies thus may be aimed at increasing or decreasing the value of one or a set of indicators. Fulfilling this primary purpose may result in having beneficial or undesirable trickle-down effects on some other indicators. The overall effect may either be an increase or decrease or even no change in the Green Score. For example, Figure 3 indicates the interrelationships among the categories and indicators defined and considered for the Green City Index. The direction of each arrow indicates the flow from cause to effect. In reverse, it would indicate the need for changes elsewhere in order to bring about changes in the indicator/category considered.

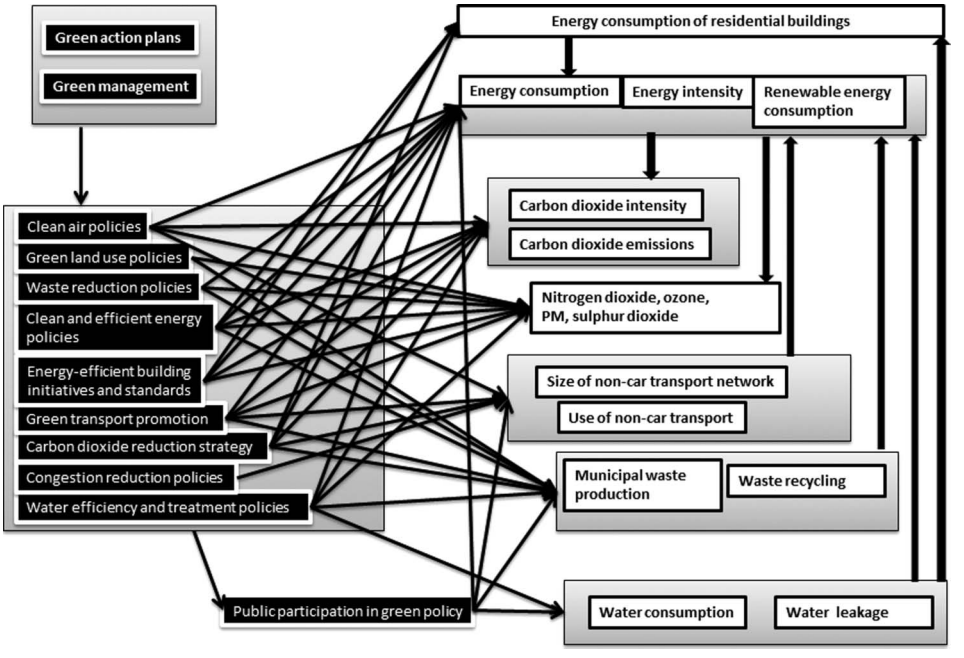

Figure 3. The interrelatedness of the categories/indicators in the Green City Index.

Is there a possibility that a little good wrought in one category becomes magnified by propagation to other categories? Or does a desired increase in the value of one indicator in one category come at the cost of an undesired drop (or increase) in others in other categories? Is there awareness about this fact?

The best example is the link between Energy and Carbon dioxide, or more specifically, Energy Consumption (or Intensity) and Carbon emissions (or Intensity). The weighting factor for the former is less than that of the latter. If there is a decrease in the Energy Intensity (assuming that this is due solely to the reduction of fossil-fuel sourced energy usage), there is automatically a drop in the Carbon Emissions. Both these reductions are desirable. The former change – the reduction in energy intensity – is the primary one, which is the reason behind the drop in carbon emissions. The cause, in this instance, is weighted less than the effect, in the calculation of the Green City Index. Indeed, a higher Public participation in Green Policy (desirable), may at once reduce Energy Consumption, Energy Intensity, Energy Consumption in Residential Builings, Water Consumption, Municipal Waste Production (all desirable changes), and also increase Use of Non-Car transport and Waste Recycling.

However, an improvement in one indicator of one category may be offset by the worsening of another indicator in another category. For example, a higher score for Wastewater Treatment (a qualitative indicator defined in the report), would mean, *inter alia*, a greater degree of nutrient removal to ensure that treated wastewater of better quality is discharged to the sink (or made available for reuse). This would entail greater Energy Consumption, and consequently, higher Carbon Emissions. However, if the wastewater treatment plant invests in anaerobic sludge digestion, and captures and utilises the biogas as a source of energy, replacing fossil-fuel

alternatives in the process, the Energy Consumption may perhaps still increase, but the Carbon Emissions (in this instance, assumed to be the non-biogenic emissions), will not. If the emissions from the combustion of biogas are considered to be biogenic and therefore not potential contributors to global warming, the Carbon Emissions from wastewater treatment will actually decrease.

The presence of all these inter-linkages among the categories suggests the indispensability of integrated policy making. The pitfalls associated with each division/department charting out its own plans and strategies, without "breaking out of silos and trying to think of a project as a joint inquiry process with other actors and stakeholders, in order to bring out a multi-perspective, multi-institutional response to complex issues" (Pittock 2012, 56), are too conspicuous to be ignored.

3.4. Awareness of conflicts/synergies with non-environmental goals:

Further, is it right to compete to rise to the top of this Green Score list viewed in isolation? Is it not necessary to also develop something called an Urban Socio-Economic Index, and define the linkages among the indicators yielding the Green Score with those making up the Urban Socio-Economic Index, explicitly?

There must be care for the environment, but it should not be done at the cost of social well-being and economic stability. The keywords here are 'well-being' and 'stability'. Once these are clearly defined and understood in their entirety, it becomes clear that something must be lost if something else has to be gained. In effect, it is all about not having too much of one 'good' and too little of another. Well-being, as has been often discussed, is not simply about material gains and comforts, but is very closely linked with several 'abstracts' and also 'concretes' (for example, health) which are influenced by the state of the environment. Sahely and Kennedy (2007) observed that many of the in-vogue model-based assessments of urban water and sanitation systems focus primarily on environmental impacts and do not include an extensive treatment of economic and social issues. What Sahely and Kennedy (2007) observed about the urban water and sanitation systems is perhaps also true for other urban systems, such as transport, energy, buildings, waste management etc.

This can be illustrated with examples. The Oslo water and wastewater utility is keen to reduce its leakages, which is one of the main reasons why it has been ranked at number 20 on the 30-country listing for the category Water in the Green City Index. Rehabilitating old /defective water pipelines is one method to solve the problem. However, this would necessitate funds. If the utility approaches the consumers for financial support in this regard, it would mean that consumers would have to pay a little more money than they are doing at present. In other words, a higher percentage of the household income would be spent on water supply and wastewater services, *vis-à-vis* the status quo. In a city like Oslo, this would not be a major problem, as the willingness to pay (a socio-economic indicator) would be high. However, if a relatively poorer city, e.g. Sofia (ranked 30) or Belgrade (ranked 29), attempted the same, it would perhaps be obstructed by a very low willingness to pay. A low willingness to pay for improvement in environmental performance is clearly a conflict between the environmental goals and the socio-economic ones. However, a controlled reduction of excessive operating pressures in water systems results in a reduction of the volume of leakage and the frequency of burst pipes (Johnson 2012, Venkatesh 2012). If pressure management is adopted as a strategy to reduce water leakages, the need to hike the water/sewage fees would not arise. The adjective 'excessive' is the

keyword here. Over-reducing the pressures exacerbates the risks associated with insufficient pressure at fire hydrants, or at times, low heads in toilets and bathrooms, which would detract from the level of service expected by the consumers.

Alternatively, consider the fact that the indicator Water consumption is also of concern to the Oslo water utility. Lifestyles which people have become used to are often hindrances to change in the right direction. Environmentally, reducing water use would be a good thing, but socio-culturally, in a society which has been used to over-consumption, there may perhaps be a sense of 'loss of welfare' if appeals were made to reduce water consumption. Thus, if social welfare, or rather 'perceived' social welfare is an indicator for the Socio-Economic Index, it would take a beating if the water utility attempted to contribute to an improvement in the Green City Index of the city by attempting to create awareness about the need to reduce water consumption – just to score well and rise in the rankings, and not because of any conspicuous water shortage in the foreseeable future.

Consider the category Transport; which is influenced by Green Transport policies which may include, *inter alia*, an attempt to promote the use of public transport. However, in some cities in Norway, for example, Trondheim (however, this is not one of the 30 cities studied in the report), the general impression among passengers is that the fare charged per journey is unduly high (€ 5.3). The willingness to pay is low and is a clear deterrent to the success of the policy, which is admirable, but may fail in reality.

4. Conclusions

This paper was intended as a critique of the European Green City Index. Inspired by observations and comments made in relevant literature sources, an attempt was made to structure the critique under four different aspects.

Every city will have its guiding criterion or set of criteria under the sustainability principle, and under the criterion (or criteria), there will be some prime indicators. This will depend on what the pressing concerns and immediate challenges are. That said, there must be care not to 'push standardised information' towards the end-users, as what is relevant and credible to one may not be so to another. In many ways, defining a generic set of indicators to be adopted by several utilities goes against the grain. The relevance, credibility and the legitimacy of the indicators depend on what the receivers of the information deem to be necessary, useful and reliable. Finally, repeating what Pittock (2012, 56) observed, ''Breaking out of silos and trying to think of a project as a joint inquiry process with other actors and stakeholders, in order to bring out a multi-perspective, multi-institutional response to complex issues'' is indispensable to successful policy making, as evidenced by the complex inter-linkages discussed in this paper.

It is not just a blind pursuit of a higher Green Score which is recommended, but an integration of the Green City Index with a Socio-Economic Index. City authorities could use the knowledge of the inter-linkages and correlations among the different indicators (and Indices) to chart the course ahead, while ensuring that complementarities and synergies are fully harnessed.

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