

Sustainability, Vulnerability, Resilience and Change: The Efficacy of Comparative Urban Metrics for City Development in Australia

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ABSTRACT: Recent comparative metrics that rank different cities based on selected criteria have yielded interesting and sometimes varied results, depending on what is being measured, how it is being measured and why it is being measured. This paper explores the efficacy of such ranking systems for Australia's largest cities, focusing on the links between ranking outcomes and policy formulation regarding vulnerability, resilience and sustainability. The paper concludes that the links between measurement and policy development are complex and that while comparative metrics may be useful, care should be taken with such tools. There is potential for the Commonwealth Government through the Major Cities Unit to work with the major environmental groups and develop meaningful and reliable sustainability metrics that incorporate notions of resilience. The paper provides a four-step process to link comparative urban sustainability metrics with resilience, with funding models and to develop an expanded notion of 'large city' that includes growing inland centres. This process, building on recent achievements in building a national urban focus by the Australian Conservation Foundation and by the Commonwealth Government, is a pragmatic way to foster urban sustainability. If done well, comparative urban metrics can be very efficacious in promoting resilience and enhancing sustainability.

Introduction

In early August, 2013 the Major Cities Unit of the Australian Government's Department of Infrastructure and Transport produced their 4th State of Australian Cities Report. This report provides excellent, updated detail on Australia's eighteen largest cities – which are those sixteen cities with a population in excess of 100 000 (see Forster and Hamnett 2008) but with what appear to be the strategic additions of Albury-Wodonga and Launceston (Commonwealth of Australia, 2013). I suggest that there is capacity, and need, to further modify this definition of "major cities" in light of the discussion below.

In this paper I expand on an argument made elsewhere in passing (McManus and Gleeson, forthcoming) that the work of this unit should be expanded to include comparative sustainability metrics, and that this work could be done by the Commonwealth Government, in conjunction with the major environmental groups in Australia. Additionally, given the role of the Commonwealth Government, it could be tied to funding priorities so that state and local governments are more likely to strive to implement sustainability actions within their jurisdictions. This work could articulate with previous work on Australia's 20 largest cities that was undertaken by the Australian Conservation Foundation (ACF) in 2010 (McManus, 2012) and it could include a focus on resilience, vulnerability and sustainability that aligns with the existing priorities in the Commonwealth of Australia (2011a) *Our Cities, Our Future* report. Before exploring these possibilities, it is necessary to note that the author of this paper was one of a number of professional and academic referees for the Australian Conservation Foundation (ACF) Sustainable Cities Index. I commented on the draft but did not have any direct input into the final ranking and its presentation.

The paper begins by presenting an overview of comparative urban sustainability literature, before looking at the complex issue of vulnerability and resilience, drawing particularly on the work of the Major Cities Unit to identify how these issues are being perceived and constructed at present in Australia. The next part of the paper presents a proposal for an initiative that expands the role of comparative urban sustainability indicators in Australia, involves government and major environmental non-governmental organization cooperation, emphasizes vulnerability, resilience and sustainability and is explicitly linked to future funding. The paper concludes with a call for immediate and meaningful action given the extent and severity of the challenges that we face.

Comparative Urban Sustainability

Attempts to rank cities in terms of sustainability are a logical extension of sustainability indicator projects in individual cities (see Bell and Morse, 1999 and 2001; McManus, 2005a; McManus, 2012) and the flawed attempts to compare the various ecological footprints of individual cities (Giradet, 1999,

McManus and Haughton, 2006). Comparative urban sustainability projects develop a set of indicators that are deemed applicable to a number of different cities and are capable of being measured consistently for all cities in the study. To this end, a number of different approaches have been adopted, ranging from Mercer's (2010) global scale approach measuring 221 cities with New York City as a baseline of 100, using six non-weighted criteria of water availability, water potability, waste removal, sewage, air pollution and traffic congestion, through to the supra-regional European Green Cities Index that was released in December 2009 and ranked 30 European cities in 30 countries using 30 indicators, 16 of which were quantitative and 14 qualitative. In the latter study the indicators were grouped into 8 categories; carbon emissions, energy, buildings, transport, water, waste and land use, air quality and environmental governance (McManus, 2012).

Within individual countries, City Rankings were first produced in 2005 (and repeated in 2006 and 2008) by SustainLane to cover the 50 most-populous cities in the USA (SustainLane, 2010). Each city's performance is benchmarked in 16 areas of urban sustainability, including the preparedness for an energy crisis and the risk of natural disaster. A weighting system was used, with 11 of the 16 data categories receiving a weighting of 1, while maintaining a stable water supply and commuting to work were both weighted 1.5 and impacts of a secondary nature such as congestion, housing affordability and the risk of natural disasters were each weighted 0.5 (McManus, 2012). Cities were grouped under five labels for each category, with the top ten cities being labeled "leading", the next ten "advanced", followed by "mixed", "challenged" and "endangered" (McManus, 2012).

The SustainLane rankings of cities are generally consistent with other rankings from the USA. The Natural Resources Defense Council's Smarter Cities ranked 655 cities in three categories of population size, including 67 cities with populations in excess of 250 000 people. They used nine categories, including air quality, water quality, green building and environmental participation. Seattle was ranked first amongst the larger cities, followed by San Francisco, Portland, Oakland and San Jose – a ranking similar to that of SustainLane (McManus, 2012).

In the United Kingdom, the Forum for the Future's annual Sustainable Cities Index tracks the progress on sustainability by assessing 13 indicators, which are weighted, in Britain's 20 largest cities. Of particular relevance for the Australian comparative urban indicators project presented later in this paper, the 13 indicators were selected partly because they were "areas where councils have the power to improve the sustainability of their city" (Forum for the Future, 2009, 14).

In Canada, since 2007 Corporate Knights has conducted a similar scoring and ranking exercise for The Natural Step, ranking 17 Canadian cities which are divided into large, medium and small cities based on local government structures. Vancouver, which is the third largest metropolitan area in Canada, is ranked as a medium size city on this basis, thereby highlighting the importance of boundary definition when considering population as a criterion for inclusion or exclusion of cities. The 2011 study comprised 28 indicators of sustainability in five categories—ecological integrity, economic security, infrastructure and built environment, governance and empowerment, and social well-being, with each parameter being weighted equally (Corporate Knights, 2011).

In June 2010, the Australian Conservation Foundation (ACF) introduced the Sustainable Cities Index, "with the aim of encouraging healthy competition, stimulating discussion and suggesting new ways of thinking about how cities can be sustainable." (Henry, 2010, 3). The 20 largest cities in Australia were ranked using 15 non-weighted criteria, namely air quality, ecological footprint, green buildings, water, biodiversity, health, density, wellbeing, transport, employment, climate change readiness, education, food production, public participation and household debt. The Sustainable Cities Index, like the SustainLane (2010) project, grouped cities into clusters based on similar performance levels. These were labelled "top performers", "mid-table performers" and "the poorer performers" (McManus, 2012).

It is pertinent to note that there appears to have been a wave of comparative urban sustainability indicator projects undertaken between about 2005 and 2010, but there is a dearth of work in this field in recent years. This may be due to the range of answers posited by different approaches, thereby raising questions about the validity of all approaches. It may also be due to financial constraints, given that many of the organisations involved are environmental groups and funding has been tight since the Global Financial Crisis (McManus, 2012). A third possibility, and one that is addressed in this paper by linking the metrics with the allocation of government funds, is that because many of these studies have been undertaken by environmental groups, the results are largely reputational. At present there is no direct financial reward for promoting sustainability, nor is there any penalty or opportunity cost for cities that perform poorly or, conversely, based on the metrics no additional resources are provided to help cities that may have financial constraints in addressing particularly urban sustainability issues.

The divergence in results when comparing ranking systems was demonstrated by McManus (2012), who showed how and why the Mercer EcoCity and the ACF Sustainable Cities Index produce very

different results for Australian cities (see Table One). In the EcoCity rankings, the highest ranked Australian city was Adelaide (7th in the world), while the lowest ranked Australian city, Sydney, still scored significantly higher than the baseline score of 100. Mercer's goal is to provide information on existing conditions rather than to be a catalyst for change. The ACF Sustainable Cities Index was, however, intended to report on the existing sustainability of cities with a goal to implement positive changes that would increase urban sustainability.

The application of diverse ranking systems, prepared for differing purposes and containing different variables and, in some cases, different ways of measuring the variables, will inevitably lead to varying results. For this reason, environmental groups working with government and using expert input is a way to enhance credibility, and to link the metrics with implementation and improved sustainability outcomes. At present, aspects of sustainability that particular commentators may believe require emphasis appear to have been overlooked in some studies (McManus, 2012). This appears to be the case around issues of vulnerability and resilience, particularly in their relationship to sustainability.

Table One: Mercer Eco-Cities Rankings (2010) Compared with ACF's Sustainable City Index Rankings (2010)

City	Mercer Eco-City Ranking, 2010. Rank within Australia (World rank in brackets)	Mercer Eco-City Ranking, 2010. Eco-city score	City	ACF Sustainable Cities Index, 2010 Rank	ACF Sustainable Cities Index, 2010 Score
Calgary (Canada)	n/a (1)	145.7	Darwin	1	119
Adelaide	1 (7)	137.5	Brisbane	3	123
Perth	2 (12)	135.3	Canberra	5	133
Canberra	3 (21)	133.3	Melbourne	7	142
Brisbane	4 (23)	131.6	Sydney	12	161
Melbourne	5 (25)	131.5	Adelaide	=14	165
Sydney	6 (46)	125	Perth	19	183

Source: Mercer (2010) and ACF (2010). Note – The higher the Mercer Eco-City score, the more sustainable the city is said to be, whereas with the ACF score, a lower figure indicates greater sustainability.

Australia's Vulnerable Cities – Becoming Resilient?

Australian cities are highly vulnerable to many environmental challenges, almost all of which are exacerbated by anthropogenic climate change. While there are important regional variations, then local differences based on factors such as topography, plus the location and the value of infrastructure, the overall scenario is that promoting resilience is critical because vulnerability is high and the likely impacts of climate change will be extensive and severe.

With regard to urban infrastructure, the Commonwealth Government modelling of exposure to climate change impacts of inundation and coastal erosion presented an upper figure of \$226 billion in losses of commercial, industrial and residential buildings, plus road and rail assets, with a high end scenario of 1.1 metre sea level rise by 2100 (Commonwealth of Australia, 2011b). Even the lower estimate for the corresponding scenario produced massive costs, particularly with residential buildings in Queensland and commercial buildings in South Australia. Not surprisingly, the majority of these projected losses were in

urban areas, with, for example, the Gold Coast and Mackay being particularly vulnerable in Queensland and Port Adelaide Enfield being vulnerable to the loss of commercial, light industrial buildings and railways. In NSW, the port cities of Newcastle and Wollongong are particularly vulnerable to the loss of rail infrastructure (Commonwealth of Australia, 2011b). Current estimates of sea level rise are that a global sea level rise of up to 82 centimetres by the end of this century is now “unequivocal”, according to reports by Reuters, and this “would have serious impacts on coastal cities everywhere” (Cubby and Hannam, 2013, 1).

While coastal vulnerability is very high, the latest report by the Major Cities Unit on the state of Australian cities highlighted the important threats of heatwaves and bushfires (Commonwealth of Australia, 2013). This threat is exacerbated by hotter, longer summers, a growing urban area that expands the urban-bush interface and the encroachment of urban development into terrain where firefighting is more difficult, amongst a range of synergistic factors that increase the risk of bushfires and the likely impacts if a bushfire does occur.

Taken together, these threats highlight the need for our cities to be made more resilient in the face of climate change risks. This should be inarguable, but it is worth noting that increasing resilience is not the same as increasing sustainability. This is a very pertinent point given the NSW Government (2013) release of the *Draft Metropolitan Strategy for Sydney to 2031*, where the term “sustainability” has been replaced by phrases such as “balanced growth” and a “healthy and resilient environment”. Leaving aside the euphemism of “balanced growth”, the promotion of a “healthy and resilient environment” in the absence of any overt notion of sustainability results in a focus on adaptation to improve the environment in our cities, making our urban areas less vulnerable to the impacts of climate change, but it does not require us to think as global citizens and to endeavour to mitigate climate change and other negative environmental impacts. It is a self-centred approach that requires greater adaptation in other urban areas, generally in less developed countries where there is less capacity to do so.

Despite these concerns, resilience is a useful idea to explore when it is articulated with notions of sustainability. Resilience is, however, a complex concept (Walker and Salt, 2006), being an ecological term applied in economic and social contexts. The strict ecological meaning of resilience is related to the ability of a system to regain the status quo after a major shock. In contrast, economic and social systems are forever changing as a result of various transformations (scientific, financial, governance, lifestyles and resource management). To maintain the status quo is often not possible, and therefore is not a meaningful goal. Rather, in social and economic contexts, resilience is understood as the ability to embrace change. This should include the capability to adapt seamlessly to largely exogenous events in what Sorensen and Epps (2005a; 2005b) termed “stable adaptation”. This concept is consistent with that used by Walker and Salt (2006, 1) who, recognizing that change is always occurring, define resilience as “the ability of a system to absorb disturbance and still retain its basic function and structure”.

As McManus et al (2012) noted, this definition does not explain what makes resilience possible. In other words, resilience is a concept that is often applied retrospectively, by which time it is too late to strengthen the capacity for resilience amongst vulnerable communities. McManus et al (2012), working in the context of vulnerable, small rural communities in inland Australia, identified the importance of belonging. They argued that it is “when attitudes of mind translate into actual interpersonal links that belonging is facilitated and resilience can be encouraged” (McManus et al, 2012, 21). These authors further argued that “in the case of rural communities and resilience, belonging to a place, a community and a citizenry coalesce and form the basis for action. Belonging, in short, is a positive attribute of rural communities that contributes to resilience” (McManus, et al, 2012, 22).

Resilience has been linked with sustainability indicators by Milman and Short (2008, 759), who argued that “sustainability indicators are distinguished from other indicators by their need to measure the ability of a system to adapt to change and to function over a long time span.” They believe that a “useful measure of sustainability should not only describe the state of the system but provide an early warning of problems” (Milman and Short, 2008, 759). Their summary, that “sustainability indicators should be leading indicators that account for the resilience of the system” (Milman and Short, 2008, 759) is the starting point for an integrated approach to comparative urban metrics for Australia’s largest cities – addressing issues of resilience in the development and implementation of these indicators is both possible and necessary.

It is important to remember that resilience is not based on a single factor, nor can it be compartmentalized into economic issues or social issues. McManus et al (2012, 28) concluded that “perceptions of the local economy, environment and community are inter-related and resilience is dependent on all three simultaneously.” This finding accords with the goals and objectives of the Major Cities Unit as shown in Table 3 of their 2011 report (Commonwealth of Australia, 2011a, 18) where the fourteen objectives address the goals of productivity, sustainability, liveability and good governance. The

development of comparative urban metrics to foster resilience in cities contributes to all four of these goals.

Using Comparative Urban Metrics to Foster Resilience

Given the developments in comparative urban metrics outlined earlier in this paper, the challenges facing Australia's vulnerable cities as discussed above, and the importance of resilience and how it should be nurtured in advance of potential disasters, it is timely to explore ways to foster resilience through the use of comparative urban metrics in Australia's largest cities. To this end a four step process has been devised and is presented below.

The first step is to accept the partnership of government and major non-governmental organisations (such as ACF, but potentially including other organisations from the environmental and social sectors) to work together to develop comparative urban metrics for Australia's largest cities. This work would extend the 2010 Sustainable Cities Index developed by the ACF, and link it with the work of the Major Cities Unit. There is significant overlap between the two areas of research as they currently exist. These indicators would have at their core the concept of resilience – in other words, the ability to indicate and respond to threats in advance, and this would be inclusive of economic, socio-cultural and environmental considerations. This first step overcomes some of the funding issues associated with environmental groups undertaking this important research, and provides increased validity for the results of the research if it is undertaken rigorously.

The second step is to extend the definition of "major cities" in Australia. As noted earlier in this paper, the current definition includes the sixteen largest cities of over one hundred thousand people, plus Albury-Wodonga and Launceston. It does, however, omit important cities such as Ballarat and Bendigo, which are respectively the third and fourth largest cities in Victoria, have almost reached the population threshold to be defined as "major" and are growing rapidly as a result of population growth in Melbourne and nearby metropolitan areas, and perhaps due to the emphasis in Victorian politics of promoting development in provincial Victoria (Connell and McManus, 2011). I suggest extending the 20 largest cities of the ACF study and the 18 largest cities of the Major Cities Unit to all urban localities with a population in excess of 50 000 people, as shown in Table Two. This would enable both coastal and inland centres to be included, it would also include some of the faster growing inland urban centres and it would result in only five (from the ACF's work) or seven (from the Major Cities Unit's work) additional cities to be considered in future studies.

There is also potential to adopt the approach used by Corporate Knights in Canada and the Natural Resources Defense Council in the USA, where there is recognition that urban localities vary in size and that comparing very large cities with smaller cities is problematic. As shown in Table Two, there are population ranges for the 25 largest urban localities in Australia. Rather than simply comparing the twenty largest cities, as done by ACF (2010) where the populations range from over four million in the case of Sydney to under 100 000 people in smaller cities such as Bendigo and Ballarat, it is possible to do an overall comparison of the 25 largest urban localities and to divide these into "very large", "large" and "medium" size cities. The exact positioning of the boundaries between these categories, and indeed the number and terminology of the categories themselves, requires negotiation. This negotiation should allow for the possibility of extending the definition of "major cities" in the future to include other significant urban areas that are currently outside of the largest 25 urban localities in Australia.

Third, following the logic for the indicators proposed in the United Kingdom by the Forum for the Future in their annual Sustainable Cities Index, indicators need to be based to some degree on localized action, in other words, to be "areas where councils have the power to improve the sustainability of their city" (Forum for the Future, 2009, 14). This third consideration then allows for a comparison of performance between metropolitan areas, recognizing that there are issues of local government fragmentation in many Australian cities (see McManus, 2005) and that the indicators are based on the metropolitan scale and there is considerable diversity within cities. This is a particularly complex point, because local government structures and funding do not coincide with urban localities, but to develop comparative urban metrics on local government structures would result in situations such as that in Canada, where Vancouver is classified as a medium size city despite being the third largest urban area in the country after Toronto and Montreal. The variation is related largely to suburban development, where the inner city areas of Australian cities (and the City of Vancouver) vary significantly from the rapidly growing outer suburban areas, where attention to issues of sustainability and resilience is often most required.

Promoting the use of comparative indicators that target resilience and foster localized action can trigger the fourth step, which is linking future funding to performance in addressing the issues identified by the comparative indicator research. How this funding should be distributed is beyond the scope of this paper, and ideally it should be part of a negotiated process to ensure buy-in and ownership of the comparative urban metrics project, but it is suffice to say that it should be transparent, fair and efficient.

There will remain some issues that cannot be addressed by local governments. This is where the work of the Major Cities Unit, other commonwealth departments, environmental groups and the various state government agencies is crucial. Reducing vulnerability, and increasing the capacity for resilience ahead of threats becoming actions and impacts, is vital for the future of Australia's cities. These measures involve multiple levels of governments and a more participatory governance approach, as suggested in this paper.

Table Two: Australia's 25 Largest Urban Localities by Location and Population Range

Urban Locality	State(s) and/or Territory	Coastal or Inland	Population Range
Sydney	NSW	Coastal	1 million or more
Melbourne	Victoria	Coastal	1 million or more
Brisbane	Queensland	Coastal	1 million or more
Perth	WA	Coastal	1 million or more
Adelaide	SA	Coastal	1 million or more
Canberra - Queanbeyan	NSW/ACT	Inland	250,000 to 999,999
Central Coast	NSW	Coastal	250,000 to 999,999
Gold Coast - Tweed Heads	Queensland/NSW	Coastal	250,000 to 999,999
Newcastle	NSW	Coastal	250,000 to 999,999
Hobart	Tasmania	Coastal	100,000 to 249,999
Darwin	Northern Territory	Coastal	100,000 to 249,999
Wollongong	NSW	Coastal	100,000 to 249,999
Geelong	Victoria	Coastal	100,000 to 249,999
Cairns	Queensland	Coastal	100,000 to 249,999
Sunshine Coast	Queensland	Coastal	100,000 to 249,999
Townsville	Queensland	Coastal	100,000 to 249,999
Albury - Wodonga	NSW/Victoria	Inland	50,000 to 99,999
Maitland	NSW	Inland near coast	50,000 to 99,999
Ballarat	Victoria	Inland	50,000 to 99,999
Bendigo	Victoria	Inland	50,000 to 99,999
Mackay	Queensland	Coastal	50,000 to 99,999
Rockhampton	Queensland	Coastal	50,000 to 99,999
Toowoomba	Queensland	Inland	50,000 to 99,999
Bunbury	WA	Coastal	50,000 to 99,999
Launceston	Tasmania	Inland near coast	50,000 to 99,999

Source: ABS (2011)

Conclusion

Comparative ranking is not, or should not be, an end in itself. It is definitely a means to an end, which in this case should be to reduce vulnerability and improve the resilience of Australia's largest cities – all 25 of them with potential to extend the scope of the work to additional cities in the future. This work is important and can provide a crucial component of making Australia's cities more sustainable, but it should not be conflated with sustainability itself. The concept of sustainability is more encompassing than simply making Australian cities more resilient in the face of adversity. It is about recognising, and addressing appropriately, the impacts of Australian cities on the land, the ocean, the atmosphere and in what Bill Rees (1997) called the "distant elsewhere". This is an enormous cultural challenge, but one small, pragmatic step that builds on recent innovative work by environmental organisations, and by the Australian government's Major Cities Unit around the development of a national urban policy, is the development of comparative urban sustainability metrics for Australian cities. These metrics will

contribute to sustainable cities in Australia, but even more importantly, following Satterthwaite (1997), can assist the contribution made by Australian cities to sustainable development. Comparative urban metrics, if done well, can be very efficacious in promoting resilience and enhancing sustainability.

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