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Striving Towards Sustainability in the City: Indicators of a Sustainable City

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The varied nature of city sustainability programs adopted and implemented within cities is quite large. Due to the inconsistencies in research as well as the autonomy that city governments have in their governing processes from one another, it is of no surprise that city sustainability policies look as different as the lands they represent. Although strides towards recognizing the importance of city sustainability adoption have been great over the last few decades, much work remains to ensure city leaders understand those city characteristics which remain important to initiating sustainability policies. This paper delineates reasons for focusing sustainability policy at the city level, presents a theoretical framework that classifies sustainability into three main pillars or categories, and describes the city characteristics or indicators of each.

Introduction

Sustainability has emerged as a natural byproduct of an increasing movement of goods, people, culture, and pollution across borders. As a revolutionary topic, it emerged with this simple description: activities which "meet[s] the needs of the present without compromising the ability of future generations to meet their own needs." (WCED, 1987, p. 8). This definition remains today as the defining springboard for discussions concerning the concept due to its clear description and its adaptability to the changing times. Further, it has also been said that sustainable development should allow "each individual the opportunity to develop himself in freedom, within a well-balanced

society and in harmony with its surroundings" (Kerk & Manuel, 2010, p. 1). Cities across the nation and globe have taken part in varied initiatives either through choice or constraint in efforts to move towards creating sustainable places that prove to be desirable for residents and their futures alike. This movement towards sustainable planning at the city level is varied in its acceptance among cities, with some cities lacking a sustainability plan (Atkisson, 1996) and other cities leading the way (Portney, 2002).

Reasons for the varied nature of embracing a sustainability plan at the city level are largely due to the confusing nature of how best to approach sustainability itself. As cities are different from one another in many ways, a successful sustainability plan is likely not replicable by other cities. Additionally, there seems to be a confusing and inordinate number of variables to consider when designing a plan of sustainable development for any given city and as such, can prove a daunting task for city planners who must take into consideration issues that span multiple cities. For instance, CO_2 emissions impact individuals across the nation and globe and are estimated to originate within cities over 40% of the time (McLarty et al, 2014). This figure grows to closer to 80% when we consider all things necessary to support modern city life (McLarty et al., 2014). It has also been reported that upwards of 40% of greenhouse gas output originates within an urban center somewhere on the globe (Feiock, 2014; Satterthwaite, 2008). As such, decisions about how to reduce carbon footprints and ensure limitations to these emissions are complex yet important to city sustainability plans (McLarty et al., 2014). City planners have traditionally designed policies specific to their geographic area, yet now face the need to consider those outside the city as well. At a time when some cities are fully aware of how to proceed towards a sustainable future while others are completely at a loss, elucidation of key characteristics and issues pertaining to the discussion is beneficial for those desiring to create a policy for positive change.

Cities as the focus of sustainable development

Cities are an organizational power with the capability to create and make change within designated geographic boundaries (United Nations, 2016). A majority of the world's population resides within urban cities as reported by the United Nations in 2008 (Ramaswami et al., 2012) yet, the interconnected networks of trade, commerce, ideas, and knowledge adhere to no such defied boundaries. Further, the impact of consumerism that relies on carbon-based emissions cannot be contained in any one city and as such, regulation of these emissions at the city level remains limited in its scope (Ramaswami et al., 2012).

The complexity of sustainability measurement

Much discussion has taken place concerning creation of sustainability indices (Portney, 2003; Sutton, 2003; Atkisson,

1996). An index is a combined set of indicators taken together to better understand a complex concept (United Nations, 2011). A combination of indicators within an index allows researchers a broader understanding about sustainability than what is possible by looking at the individual indicators themselves (Garnasjordet et al., 2012; United Nations, 2011). For example, some indices measure sustainability on a national level as provided by the Sustainable Society Foundation (Kerk, 2015) while others are site specific to a certain city, such as the Sustainable Seattle Initiative (Atkisson, 1996). Cities prove a logical framework for application of sustainability efforts as they are geographically bounded areas that can create change due to policy supported through local governmental processes. As Portney has noted, "cities are among the more important building blocks" in the sustainable movement (2002, p. 364). Further, cities can gain local support for the necessary impetus of change because they are natural leaders in the target area (United Nations Conference on Environment and Development, 1992). When dealing with specific local sustainability needs, city government is much better equipped to handle specific issues pertaining to the city.

Sustainability indices may vary widely regarding the specific indicators used even though they are attempting to assess the same general concept. However, these differences are acceptable because it is not the individual indicators that illuminate the outlook of sustainability for a city, but the concept as measured by many indicators. (Garnasjordet et al., 2012; United Nations, 2011). If data is not available for the desired indicator, it may be "supplemented by other statistical information or indicators," (Garnasjordet et al., 2012, p. 323). For instance when creating an air quality indicator, all vehicle emissions or the amount of carbon dioxide found in the air can both prove adequate data for the desired indicator.

The sustainability framework

Sustainable community development has often been broken down into three main categories (Hemple, 2009; Schlossberg & Zimmerman, 2003), although some may argue for an additional fourth (Ekins & Dahlström, 2008) or possibly even five categories as the Global Tomorrow Initiative of Sustainable Seattle does (Portney, 2013). For the purposes of this work, the three main categories are utilized as they sufficiently encompass the fourth and fifth suggested ones of ethics and politics. The three main categories are commonly referred to as the "three E's of sustainability," or the balance of the (a) environment, (b) economy, and (c) social equity (Hemple, 2009; Opp & Kyle, 2012) and have oftentimes been reviewed individually within the literature. It is in fact more common to find literature regarding environmental, or economic, or social sustainability as opposed to literature focused upon reconciliation of all three E's (Brugmann, 1997; Holling, 2001; Jepson, 2001; Michalos, 1997).

Environmental sustainability includes any issue regarding clean land, clean air, clean water, biodiversity of natural aquatic and land wildlife, the availability of green space, and the amount of natural resources available for future use (Opp & Sunders, 2012). Issues concerning the natural environment fall within the environmental pillar of sustainability and are by far the most widely used sustainability indicators when measuring sustainability though by no means more important than the other two (Portney, 2013). The economic vitality pillar of sustainable communities includes issues such as the stability of economy where all residents of the area have adequate opportunity to live the quality of life desired (Saha & Paterson, 2008). Further, the population retains this ability to support itself economically without government assistance. Social sustainability includes topics that impact people and their quality of life. For instance, the availability of adequate healthcare for all residents living within a city increases social equity. Additionally, for individuals unable to provide for themselves, they have access to social, medical, housing, and food programs. Greater social equity is also present when residents have a variety of amenities close by that increases social cohesion and quality of life (Dempsey et al., 2011). Taken together, all three categories or pillars constitute a robust sustainability framework. Provided below is a closer examination of specific indicators used when creating indices for the three pillars of sustainability.

Review of Environmental Indicators

Environmental indicators are the most widely talked about and implemented indicators for sustainability plans because determining directionality towards a more sustainable environmental practice is much easier than determining what constitutes greater social and economic equity (Portney, 2013). The ways in which we view the environment have changed post-developmentalism as the cost of carbon-intensive lifestyles to fuel growth and expansion have been great, especially when we consider that the built structures (e.g. pipelines and road systems) to handle movement of resources (e.g. natural gas, oil, consumer goods) are substantially more imposing on the environment than the natural resources themselves (Ramaswami et al., 2012). Higher rates of air pollution, health concerns, and loss of non-renewable resources impact how people experience a healthy lifestyle (US Environmental Protection Agency, 2017; Uddin & Khorshed, 2015).

Much has been written on the importance of air and water quality of a given area to sustainability as these have large implications regarding the longevity of resources and health (US Environmental Protection Agency, 2017; Portney, 2002). Poor air quality from particulates in the air resulting from carbon-based private and public transportation systems and manufacturing processes has been linked to higher incidences of asthma and cancer (US Environmental Protection Agency Factsheet, 2009). Additionally, water

quality remains an important variable in assessment of environmental sustainability as individuals need clean and adequately supplied sources of water to sustain life. Likewise, clean and adequate supplies of water are crucial for the survival of animals and plants both on land and in water.

One way to preserve air and water quality is to have more green space within urban areas (Gomez et al., 2011). Increases in green space may decrease average temperatures as well as retain rain water by using less concrete to allow rainwater to reenter the natural water supplies of the area (Gomez et al., 2011). This is known as tempering the "environmental aggression" by employing the natural world to do what it has historically done in renewing and replenishing water and air supplies (Gomez et al., 2011, p. 312).

Population density, a city demographic measure, has also been linked with the health of the natural environment. Jabareen (2006) has argued that high population density as opposed to a geographically spread out population is a conservator of natural resources due to less land mass utilized for human habitation, leaving more area for natural environment in surrounding areas and as a plus "encourages social interaction" (p. 40). Of course, this assumes that the surrounding areas of high-density places remain largely unaltered from their natural state.

Thermal heat has been linked to the health of individuals not only physically but emotionally as well (Gomez et al., 2011). With the inclusion of more green space, urban centers decrease the intense temperatures that may be experienced in conjunction with large amounts of concrete and steel. We might expect that air and water quality would impact human health, but we might be less likely to consider temperature as impacting health of individuals. Research has been conducted on "heat zones" and the discomfort index (Kim, 1989), focusing on the correlation between human comfort and the heat of place of residence. Temperature is something that is largely out of our control, yet some argue that we can do some things to at least mitigate the intense heat of urban areas. For example, urban gardens can "reduce heat islands" in climates that are hot, making the living conditions more bearable for residents (Gomez et al., 2011, p. 312).

Average annual precipitation is another way that humans may be impacted by the environment. As rain replenishes the natural vegetation, it also may mitigate the height of temperatures in urban areas (Gomez et al., 2011). In sum, environmentally friendly urban design should be considered for measuring city sustainability.

Review of Economic Indicators

Recent trends in the literature suggest that as economic vitality increases, environmental sustainability suffers (Grossman & Krueger, 1993; Güney, 2014). One explanation for this inverse relationship is that a traditional foundation for economic vitality is an increase in individuals and businesses (Güney, 2014). These result in a byproduct of increased production that subsequently creates more

stress on the natural environment in the form of higher proportions of pollution in the air and water, as well as heavier reliance on natural resources such as water, fossil fuels, and trees.

Leigh and Li (2015, p. 635) have suggested this negative relationship may be mitigated through various techniques such as businesses striving to reduce their carbon footprint by "designing for the environment" whereby products are more environmentally friendly via reusability or being "recoverable in disposal" of the product. Lubell, Feiock, and Handy (2009) have suggested that industrialization and the businesses that manufacture products can be good for city economy but need policy regulation to ensure participation in sustainable practices. Saha and Paterson (2008) have noted that economic vitality may be achieved when residents of a given area have adequate opportunity to live the quality of life desired, while industry remains prosperous. One way to ensure that individual and business interests coincide is to develop "smart growth" whereby multi-use city plans allow for individual use and business use within the same area (Portney, 2013). This might appear as a downtown area that offers opportunity for residential living spaces alongside small businesses and parks. Oftentimes, smart growth plans will include a refocusing of efforts towards improving older or run-down areas of the city, incorporating public transit options and bike pathways, while adding amenities such as open space to attract and grow social cohesion (Newman, 2005; Portney, 2013). Thus, sometimes the idea of smart growth is to repurpose previous development space in such a way that it increases the desire of people to stay and conduct business in the city and reduces urban sprawl. Thus, smart growth allows for the maximization of space without overconsumption, meaning that more of the natural environment is preserved as the built environment is better utilized.

Another way cities can revitalize their economy is to focus on "green jobs" (Portney, 2013). For example, cities can provide incentives for engineering firms to train staff on environmentally friendly building designs that promote green development/redevelopment of built city structures. Newman (2005, p. 385) has suggested that the larger picture related to sustainable economic growth should focus not on the loss of traditional manufacturing business and industry but instead focus on a redesigning of economic growth towards incentives for smart growth and green development, or as he puts it, "managing the negative" or "promoting the positive." As such, economic prosperity should occur in conjunction with environmental protectionism, supporting the sustainability framework.

Traditionally, city revenue and employment have been used to measure economic growth of a city or neighborhood (Howley, et al., 2009). Under the sustainability framework, we do not want to ignore these traditional measures of economy, but rather to utilize them in thoughtful ways to boost our understanding of the future viability of the city economy in conjunction with sustainable practices. In particular,

employment can be significant to sustainability as employed individuals have much to offer the city in the way of reinvesting in other businesses, home ownership, as well as being a source of revenue and thereby supporting future growth of the city (Howely, et al, 2009). Research has indicated that places with high unemployment struggle economically due to reduced home ownership and business investment (Alberti, 1996). Looking more closely at the one-dimensional indicator of employment, Portney (2013) has found that it is not simply employment itself but rather the type of employment that is correlated with a successful of sustainability plan implemented at the city level. In particular, Portney (2013) found that "creative" job employment was associated with greater participation in sustainable governance while manufacturing and service industry employment were not correlated with an increase in the success of sustainability plans at the city level. These findings indicate there is a necessity to move past traditional measures of economic prosperity to differentiate between types of employment when designing economic indicators for the sustainability framework.

Home values, median income, and level of education have also been linked to sustainability and economic vitality (Portney, 2013). Portney found that with increases in home values and median income, cities tended to enact more sustainability policies at the city level (2013). It seems rational that higher levels of education will ensure more people are employed, thereby increasing economic vitality that is sustainable. Portney (2013) found that level of education did not seem to impact willingness to adopt city sustainability plans; yet, others have found that levels of education are positively correlated with life expectancies and negatively correlated with unemployment rates of a city (Steinbrueck et al., 2014). These findings indicate that level of education may be important when considering the sustainability framework as this indicator may impact the city in many ways, even if it lacks the ability to directly impact whether a city adopts a sustainability plan or not. Regarding traditional modes of measuring a city's economy, it is important to consider not only the current state of economic affairs, but also the future outlook as well. As such, when designing economic indicators for the sustainability framework we can draw upon these traditional modes of measurement as well.

Review of Social Equity Indicators

When considering where to purchase a home or build a business, individuals will consider many things, including ease of transport, city cohesiveness, health and well-being (Steinbrueck et al., 2014; Widok, 2009) access to wholesome food, and safety (Steinbrueck et al., 2014). Social equity is the ability for all residents within a city to have access to the same societal networks set in place such as "governments, judiciaries, militaries, healthcare systems, banking systems, education systems, charities, etc." (Widok, 2009, p. 43). Further, Widok (2009) has suggested that these

social systems and characteristics are so important to individuals and their well-being that they are foundational to measuring social sustainability and ensuring future generations have access to them. Measurement of equity of access to all the social networks available within a city is discussed below.

Bearing in mind the sustainability framework, the indicators that can hinder access to social networks and have a long-term impact on the city are significant. For instance, Howely (2009) found that relative safety of a city negatively impacts peoples' satisfaction with their place of residence, a finding that could lead to a loss of people willing to invest their time and money into the city. Additionally, higher crime rates have been linked with poverty, less access to higher education, and lower sustainability (Adidjaja, 2012; Alberti, 1996, Widok, 2009). To further this point, the Seattle Sustainable Neighborhoods Assessment Project found that crime steadily declined in Seattle between 1994 and 2014 (Steinbrueck et al., 2014). This is a significant finding for sustainability research since Seattle has for some time been considered a national leader in sustainability design and has worked continuously through the years to become more sustainable. The findings show that as Seattle worked towards greater sustainability, the crime rates of the city declined.

Green spaces, or places for outdoor exercise and interaction with others within urban communities have been linked to an increase in social cohesion of individuals and accessibility to social networks (Baur & Tynon, 2010; Karuppannan & Sivam, 2011). As individuals are more active within their community, they tend to interact with one another and are more directly involved within their community and each other. This social cohesion will, in turn, directly affect participation and enhancement of economic relationships of businesses within the community (Coleman, 1993). As individuals are provided a community that contains open space for interaction or smart growth areas, this can lead to increased participation in the community, thereby enhancing the connectedness to place and people, allowing for greater access to the networks necessary for a sustainable city. Because social cohesion or connectedness affects sustainability, things such as open space that will enhance community cohesion, are considered indicators in the sustainability framework.

Another way to increase social cohesion is to have a transparent policy process at the city level and involvement of individuals during the process to ensure success of initiatives (Portney, 2002). This can greatly encourage buy-in from the public and make positive change towards sustainability. In this regard, city sustainability initiatives will mirror the community values in which they are designed. These participatory opportunities by individuals in the policy process will profit the city in other ways as well. For instance, a community with much network participation, communication, and exchange will not only experience greater buy-in of sustainability initiatives but may also see higher rates of economic prosperity (Crowe, 2010). Surprisingly, the age of the

city might impact how involved the public becomes in the process to adopt sustainability initiatives. Lubell, Feiock, and Handy (2009) found that older cities may have a more difficult time creating spaces that allow for network participation, as older cities have little room for drastic changes to old land development models and industrialized systems already in place. Therefore, older cities may need to work a little harder to increase social cohesion of the city, encourage interaction of individuals, and to create more equitable access to social networks necessary for a sustainable future. In sum, social sustainability is best achieved through a coordination of public and private interests, equity of access to necessary systems, and livability of place.

Summary

City sustainability is a topic of great discussion not only among academia but city policymakers and residents as well. Since the emergence of increased environmental awareness as related to our post-industrialized societies, we have discovered a desire to preserve natural and built environments such that future generations have access to them as well. In this regard, much discussion has led to action on the front of sustainable development both at the individual and government level. We live in a world where access to information and education regarding best sustainable practices is at our fingertips, yet oftentimes difficult to understand or apply. This paper outlines reasons for the city to be considered an appropriate place to initiate policy change and has presented a theoretical foundation made up of three pillars of sustainability that cities can incorporate within their sustainability plans.

Cities are best equipped to design, implement, monitor, and adjust sustainability policy. Regarding the environment, researchers have found that air and water quality, the amount of resources available, temperature, precipitation, and open space are important to consider. Regarding the economy, researchers have found income, industry, type of employment, and smart growth to be important characteristics to consider. For social equity, researchers have pointed to social cohesion, open space, access to social programs, and crime in their study of sustainability. With access to these important city sustainability indicators, city planners can focus their efforts on improving sustainability as they strive to create a more reliable and equitable future.

REFERENCES

Adidjaja, E. (2012). The demographics of the largest 25 U.S. cities in relation to their online sustainability reporting and sustainability performance. *The International Journal of Interdisciplinary Social Sciences, 6*(8), 191-200.

Atkisson, A. (1996). Developing indicators of a sustainable community: lessons from Sustainable Seattle, in: D. Satterthwaite (Ed.) *The*

Earthscan Reader in Sustainable Cities (London, Earthscan).

Alam, K., Gow, J., & Uddin, G.A. (2015). Estimating the relationship between grain crop consumption in Australia and environmental sustainability. *Journal of Developing Areas*, *49*(6), 49-60.

Barbour, E & Teitz, M. (2009). Blueprint planning in California: An experiement in regional planning for sustainable development. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed.* (pp. 171-200). Cambridge, Massachusetts: The MIT Press.

Batton, J. J. (2015). Our world is changing at a faster pace than ever before. *Sustainable Cities Index.* Retrieved from https://s3.amazonaws.com/arcadis-whitepaper/arcadis-sustainable-cities-index-report.pdf.

Baur, J. W. R. & Tynon, J. F. (2010). Small-scale urban nature parks: why should we care? *Leisure Sciences*, *32*, 195–200.

Bell, M. M. (2012). *An Invitation to Environmental Sociology*. (4th edition) New York: Pine Forge.

Bithas, K. P., & Christofakis, M. (2006). Environmentally sustainable cities. Critical review and operational conditions. *Sustainable Development*, *14*(3), 177-189.

Borsa, S. & Marchettini, N. (2008). Ecological footprint analysis applied to the production of two Italian wines. *Agriculture, Ecosystems and Environment,* Vol. 128, 162-166.

Bowler, Bryan, & Cocklin. (2002). *The Sustainability of Rural Systems: Geographical Interpretations.*

Coleman, J. S. (1993). The rational reconstruction of society. *American Sociological Review*, *58*(1), 1-15.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16(3)*, 297-334.

Crowe, J. (2010). Community attachment and satisfaction: The role of a community's social network structure. *Journal of Community Psychology, 38*(5), 622-644.

Daniels, T. L. (2009). A Trail Across Time: American Environmental Planning from City Beautiful to Sustainability. *Journal of The American Planning Association*, *75*(2), 178-192.

Dassen, T., Kunseler, E., & Kessenich, L. M. (2013). The Sustainable City: An Analytical-Deliberative Approach to Assess Policy in the Context of Sustainable Urban Development. *Sustainable Development*, *21*(3), 193-205.

Dave, S. (2011). Neighbourhood density and social sustainability in cities of developing countries. *Sustainable Development*, *19*(3), 189-205.

Dempsey, N.; Bramley, G.; Power, S.; & Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. *Sustainable Development 19,* 289-300.

Deniz, D., & Ozcan, A. C. (2014). Crime Prevention in Residential

Settlements or New Sustainable Communities-cities. *International Journal for Housing Science & Its Applications*, *38*(3), 173-181.

Drexhage, J. & Murphy, D. (2010). *Sustainable Development: From Brundtland to Rio 2012.* Retrieved from http://www.un.org/wcm/webdav/site/climatechange/shared/gsp/docs/GSP1-6_Background%20on%20Sustainable%20Devt.pdf.

Fiorino, Daniel J. (2009). Regulating for the future: A new approach for environmental governance. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward Sustainable Communities: Transition and Transformations in Environmental Policy, 2nd Ed.* (pp. 63-86). Cambridge, Massachusetts: The MIT Press.

Friedman, Thomas L. (2008). *Hot, flat, and Crowded Release 2.0*. New York: Farrar, Straus and Giroux.

Garnåsjordet, P. A., Aslaksen, I., Giampietro, M., Funtowicz, S., & Ericson, T. (2012). Sustainable Development Indicators: From Statistics to Policy. *Environmental Policy & Governance*, *22*(5), 322-336.

Global Footprint Network. (2012). *Advancing the Science of Sustainability*. Retrieved from http://www.footprintnetwork.org

Gómez, F., Jabaloyes, J., Montero, L., De Vicente, V., & Valcuende, M. (2011). Green Areas, the Most Significant Indicator of the Sustainability of Cities: Research on Their Utility for Urban Planning. *Journal of Urban Planning & Development*, *137*(3), 311-328.

Gonzalez, A., Donnelly, A., Jones, M., Klostermann, J., Groot, A., & Breil, M. (2011). Community of Practice Approach to Developing Urban Sustainability Indicators. *Journal of Environmental Assessment Policy & Management*, *13*(4), 591-617.

Goodland, R. (1995). The concept of environmental sustainability. *Annual Review of Ecology and Systematics.* Vol. 26, 1-24.

Grossman, G.M., Krueger, A.B. (1993). *Environmental Impacts of a North American Free Trade Agreement. The Mexico-U.S. Free Trade Agreement*. MIT Press, Cambridge, 13-56.

Guimarães, L. M. (2012). Sustainability and cities: a proposal for implementation of a sustainable town. *Work*, *41*2160-2168.

Güney, T. (2015). Environmental sustainability and pressure groups. *Quality & Quantity*, *49*(6), 2331-2344.

Hempel, Lamont C. (2009). Conceptual and analytical challenges in building sustainable communities. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed.* (pp. 33-62). Cambridge, Massachusetts: The MIT Press.

Howley, P., Scott, M., & Redmond, D. (2009). Sustainability versus liveability: an investigation of neighbourhood satisfaction. *Journal*

of Environmental Planning & Management, *52*(6), 847-864.

Jabareen, Y.R. (2006). Sustainable urban forms: Their typologies, models, and concepts. *Journal of Planning Education and Research, 26(*38).

Kamieniecki, S. (2009). Forward. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed.* (pp. vii-viii). Cambridge, Massachusetts: The MIT Press.

Karuppannan, S., & Sivam, A. (2011). Social sustainability and neighbourhood design: an investigation of residents' satisfaction in Delhi. *Local Environment*, *16*(9), 849-870.

Kraft, Michael E. (2009). Cleaning Wisconsin's waters: From command and control to collaborative decision making. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed.* (pp. 115-140). Cambridge, Massachusetts: The MIT Press.

Krank, S., Wallbaum, H., & Grêt-Regamey, A. (2010). Constraints to implementation of sustainability indicator systems in five Asian cities. *Local Environment*, *15*(8), 731-742.

Leigh, M. & Li, X. (2015). Industrial ecology, industrial symbiosis and supply chain environmental sustainability: A case study of a large UK distributor. *Journal of Cleaner Production.* Vol. 106, 632-643.

Lenzen, M. & Murray, S.A. (2003). The ecological footprint- Issues and trends, the University of Sydney, ISA Research Paper. 1-3. Retrieved from http://www.isa.org.usyd.edu.au

Lewis, J. (1988). Looking backward: A historical perspective on environmental regulations. *Environmental Protection Agency*. Retrieved from http://www2.epa.gov/aboutepa/looking-backward-historical-perspective-environmental-regulations

Li, T., Zhang, H., Yuan, C., Liu, Z., & Fan, C. (2012). A PCA-based method for construction of composite sustainability indicators. *International Journal of Life Cycle Assessment*, *17*(5), 593-603.

Lubell, M., Feiock, R., & Handy, S. (2009). City Adoption of Environmentally Sustainable Policies in California's Central Valley. *Journal of The American Planning Association*, *75*(3), 293-308.

Magee, L., & Scerri, A. (2012). From issues to indicators: developing robust community sustainability measures. *Local Environment*, *17*(8), 915-933.

Massey, D. (2007). *World City.* Cambridge, UK: Polity Press.

Mayer, H. & Provo, J. (2004). The Portland edge in context. In C. P. Ozawa (Eds), *The Portland edge: Challenges and successes in growing communities,* (pp. 9-34). Washington: The Island Press.

Mazmanian, D. A. (2009). Los Angeles' clean air saga-Spanning the three epochs. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed.* (pp. 89-114). Cambridge, Massachusetts: The MIT Press.

Mazmanian, D. A., & Kraft, M. E. (2009). The three Epochs of the environmental movement. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed*. (pp. 3-62). Cambridge, Massachusetts: The MIT Press.

McCarthy, G. (2015). *History of the clean water act.* Retrieved from http://www2.epa.gov/laws-regulations/history-clean-water-act.

McLarty, D., Davis, N., Gellers, J., Nasrollahi, N., & Altenbernd, E. (2014). Sisters in sustainability: municipal partnerships for social, environmental, and economic growth. *Sustainability Science*, *9*(3), 277-292.

McKinsey & Company. (2012). Sustainable Urban Infrastructure, London edition- a view to 2025. *Seimens AG. Retrieved from* http://www.siemens.com/entry/cc/features/urbanization_development/all/en/pdf/study_london_en.pdf

Accessed on January 1, 2013.

McManus, P. (2012). Measuring Urban Sustainability: the potential and pitfalls of city rankings. *Australian Geographer*, *43*(4), 411-424.

Moore, D. (2011). Ecological footprint analysis: San Francisco-Oakland-Fremont, CA metropolitan statistical area. Retrieved from http://www.footprintnetwork.org

Morse, S. (2015). Developing Sustainability Indicators and Indices. *Sustainable Development*, *23*(2), 84-95.

Mukherjee, R., Sengupta, D., & Sikdar, S. (2013). Parsimonious use of indicators for evaluating sustainability systems with multivariate statistical analyses. *Clean Technologies & Environmental Policy*, *15*(4), 699-706.

Müller, Daniel. (2012). Sustainable Urban Infrastructure, Munich Edition – paths toward a carbon-free future. *Seimens AG*. Retrieved from http://www.siemens.com/entry/cc/features/urbanization_development/all/en/pdf/study_munich_en.pdf. Accessed on January 1, 2012.

Muñoz-Erickson, T. A. (2014). Multiple pathways to sustainability in the city: the case of San Juan, Puerto Rico. *Ecology & Society*, *19*(3), 8-16.

Newman, P. (2005). Sustainability Assessment and Cities. *International Review for Environmental Strategies*, *5*(2), 383-398.

Niccolucci, V., Galli, A. K., & Pulselli, R.M. (2008). Ecological footprint analysis applied to the production of two Itaian wines. *Agriculture, Ecosystems and Environment,* Vol. 128, 162-166.

Nunnally, J. C. (1978). Psychometric theory (2nd ed.), New York: McGraw-Hill.

Opp, Susan M. & Saunders, Kyle L. (2012). Pillar talk: Local sustainability initiatives and policies in the United States- Finding evidence of the "Three E's": Economic development, environmental protection, and social equity. *Urban Affairs Review 49(*5): 678-717.

Portney, K. E. (2002). Taking Sustainable Cities Seriously: a comparative analysis of twenty-four US cities. *Local Environment*, *7*(4), 363-380.

Portney, K. E. (2009). Sustainability in American Cities: A comprehensive look at what cities are doing and why. In D. A. Mazmanian & M. E. Kraft (Eds.), *Toward sustainable communities: Transition and transformations in environmental policy, 2nd Ed.* (pp. 227-254). Cambridge, Massachusetts: The MIT Press.

Portney, K.E. (2013). *Taking Sustainable Cities Seriously: Economic development, the environment, and quality of life in American cities, 2nd Ed*. Cambridge, Massachusetts: The MIT Press.

Portney, K. E., & Cuttler, Z. (2010). The local nonprofit sector and the pursuit of sustainability in American cities: a preliminary exploration. *Local Environment*, *15*(4), 323-339.

Print, M., & Coleman, D. (2003). Towards understanding of social capital and citizenship education. *Cambridge Journal of Education*, *33*(1), 123.

Ramaswami, A., Weible, C., Main, D., Heikkila, T., Siddiki, S., Duvall, A., & ... Bernard, M. (2012). A Social-Ecological-Infrastructural Systems Framework for Interdisciplinary Study of Sustainable City Systems. *Journal of Industrial Ecology*, *16*(6), 801-813.

Rifkin, Jeremy. (2011). *The Third Industrial Revolution: How Lateral Power is Transforming Energy, the Economy, and the World*. Palgrave Macmillan.

Sassen, S. (2005). The global city: Introducing a concept. *Brown Journal of World Affairs, 11*(2), 27-43.

Satterthwaite, D. 2008. "Cities' Contribution to Global Warming: Notes on the Allocation of Greenhouse Gas Emissions." Environment & Urbanization 20:539–49.

Schenone, C., Delponte, I., & Pittaluga, I. (2015). The preparation of the Sustainable Energy Action Plan as a city-level tool for sustainability: The case of Genoa. *Journal of Renewable & Sustainable Energy*, *7*(3), 1-22.

Schlossberg, M., & Zimmerman, A. (2003). Developing Statewide Indices of Environmental, Economic, and Social Sustainability: a look at Oregon and the Oregon Benchmarks. *Local Environment*,*8*(6), 641-660.

Simmel, G. Conflict. Translated by Kurt H. Wolff. The Free Press New York. 1955.

Steinbrueck, P., Winter, M., Williamson, S., Patterson, M. S., Barbe, D., & Greaney, Y. (2014). Seattle Sustainable Neighborhoods Assessment Project Report 2014. https://www.seattle.gov. Retrieved on December 1, 2017.

Sulkowski, A. J. (2016). City Sustainability Reporting: An Emerging & Desirable Legal Necessity. *Pace Environmental Law Review*, *33*(2), 278-299.

Sustainable Society Foundation. (2015). http://www.ssfindex.com/. Retrieved on July 15, 2015.

Tanguay, G.A., Rajaonson, J., Lefebvre, J., & Lanoie, P. (2010). Measuring the sustainability of cities: An analysis of the use of local indicators. *Ecological Indicators.* Vol. 10, 407-418.

Tilt, Bryan. (2010). *The struggle for sustainability in rural China*. Columbia University Press.

Turner, B., Henryks, J., & Pearson, D. (2011). Community gardens: sustainability, health and inclusion in the city. *Local Environment*, *16*(6), 489-492.

United Nations. (2012). *Millennium Development Goals Report 2012.* New York: United Nations.

United States Census Bureau. (2015). *2010 Census Urban and Rural Classification and Urban Area Criteria*. Retrieved from https://www.census.gov/geo/reference/ua/urban-rural-2010.html

United States Environmental Protection Agency. (2017). About Urban Air Toxics. Retrieved December 21, 2017, from https://www.epa.gov/urban-air-toxics/about-urban-air-toxics.

U.S. Department of Energy. Funding & Financing. (n.d.). Retrieved March 20, 2017, from https://energy.gov/public-services/funding-financing

USGCRP, 2016: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX

Van de Kerk, G., & Manuel, A. (2010). *Sustainable Society Index*. Netherlands: Sustainable Society Foundation. Retrieved from http://www.ssfindex.com/cms/wp-content/uploads/Publication_SSI2010.pdf.

Wackernagel, M., Monfreda, C., & Deumling, D. (2002). Ecological footprint of nations update: How much nature do they have? *Refining Sustainability Issue Brief, (November).* Retrieved from http://rprogress.org/ecological_footprint/about_ecological_footprint.htm

Widok, A. (2009). Social sustainability: Theories, concepts, practicability. *Environmental Informatics and Industrial Environmental Protection:*

Concepts, Methods and Tools. ISBN: 978-3-8322-8397-1.

World Commission on Environment and Development (WCED) (Brundtland Commission). (1987). *Our Common Future*. New York: Oxford University Press.

Yli-Viikari, A., Risku-Norja, H., & Aakkula, J. (2012). Sustainability Indicators: Providing Policy Indications or Just Adding Informative Chaos? *Journal of Sustainable Agriculture*, *36*(1), 127-150.

Yli-Viikari, A. (2009). Confusing messages of sustainability indicators. *Local Environment*, *14*(10), 891-903.

Zeemering, E. (2012). Recognising interdependence and defining multi-level governance in city sustainability plans. *Local Environment*, *17*(4), 409-424.

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