AN ASSESSMENT OF SUSTAINABILITY INDICATOR PROGRAMS IN LARGE US CITIES

by

Josef Kaul, B.S

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Committee Members:

Gail Dickinson, Chair

Gwendolyn Hustvedt

Andrew Sansom

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ABSTRACT

Sustainability is a concept wrought with meaning and importance in today's world. Although many different definitions and uses of the word exist, the most common definition comes from the Brundtland report (1987), "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (paragraph 49). This definition, along with mandates set out by the United Nation's *Agenda 21*, have spurred the growth of Sustainability Indicators (SIs) (United Nations, 1993). SIs are measurable metrics, statistics, or other data that can assess progress towards a desired sustainability goal.

This study aims to answer the question, "How many US metro regions have sustainability plans and are measuring their success with Sustainability Indicators?" It then attempts to create a comparable list of SIs being used in the 40 largest metro areas in the United States by using the International Urban Sustainability Indicators List (IUSIL).

The results of this study indicate that 35 out of the 40 largest US metro areas use sustainability plans. Additionally, 23 out of the 40 metro areas use Sustainability Indicators to measure progress towards the sustainability goals set forth in their plans. This means 46% of the US population live in cities using sustainability plans, and 29% of the population live in cities using Sustainability Indicators. The study also reveals only a 17% average compliance rate with the IUSIL. The study recommends that communities use the STAR Community Index for a comprehensive list of Sustainability Indicators.

1. INTRODUCTION

Background of Problem

Sustainability has become a mainstream concept with many uses and definitions. However, most common uses and definitions stem from the World Commission on Environment and Development's *Our Common Future*, also known as the Brundtland Report's (1987; Tanguay 2009) definition, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (paragraph 49). This concept is wrought with meaning and derives much of its value from the environmental movement of the 1960s and 70s.

At a time when songbirds were dying from DDT, rivers were catching on fire in America's rust belt, and an unfettered raping of our nation's forests was happening in the northwest, a movement began to protect these unprotected resources. Some of the meaning of the Brundtland Report's definition stems from this time of wonton disregard for resources and their longevity. The environmental movement came about after mass extinctions of pigeons and bison happened in the early 19th century, and was on the eve of other such extinctions happening again. The mandate to protect, conserve, and preserve our nation's natural resources was never felt as strongly as in the series of environmental legislation passed during the 1970s. These acts of congress included the Endangered Species Act (1973), the Clean Water Act (1972), and the Clean Air Act (1970). While the movement during that time in the first world was focused on sustaining our environment, there were other movements happening other parts of the world with a different focus.

Starting with President Jimmy Carter's self-realization to become a better global citizen, and stretching into the neoliberal-capitalism of the 1980s, an equality movement has been happening alongside the environmental movement (Fortmann, 2006). The global north has been trying, in sometimes-unsuccessful ways, to redistribute and equalize both economic opportunity and social wellbeing in the global south. After both the environmental and equality movements of the 1970s made their way into the 1990s, people working in both movements started heading in a new direction. This time, under the auspices of "sustainability," advocates for both the environment and for equality began marching together. The culmination of this new partnership happened first at the 1992 Earth Summit in Rio.

Nowadays, the word "sustainability" is used to mean a lot of things. Some people refer to it when talking about "greening" things, like hybrid cars and organic fiber. Despite its mainstream over-use, sustainability, and sustainable development specifically, have accepted concrete definitions. The Brundtland report (Tanguay, 2009; WCED, 1987) indicates that sustainable development has three main concepts: economic, social, and environmental. Each of these separate concepts, it is said, should be balanced and integrated. Therefore, sustainable development should incorporate the needs of an economy, an environment, and a community. When businesses, organizations, or governments strive for this balance, it is often referred to as the triple bottom line.

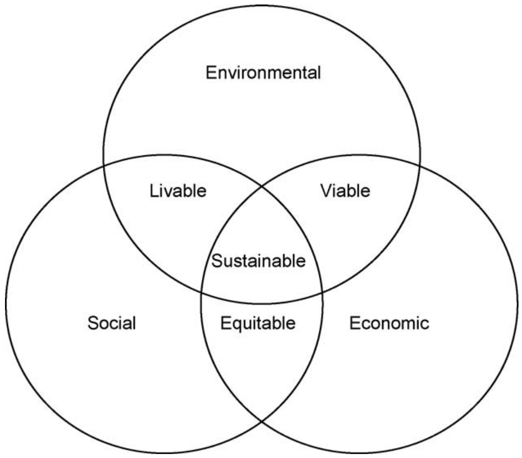

Figure 1 Classic dimension of sustainable development. Taken from Tanguay 2009.

Furthermore, the concept of sustainable development has become a local concern. While the convergence of two global movements happened at the United Nations' 1992 Earth Summit in Rio, the outcome of that summit was of local concern. *Agenda 21*, the report directed at various nations that was the result of the Earth Summit, instructed local municipalities to begin focusing more on sustainable development. *Agenda 21* recommends that local authorities should, "play a vital role in educating, mobilizing and responding to the public to promote sustainable development" (United Nations, 1993, ch. 28). This guiding document also encourages the development of "indicators of sustainable development" to increase local capacity to "collect and use multisectoral information in decision making processes" (United Nations, 1993, ch. 40). Since the development of this guiding document in 1993, many organizations, municipalities, and governments have tried to create and use such indicators. In other parts of the world, Canada and Europe namely, actions are being taken at a national or regional scale (Parris and Kates, 2003). Here in the United States, the federal government has not signed a critical agreement to curb environmentally dangerous greenhouse gas emissions known as the Kyoto Protocol (Rahm, 2010). Because of this lack of leadership on the federal level, cities have had to become the incubator for sustainable development. At this local scale, mayors, non-profits, and other jurisdictions are creating sustainability plans that balance the environment, the economy, and the quality of life of their communities. These plans go beyond the goals of the Kyoto Protocol by introducing this balance. In order to measure progress towards the goals laid out in these sustainability plans, many plan creators are using a tool called sustainability indicators as called for in *Agenda 21* (United Nations, 1993).

Sustainability Indicators (SIs) are “numerical measures that aim to capture the state of a complex social, economic, or physical condition” (Wells, 2006, p. 9). Their uses vary as widely as the definition of sustainability itself. Their purpose, however, is clear. SIs are not just used to monitor progress, rather they are used to make progress happen (Raimond dit Yvon, 2013; Wells, 2006). In other words, SIs “are tools which represent the transition from theory to practice” (Ceron, Dubois & Raoul-Duval, 1999, p. 3; Raimond dit Yvon, 2013, p. 1). These measurement tools are thus used to monitor sustainability successes and failures *and* thereby are used to actually "move the needle” of sustainability.

Statement of Problem

A report released in 2008, "A Comparative Analysis of Sustainable Community Frameworks” highlights the current state of SIs in America. A brief list of its findings include the following:

> The vast diversity in framework structure and focus makes it very difficult to compare the progress of one locality to another, and misses the opportunity to leverage change and share lessons learned.
>
> While frameworks may contain commonalities in terms of verbiage used and apparent themes addressed, these terms and themes do not share common definitions, leading to additional potential confusion and lost opportunities for collaboration. (Peterson, 2008, p. 3)

For the purposes of research, this study will define Sustainability Indicators as a system of metrics or statistics that are used to measure progress or change towards sustainability goals. The report defines frameworks in much the same way that this study defines SIs:

> A program or approach by which an entity aims to evaluate the progress of itself or other entities with respect to performance in the arenas of environmental, human, and economic health. The framework must have defined boundaries (geographic or organizational) to allow for comparison, and indicators or other measures of evaluation" (Peterson, 2008, p. 4).

This definition, however, includes the requirement that the criteria used must be comparable among sets of indicators. The problem is that the existing SIs being used by cities across the country do not currently have a method for comparability. The growth in the use of sustainability plans has been documented, though. According to the Green Survey conducted in 2009, more than half of all big cities in the United States are either "currently creating sustainability plans, or have finished one within the past year" (Living Cities, 2009). In addition, 4 out of 5 big cities claim that sustainability is a top five priority. The same data does not exist regarding large cities' use of Sustainability Indicators.

The purposes of this this study are to 1) quantify the use of SIs in a sample of US metro areas and 2) categorize the indicators so that a national framework can be developed and used by municipalities. This data will be used to tell the ever-evolving story of sustainability in America. Starting with the environmental and equality movements of the mid-20th century, and now combining those efforts at a local scale, the sustainability movement has a lot at stake. Trying to balance environmental, economic, and social issues in cities that lie within our country's Pacific Northwest, our rust belt, and our ecologically diverse coastline are dense challenges. This research hopes to provide data to help tackle some of these challenges by providing a more detailed baseline of the use of sustainability plans and sustainability indicators.

Research Questions

This paper aims to answer the question, "How many US metro regions have sustainability plans and are measuring their success with Sustainability Indicators?"

The following hypotheses will be tested:

H1= A majority of the top 40 largest US metro regions have formal sustainability plans.

H2= A minority of the top 40 largest US metro regions use Sustainability Indicators to measure their plan's success.

H3= There are common trends and best practices among the US metro regions using SIs.

2. REVIEW OF LITERATURE

This literature review tries to point out many of the commonalities and trends among SI research. It starts with a background of need, both in terms of urban sustainability and indicator use. This leads to a discussion of the history and current use of SIs. Then, a discourse on the current state of literature begins. Generally, the literature can be broken into three typologies. First, this review examines indicators through the lens of "sound science" or, the search for the *ideal* indicator. After that, this review discusses the soft, or intangible benefits of SI use and development. The third and final typology of research consists of SIs' use in policy implementation. For each of the typologies, this review identifies 1) how the research defines an indicator, 2) why indicators are used, and 3) who are the end users of an indicator. While there is some overlap of ideas in each of the bodies of research, the "sound science" typology focuses on *how*, the community involvement typology focuses on *why*, and the public participation typology focuses on *who*. Following this examination of typologies, this review explores the current frameworks being used to categorize SIs. The review of the literature concludes by summarizing some key findings of indicator trends.

Background

The world is quickly becoming more urbanized. The UN *World Urbanization Prospects* report (2013) predicts an 84% increase in urban population in the next 40 years (United Nations, 2013; Young, 2012). The process of global population shift has already begun, with more people now living in cities than in rural locations for the first time ever. More urbanized cities can lead to more pollution, altered land use, biodiversity degradation, increased global warming, and social inequalities (Grimm *et al.* 2008; Young 2012). With the juxtaposition of urban growth and issues of sustainability on many people's mind, the study of urban sustainability has emerged. Urban sustainability studies not only include the evaluation of ecological or environmental factors, they also incorporate economic and social factors.

Cities are becoming more popular, yes, but they are also becoming more critical to the development of sustainability goals. Ever since the Earth Summit in Rio de Janeiro in 1992 and the creation of *Agenda 21*, cities have been the scale at which sustainability goals are being set and reached in many places (Camagni, 2002; Campbell, 1996; Shen, Ochoa, Shah & Zhang, 2011). "In the absence of any global agreement including the world's largest carbon emitting nations, local initiatives have emerged to address the issues at hand" (Young, 2012, p. 7). Part of this is the result of the guiding principles within *Agenda 21* itself, with an entire chapter focusing on local sustainability. This chapter has led to the creation of Local Agenda 21 (LA21) programs throughout the world. While there is still some debate over the appropriateness of tackling global issues on a local scale (Evan, Sundback & Theobald*,* 2006; Young 2012), there is a thirst for more urban sustainability initiatives (Huang, Wong & Chen, 1998; Pierce, Budd & Lovrich, 2011; Shen *et al.,* 2010).

These urban sustainability initiatives often take the shape of a system of indicators, frameworks and assessment tools (Briassoulis, 2001; Davison, 1996; Shen et al., 2011). This is not a new trend, but it is trend with a more defined focus than ever before. The use of measurement tools to gauge humanity's progress date back to the pioneering work done by Nordhaus and Tobin (1971), Zolotas (1981), and Osberg (1985). These innovators began the task of creating "wellbeing indices" (Bohringer and Jochem, 2007). The United States uses numerous other indicator systems today such as GDP (Gross Domestic Product), unemployment, economic growth rates and the like. The statistics provide a snapshot in time, a way to gauge one's progress, and by no means a complete picture of how, for example, the economy is doing. Economists, politicians, and civil leaders, however, use these simplified metrics to make decisions, influence change, or keep on the straight and narrow.

The use of Sustainability Indicators is growing to be the same as these other, more commonly used metrics. The use of these indicators in urban settings has become especially important. The use of SIs in urban planning is "crucial for helping target setting, performance reviews and facilitating communication among the policymakers, experts, and the public" (Shen et al., 2011, p. 17; Verbruggen & Kuik, 1991). For at least two decades, local governments around the world have begun to use SIs to measure success towards sustainability based on their own priorities (Shen et al., 2011; Parris & Kates, 2003). In the urban sector:

> …the key issue is not really 'sustainable cities' but cities whose built form, government structure, production systems, consumption patterns and waste generation and management systems are compatible with sustainable development goals for the city, its wider region and the whole biosphere" (Keirstead & Leach 2007, p. 329; Satterthwaite 1999).

This is where the definition of sustainability can be expanded from the basic three-tiered environment, economy, and society concept to one that includes a governance component. The intended use of these indicators, however, varies widely. Different entities develop different indicators for different reasons. Some governments develop indicators, some non-profits, and even some businesses utilize SIs. With this wide difference in mind, a synthesis of the current research on the use of SIs is in the next section. As mentioned before, because of the varied definitions, user groups, and reasons for use discussed by other authors, this study will attempt to answer the following questions about each typology of research in a systematic order: *what, why, and who*.

Sound Science

The literature discussed here focuses on the technical development of SIs. For a long time, much of the literature only focused on this topic. Indicators were seen as a means to an end, as a tool to plug in to the policymaking process, and if "sound science" was used correctly, an *ideal* indicator could be created (Holman, 2009). In an effort to make the development and use of indicators as scientific as possible, checklists were created so that the *ideal* criteria could be plugged into a linear policy making process.

What is an indicator?

Defining indicators requires some basic assumptions. The basic assumptions for *ideal* indicator development are that indicators should be: "policy relevant; resonant; scientifically valid, and; measurable (i.e. the necessary data are available)" (Levett, 1998, p. 298). Other, more detailed criteria exist as well, making up a longer and longer checklist of an *ideal* indicator. For instance, when creating indicators for a European SI Framework, the following criteria were used to select appropriate indicators:

- Resonance: would the audience empathize with the indicator?
- Significance: is the indication unambiguous and clear?
- Comparability: Is the indication capable of comparison with other values reported elsewhere?
- Action orientation: is it clear who will carry out the required action?
- Relation to other indicators: as well as being meaningful on its own, does the indicator have collective meaning? (Holland, 1997, p. 44)

Other authors say that an indicator must be SMART (Specific, Measurable, Achievable, Relevant, and Time-related) (Persson, 2013; Shen et al., 2011). SPICED is another acronym, but it applies more to local sustainability projects: Subjective, Participatory, Interpreted and communicable, Cross-checked and compared, Empowering, Diverse and disaggregated (Persson, 2013). These assumptions, or checks in a list, then become criteria by which to measure the indicators. It is the goal of this research to make the indicators tools that can synthesize large amounts of data and provide simple answers to complex questions. In fact, the use of these technocratic, simplified measures is idealized because of their ease of measurability and the fact that data already exist.

Why do we use indicators?

According to Holman (2009), this research focuses on two reasons for "sound science." Some of the research relies on this technocratic method because it makes complex issues simple and other articles focus on the "rather aspirational role indicators should play in relation to decision-making" (Holman, 2009, p. 367). It is hypothesized that taking the scientific approach to indicator development can create tangible data that can be easily plugged into the policymaking process.

The first reason to use this approach to indicator development proposed here is that it can make complex systems and data simple to understand. The focus of this body of work is on the inherent complexity of sustainability. More specifically, many of the studies focus on the inherent complexity of the environmental leg of sustainability. From Noss's (1990) *Indicators for monitoring biodiversity: a hierarchical approach* to more recent publications by Tasser, Sternbach, and Tappeiner (2008) and Niemeijer and de Groot (2008), there is an effort to find simply measured indicators that can make sense of complex biological relationships. Because of the intrinsic dependencies in ecosystems, many of these authors propose multiple frameworks so that scale and interdependencies can be expressed (Holman, 2009). This body of work does make great strides in making data visually comprehendible through the incorporation of GIS tools and simplified indicators (Tasser *et all.* 2008).

Other authors that hold fast to the "sound science" of indicator development argue that policymaking is a linear process and in order for policymakers to use this complex information, the data must be gathered by impartial scientists using scientifically defendable procedures. This "aspirational" argument rests on the assumption that policymakers make decisions in a vacuum. For instance, some authors "speak of indicators as providing an '…exhaustive and quantitative picture of the complex relationships between society and the environment' that will provide administrators and decision makers the information they need to direct policy" (Holman, 2009, p. 368, Bagliani, Galli, Niccolucci & Marchettini, 2008). This body of work really gets to the heart of *why* the scientific approach should be used for indicator development. As Moldan and Dahl (2007) indicate, the goal of SIs is to assimilate massive amounts of complex information for use by busy decision makers. They argue that an SI's function and purpose rest solely on their ability to influence decision makers and ease their decision making process. According to these authors, it is the goal of indicators to "condense and digest information for rapid assimilation" (Moldan & Dahl, 2007). Keirstead and Leach (2007) also discuss the use of SIs as a policy tool. In their analysis of London's SIs, they try to compare the *idealized* use of indictors versus the actual use. While their research finds a disconnect between the two, the authors acknowledge the importance of a scientifically sound indicator when trying to impact change. The *why* question in this case, ultimately is directed at the *who.*

Who uses indicators?

The *ideal* indicator can be an efficient tool to plugging in to the policy making process. Therefore, the users of these SIs are said to be decision makers. As Böhringer and Jochem (2011) argue, without using scientific rules, "which guarantee consistency and meaningfulness" SIs are useless in the policymaking process and misleading. The aim of sound indicator quality research is thus to ultimately disseminate sustainability successes and failures to the layperson making decisions (Rosenström, 2009).

Issues with this focus

Policymaking is not linear, and therefore the plug-and-chug method of this technocratic indicator development does not work in the real world. Also, the focus on data-driven, simplistic indicators might be measuring something totally irrelevant to *actual sustainability*. Just because something is measurable, data exist for it (or can be easily retrieved), and it meets the assumptions listed above, does not mean that it is indicating something of value. As Keirstead and Leach (2007) argue, it is one thing to find and measure a scientifically valid SI, it is quite another to bridge to gap between theory and practice. Moldan and Dahl (2007), Holman (2009), and Terry (2008) have also addressed this unique problem. This solely scientific approach leaves out the values that communities place on the measures and criteria.

Community Involvement

Gahin, Veleva, and Hart (2003) take a different approach to developing SIs. Based on their analysis of five community-level SIs, they determined three unique outcomes that come from SI use: intangible benefits, concrete benefits, and measurable change constitute the realm of possibilities when classifying SIs' successes (Gahin *et al.,* 2003). The *concrete benefits* are sought through the creation of *ideal* indicators, as discussed above. The *measurable change* constitutes its own brand of research and will be discussed below under "Policy Implications." *Measurable change*, in this sense, means progress or movement towards a target that has been determined is more sustainable. The benefits of community involvement, however, fall under the first category listed, *intangible benefits*. Some of the intangible benefits include:

- Provide forum for discussion
- Bring people together; facilitate new working relationships
- New working relationships, organizations form
- Increased awareness
- Value shifts (Gahin *et al.*, 2003, p. 663)

All of these intangible benefits are the outcomes of community involvement. These benefits, which are often hard to define or objectify, result in an increased ability to solve problems.

What is an indicator?

This body of research leaves the question of "what is an indicator" unanswered for the most part. In fact, it is up to the participants involved in the indicator development process to decide what an indicator truly is (Santana-Medina et. al *et al.* 2013). One of the benefits of this participatory approach is that the democratization of the SI development process leads to community-relevant ideas based on community needs and desires. This can also create many indicators focusing on either a considerably narrow aspect of sustainability or an exhaustively broad look at all issues (Holden, 2009;

Holman, 2009; Rosenström, 2009; Santa-Medina *et al.,* 2013). However, because this research focuses on *why* we use indicators, the fact that the indicators may not meet the explicit standards laid out in the previous section is considered all right.

Why do we use indicators?

Community Involvement research emphasizes this component of SI use and implementation. As Holman (2009) expresses, this process of community involvement in indicator development is what it means to "do" sustainability. In effect, this is where the rubber meets the road. The very act of participating, learning, and being engaged is in itself the great benefit of using and developing SIs. Whether any actual change is happening is looked at second, but if the citizenry became more informed through the process then the process is a success is the essential argument of this body of research.

One of the inherent benefits of this process has been talked about for a long time. Basically, by involving more people, the process is leading to a stronger democracy (Barber, 1984; Elster, 1998; Saward, 1998). By having a stronger democracy, elected officials and decision makers have a better understanding of the issues the people actually care about (OECD, 2002). However, this research also points out that having too many actors involved can slow down the process and having not enough defeats the purpose of involving the community (Santa-Medina, 2013). It is this direct use of democracy that can lead to productive implementation of SIs because it connects policymakers to the public (Connelly, 2009).

The involvement of more people is not the only benefit of this approach. When more people are involved, there is teaching and learning happening around every turn. The fact that participants are learning more about sustainable development simply through the process of developing SIs is said to be a benefit in its own right. Bell and Morse (2005), and Becker (2005) emphasize this feature of the community led process in their research. The authors note the questionable *measurable change* of SIs, but are quick to point out, “they do serve as an excellent learning opportunity for stakeholders” (Becker, 2005; Bell & Morse, 2005; Holman, 2009). Becker explicitly emphasizes the knowledge benefits of community involvement. She proposes a new participatory framework with which to involve stakeholders and guide the process of SI development. Through this process, she aims to increase the “stakeholder’s understanding of how to *achieve* sustainable development, which is the first step in making progress towards it” (Becker, 2005, p. 99). Therefore, the knowledge gained through the development process, it is said, should be the goal of SIs.

The third reason to use the participatory approach is engagement. This differs from improving democracy and teaching the public because it is even less tangible than those two benefits. Building on a series of papers by Bell and Morse (2001), Magee and Scerri (2012) and others (Baldwin & Chandler, 2010; Fischer, 2009; Middlemiss, 2011; Mitchell, Curtis & Davidson, 2008; Paton & Fairbairn-Dunlop, 2010) discuss the benefits of this community engagement. They cite the utility that the bottom-up approaches have through the process of “dialogue and deliberation” (Magee & Scerri 2012). Not only does this process yield utility, it “can often have transformative impacts on the individuals involved” (Magee and Scerri 2012, p. 916; Middlemiss, 2011). Thus, just the fact that people are engaged in the process can be seen as a success.

Who uses indicators?

The question of *who* uses the SIs is closely linked with the question of *why* SIs should be used. When the focus is on community involvement, the audience is as broad as one can imagine. While the implications of the “sound science” doctrine listed above were to direct policy actors in their decisions, the goal of the participatory approach is to bring everyone to the table. If policy change results from the use of the SIs, that is a side benefit. Therefore, the users of these SIs are the public.

Issues with this focus

This bottom-up approach certainly aims to be inclusive and holistic in its attempt to use SIs. However, there are issues with using this community-led effort. Some authors point out the "consultation fatigue", *i.e.* the over-engagement of the public (Richards, Carter & Sherlock, 2004; Rosenström, 2009; Smith, 2008). Other issues pertain to the inherent complexities in using a participatory approach. These methods are often not repeatable or defensible, they are often slow and costly, and at their worst they cannot achieve even the most intangible of goals: engagement (Magee & Scerri, 2012; Rydin & Pennignton, 2000). The selection of indicators based on local knowledge can also "lead to fruitless process, because the indicators would not comply with the required standards" that are often utilized by others (Santana-Medina et. al, 2013, p.8). So, while the inclusion of many participants can yield some interesting results in the way of democracy, knowledge, and engagement, their overall utility is less than ideal. It is for this reason that many authors propose a combination of the top-down, technocratic process listed previously and this bottom-up, participatory process.

Policy Implications

In order to delve into the litany of research on policy implications of SIs, we must first understand the policy process. Figure 2 shows the policy cycle, from which it will be possible to assess the uses and users of SIs in the policymaking process (Rosenström, 2009, p. 22). To frame this body of research, it is important to first discuss the theorized view of how SIs can impact policy. Then, through the same methods as done with the previous two bodies of research, this review will explain how authors in this category define indicators, why the SIs are used, and who is the intended user. Throughout this process, the existing research will be compared and contrasted with the idealized process discussed here.

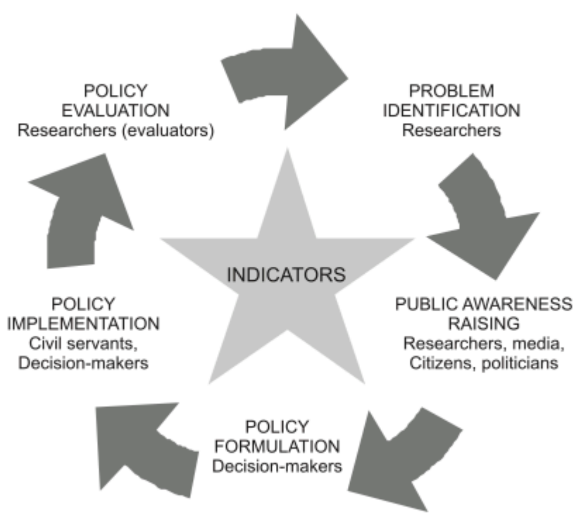

Figure 2 Policy cycle and the use of indicators. Modified from Moldan, 1997. Taken from Rosenstrom 2009.

If the policy cycle were to have a concrete starting point, it would be the point at which a problem is identified (Smith, 2010). Because the policymaking process is a cycle, though, and not a linear function, this is not always the case. For our purposes here, this is where will begin the discussion of the idealized policy process. The use of SIs can be influential in the problem identification stage (Moldan, 1997; Rosenström, 2009). Here, the process refers to problem identification by decision makers. While scientists and others may have already accepted the presence of a problem, they often have to spend time convincing policymakers that a problem exists. SIs can aid in this process. Either because the SIs have been developed with purely scientific impartiality or because they have been developed through an incredibly democratic process, they represent an important voice to politician's ears.

After policy actors have defined the problem, they need to act on the issue (Rosenström, 2009). Again, the use of SIs can prove incredibly useful during this stage of policy enlightenment. Smith (2010) argues for the use of memos and fact sheets, but another tool that can be used for raising public awareness can be SIs. The technocratic method of indicator development and use lends itself well to this stage in policy development because the users have taken great care to synthesize complex ideas into easy to understand graphs, maps, or other visualization.

Policy formation is perhaps the most sought after stage of policy creation for SI use. This is the part of the process where pen meets paper and real decisions are made for the future. Because of this importance, SI users often think of this stage of the policy process when creating indicator sets. This is also the stage where many authors see room for overlap and coordination. It is thought that the co-creation of policy and indicators at the same time can help both be more successful (Rosenström, 2009). If this ideal relationship exists, where policy and indicators are developed simultaneously, then the indicators can also be used in the later stages of the policy cycle. The indicators can also be used to explain or justify a political decision (Majone, 1989; Rosenström, 2009).

Therefore, SIs can be used by many for many purposes during this stage of the policy life cycle.

The longest process in the policy cycle is the policy implementation phase (Rosenström, 2009; Smith, 2010). Because of the natural length of this phase, it is crucial that SIs are being used. They provide a static benchmark by which decision-makers and policy-implementers can measure change. This static benchmark functionality, many argue, is the central role of indicators.

The ability to measure oneself against categorical and quantifiable objectives is a critical role of SIs. This is their inherent function when being used in final phase of the policy cycle: policy evaluation. According to Rosenström (2009, p. 23), "indicators not only measure the impacts of the policy, but also aid in guaranteeing that the policies have been executed." Therefore, it is this evaluation phase that *change* can actually be measured. While policy change is not the explicit goal of all SIs in America, it is certainly implicit throughout their use (Pettibone, 2012, Pourtney, 2003; Wells, 2006).

The ideal use of SIs would be intricately linked to all stages of the policy process. This, however, is rarely the case. SIs are often overlooked by policymakers, used to promote one's own existing idea or ideology, or are misused so that there is little acceptance from the public. However, even though this ideal relationship is rarely realized, it is important to point out the other impacts that SIs have in the policy process.

What is an indicator?

When the focus rests on policy implications, SIs are seen as normative (Holden, 2013). This means that, although the intended use of SIs is often to be catalytic, the users dictate their actual use. In this case, policy makers and decision makers use SIs in a conceptual way as communication, understanding, and engagement tools (Cash *et al.,* 2003; Holden, 2013). Bell, Eason and Frederiksen (2011) specify that indicator systems play “a conceptual role by helping to diffuse such visions and ideas to support alternative thinking and new concepts rather than leading to political action [directly]” (Bell *et al.,* 2011, p. 11; Holden, 2013). Put another way, SIs are seen as “boundary objects” (Bauler, 2012; Holden, 2013). This means that SIs act as an “intermediary between different policy actors, operating at new policy boundaries; between formal and informal policy roles; policy design and implementation; data inputs and trend outputs” (Holden, 2013, p. 90). Research focused on policymaking sees SIs as tools: a conversation starter, a rallying point, or trust builder.

Why do we use indicators?

While thinking of SIs as boundary objects, tools that link important policy processes and actors, it is necessary to identify the uses of these tools. According to Holman (2009), these *tools* can be used to build relationships, make governments more responsible, and open a door of communication. These goals of policy input reflect the very nature of SIs’ use as boundary objects.

For example, Terry (2008) discusses a South African Program that ran from 1998 to 2001 in which the development and use of SIs failed. His analysis of the project, though, does not place the blame of the failure on the community for not being involved enough, or even on the shoulders of the decision makers. Terry argues that the failure was the result of poor relationships between stakeholders and decision makers. Rather than letting the development and use of SIs foster and build these critical relationships, the program managers kept the community and politicians separated in an effort to have a truly democratized process. Terry, and others (Holman, 2007; Holman, 2009; Rydin & Holman, 2004) therefore postulate that “relationships of trust and networks built over time” are vital to the success of any community involvement. SIs can build these relationships and trust over time by creating a dialogue and common ground on which to build.

Another use of SIs in policy implementation is to make governments more responsible. This falls under the idealized policy implementation and evaluation phase of the policy cycle. By providing citizens with the tools to assess how successful policies are, it in effect holds the governments enacting these policies accountable. We see this play out again in Terry's examination of the *Community Sustainable Development Indicators Project* (Holman, 2009; Terry, 2008). When stakeholders are brought to the table, and policymakers are there to listen, governments are held accountable.

In order for relationships to be built and for accountability to be held, policymakers must first engage in a dialogue with the science and lay community involved with SI development and use. Many authors cite this reason for the use of SIs (Bauler, 2012; Holden, 2006, Holman, 2009; McCool & Stankey, 2004). Rather than simply creating a conversation and increasing public knowledge, as outlined in the *Community Involvement* section, these papers aim to promote the specific dialogue created with and among decision makers. This dialogue can then lead to a breakdown of silos within and among agencies. The departmentalization of goals and tasks does not lend itself well to sustainability outcomes. Therefore, by using SIs, boundaries can be crossed and a utility can be found "at the gaps and overlaps between different policy spheres in terms of convening, translating, and connecting different groups and different perspectives" (Holden, 2013, p. 95). The use of SIs as boundary objects can thus yield better relationships with policy actors, more accountability of policy actors, and better dialogue with and among policy actors.

Who uses indicators?

The reason to use SIs as boundary objects is to influence policy actors, either through enhancing a relationship, making them more responsible for their decisions, or by promoting better discourse. Although policymakers are the target, they are not necessarily the only users of the indicators when trying to influence policy. The question of *who* uses the indicators, however, is paramount in the literature on policy implementation. For further discussion of the players here, we will return to the idealized role that SIs *could* play in policy implementation.

The first part of the policy cycle, problem identification, involves a community of concerned persons (scientists, citizens, or both) and a decision maker. This is part of the relationship-building component of SIs' use as boundary objects. The next step in the process broadens the user group somewhat. When trying to raise public awareness of an issue, not only are the concerned policy actors and citizens involved, so are the media and the not-concerned citizens. From here, policy formulation takes place. This is where the policymakers take over the use of the SIs to formulate the actual rules and institutions that will incorporate them. This is not necessarily where politicians are involved, because it is often left to civil servants or lobbyists to craft the actual legislation. The next phase involves politicians because it is where the policies are enacted. In order to gain support and agency, politicians will turn to the SIs and use them to justify or explain the policy. Regulators and public overseers take the reigns during the evaluation phase. Here, these players use the SIs to actually measure the successes or failures of the particular decisions and policy.

Issues with this focus

The major issue with the policy-focused use of SIs is that not all SIs are developed with policy change as a goal. Therefore, even though some may want to evaluate particular SIs achievements by way of policy change, it might not be relevant to the goals of the specific set of indicators. Another major issue concerning this focus is that the reality differs greatly from the ideal. The goal of many who create and use SIs is to influence policy; even it is during just one phase of the policy cycle. However, this is rarely this case (Hezri & Dovers, 2009; Holden, 2013; Holman, 2009; Rosenström, 2009). Indicators are not used purely as concrete instruments of change. Rather, they are often used conceptually as a means to gain knowledge about a topic. While "this is [expected] from a knowledge utilization perspective, [it is] at odds with the expectations of some knowledge providers" (Hezri & Dovers, 2009, p. 314).

Current Frameworks

The Compendium of Sustainable Development Indicator Initiatives has identified almost 900 SI programs globally (IISD, 2013). While this is admittedly not nearly a comprehensive list of indicator programs, it provides a starting point for the discussion of breadth and scale we are talking about. The global impetus set out by *Agenda 21* to create indicators, and tackle sustainability locally has led to what some call an "indicator industry" (King *et al*., 2000; Rosenström, 2009; Rydin, Holman & Wolff, 2003;). This industry has created global indices for assessing sustainability, statewide measurement tools, and local programs to measure sustainability progress.

There has been a lot of research done to compare and contrast some of the most commonly used SI "frameworks". In this context, "framework" refers to different systems of measuring sustainability through the use of statistics or indicators that can be generalized to many users or can aggregate the total progress of an identified population (Bohringer & Jochem, 2007; Peterson, 2008). Due to this wide disparity in scale and purpose, the next two sections will split a brief analysis. Here, the paper will address some of the most commonly used aggregate indices. This study, however, is not focused on an aggregate index, and it will therefore only synthesize other meta-analyses of these indices. This is because many policymakers "demand an aggregate index that can be unambiguously interpreted and easily communicated to the general public" (Bohringer & Jochem, 2007, p. 1). The next section, "Types and Trends in Sustainable Indicators" will look at what is happening on a more localized scale in terms of SI use and development.

After reviewing the literature on the subject, the 4 most commonly reviewed aggregate indices for Sustainability Indicators have been identified. First, an index is simply a measurement made up of an aggregate of indicators (Ness *et al.,* 2007). The four indices that will be quickly reviewed here are the Ecological Footprint, Environmental Sustainability Index, the Human Development Index, and the Wellbeing

Index. Each of these tools was created by an international agency for the purpose of evaluating sustainability across all spectrums (Bohringer & Jochem, 2007; Mori & Christodoulou, 2011; Ness *et al.,* 2007; Parris & Kates 2003, Peterson 2008; Singh *et al.,* 2009). The essential goal of each of these tools is to create comparability among countries' sustainability progress. While there are numerous other programs that exist and are designed with the exact same purpose, a focus on these four will give a sample of the overall industry of SI indices.

Ecological Footprint

The Ecological Footprint (EF) is designed around the quantifiable metrics of land and water requirements to maintain a national living standard into the future. It focuses on waste assimilation and resource allocation ratios. It takes a multi-stage process to calculate an EF. First, using national statistics, it calculates a person's average consumption rates. Then, it calculates how much land and water those consumption rates require. Finally, all the areas of need are summed and a ratio is produced. If the ratio is greater than one, it means that contemporary consumption rates are unsustainable. The EF is applied mainly at a national level to assess sustainability of countries compared to other countries (Wackernagel & Reese, 1996)

The Environmental Sustainability Index

The Environmental Sustainability Index (ESI) is a measurement of "overall progress toward environmental sustainability" (CIESIN, 2013). Its most recent iteration in 2005 was built to "create a comparative index of national-level environmental sustainability and to provide a mechanism for making environmental management more quantitative, empirically grounded and systematic" (CIESIN, 2013). It uses 21 indicators from 76 underlying data sets that are readily available. The index focuses on environmental issues but also includes some social issues. ESI bases its definition of sustainability on the ability of a nation to preserve its environmental and social resources into the future.

Human Development Index

Developed by the United Nations Development Program (UNDP), the Human Development Index (HDI) measures longevity, knowledge, and standard of living using a single indicator for each. While not quite the triple bottom line, the index does account for a balance of three separate sub-indices. For longevity, it uses life expectancy at birth, for knowledge it measures literacy rates and combined enrollment rates, and for standard of living, HDI tracks GDP per capita. Its purpose again lies with being able to compare countries objectively.

The Wellbeing Index

The Wellbeing Index (Prescott-Allen, 2001) is the aggregated mean of two other indices, the Human Wellbeing Index (HWI) and the Ecosystem Wellbeing Index (EWI). Each of these two, in turn, measures five sub-indices. The HWI looks at issues of health, population, welfare, knowledge, culture, society, and equity. The EWI considers land, water, species diversity, and resource use indicators. The HWI has 36 indicators and the EWI has 51 indicators (Bohringer & Jochem, 2007).

Star Community Index

The STAR Community Index is like a "LEED for Cities." Starting in 2010 with several "Beta Communities," this is a comprehensive list of Sustainability Indicators. The Beta Communities helped create the framework, and provide guidance on indicators for actions and outcomes. It was developed by the ICLEI with help from the Beta Communities and over 200 volunteers representing 50 cities and counties (Indianapolis, 2013). It includes 7 categories for indicators and an 8th innovation category. The categories include: built environment; climate and energy; economy and jobs; education; arts and community; equity and empowerment; health and safety; and natural systems. There are a total of 44 focus areas within those categories. Forty-one different communities throughout the countries are using this new index of indicators.

Summary

This represents a mere fraction of all sustainability indices that exist. This representative sample gives a brief overview of and type, scope, and purpose for these international SI programs. Each index is designed to function as a tool for comparability. Their intended role in society represents both the first and third typology above. In terms of "sound science", they mostly meet the requirements of SMART. However, Bohringer and Jochem (2007, p. 2) argue, "…fundamental formal conditions for meaningful aggregation are widely neglected even though they could easily be met for some of the indices." In terms of policy implications, each of the indices claims that their objective comparability of sustainability should lead to policy change. Although, as discussed earlier, this end goal is not always realized.

Types and Trends in Sustainability Indicators

This section will focus on the use of SIs in community development plans at local scales. This type of research is precisely in line with this study because it examines the success, commonalities, and use of SIs at a local scale.

Types of Indicators

To begin, this study will further differentiate the scale and definition of this type of analysis. When communities, whether cities, municipalities, states, metro areas or the like, use indicators to assess and plan for a more sustainable future, they are called Sustainable Community Frameworks (Peterson, 2008). In his Sustainability Framework Analysis, Peterson (2008) identifies four types of frameworks that communities use. There are ranking projects, designation systems, indicator initiatives, and sustainability programs. This study's focus falls into the realm of indicator initiatives. First, this study will define all four types, then it will summarize the trends in indicator use and development through these initiatives.

Ranking projects are large, national level uses of indicators that try to compare cities or other entities to one another. By creating a set of quantifiable indicators, these ranking systems place cities or other entities into a hierarchical order of most to least sustainable. Sustainlane.com used to rank the 50 largest cities based on their sustainability. Another example is the College Sustainability Report Card, which ranks universities based on their response to a survey (Peterson, 2008).

The next type of community framework is a designation system. These systems, again, are designed to offer comparability across a spectrum. They offer credits to users that are a part of the system. Almost like an expansion of LEED certification, these programs operate by certifying cities or other entities based on a series of criteria they develop. The Florida Green Building Coalition's Green Local Government Standard is an example of this type of system (Peterson, 2008).

Sustainability programs and indicator initiatives are often used in tandem but, they can also be used separately. A sustainability program is designed by and implemented by a government. The local governing authority creates a sustainability program, its corresponding initiatives, and implements the plan to raise awareness and brand its local efforts. These government-led and created efforts usually have a clear set of defined goals, a vision, and often indicate the responsible department for achieving a specific goal. Often, because the policymakers are already involved with sustainability programs, the use of the indicators is because of sound science (in order to measure progress explicitly) or to gain community support. PlanNYC and Marin Community Development Agency's Countywide Plan are examples of this top-down approach (Peterson, 2008).

The focus of this paper is on the fourth type of sustainable community framework. Indicator initiatives gather SMART data based on quantitative and qualitative factors deemed to be indicative of sustainable progress (Persson, 2013; Peterson, 2008). These initiatives usually track change over time. They are intended to move a city or other entity towards or away from a certain goal. The process of creating and using these indicator initiatives vary in purpose, based on the three typologies outlined above. These indicator initiatives are statistical in nature and can therefore allow analysis of multiple variables at once. They can be used in tandem with sustainability programs because often their creation and end use switch back and forth from government to community.

Trends in Indicators

In order to look at the recent trends of these indicators, this paper will look at other meta analyses that have been done to find commonalities and differences of SI use.

The existing research on these trends looks at a multitude of local indicator initiatives and finds the characteristics that bind them all together. This same type of meta analysis is what will be done to evaluate hypothesis 4.

Berke and Conroy (2000) evaluated 30 comprehensive, community plans to assess how well they plan for sustainable development. In their analysis, they identified six operational performance principles in order to evaluate the plans next to one another. These 6 principles then became the standard by which a comparison could be made among the plans. For this study's purposes, these 6 principles offer an insight into the common trends exhibited by the 30 plans. The 6 principles are: harmony with nature, livable built environments, place-based economy, equity, polluters pay, and responsible regionalism (Berke & Conroy, 2000).

The first principle outlined is harmony with nature. This tells us that many of the indicator initiatives have some component of a need for environmental balance. The focus here is on land, water, and resource use and function. The next principle is livable built environments. The trend indicated here is the need for smart development. "Livable built environments" are places where we live, and this speaks to the balance between urban needs and ecological capacity. Place-based economy is next, and this trend is prevalent throughout many of the plans. This focuses on the economic leg of the sustainable triple-bottom line. Equity is a principle, and therefore a trend, that finds its home in the social leg of the triple-bottom line. Many of the SI programs include some component of equity. The final two principles have become less prevalent since the publication of this article. Polluters pay is the idea that "culpable interests" that harm the environment should "bear the cost of pollution" (Berke &Conroy, 2000, p. 23). This principle does not necessarily lend itself to the use of indicators as a measurement of progress. Responsible regionalism takes into account the impact a city or other entity has on other places. Again, this is not readily measurable with local data, and therefore has not been as common in SI programs recently.

Tanguay et al. (2010) conducted a meta analysis of seventeen studies. Each of the seventeen studies in the report investigated a range of SI programs within 1 to 67 municipalities. Therefore, a lot of data were represented by this scope of work. They find a range of 10 to 86 SIs were used by different municipalities. This large discrepancy in the number of indicators used signifies that there is not a "consensus on the optimal number of indicators" (Tanguay *et al.,* 2010, p. 410). The number of indicators used to measure environmental impacts varied the largest, thus a defined lack of consensus on this one component is even more severe. They credit this lack of consensus to two specific reasons. One, there is a lack of consensus over the relationship of data consolidation and audience. Some (scientists especially) prefer to have a simplified, small number of indicators so they can be easily aggregated. Others prefer a more diverse set of indicators to account for all the needs of a community (Tanguay *et al.* 2010). The other reason for a lack of consensus is due to a lack of available data in some places. Without the data, the indicator cannot be measured, and therefore is left out of the SI program.

The next trend identified is the frequency of use by category. The authors want to know the balance between environmental, economic, and social indicators. They, in fact, took it one step further to include measures of livability, viability, and overall sustainability. Figure 3 shows the balance between identified indicators and the triple bottom line component they fall under. The extreme lack of environmental indicators is surprising. These trends are reflected in Pissourios's (2013) work examining the difference in quality-of-life, macroeconomic, environmental, welfare and Sustainability Indicators.

While many more trends and difference can be identified, the following are the most commonly researched and discussed trends in the literature today: a lack of consensus on number and selection of indicators, an over valuation of social and economic indicators, and the general categories identified by Berke and Conroy (2000).

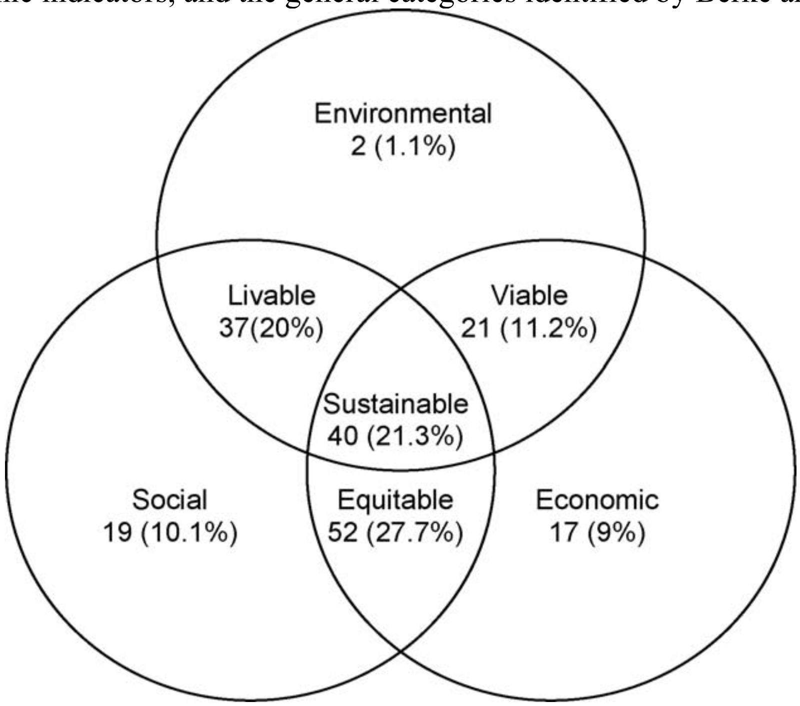

Figure 3 Classification of 188 different indicators identified by Tanguay et. al (2010)

3. METHODS AND PROCEDURES

Introduction

This study is applied research because it is policy-oriented rather than theoretical (Gahin, 2001). The purpose of this study is more to explore and less to explain. Although the questions have been laid out in the form of hypotheses, the focus of this research more closely resembles program evaluation.

The study sample was comprised of cities within the list of the 40 largest United States metropolitan areas that have sustainability plans. 2010 US census data was used to determine the 40 largest metropolitan areas. After determining the list of the 40 largest metropolitan areas in the United States, each city's main website Google search terms such as "sustainability plan" + [city name] were used to find evidence of a sustainability plan. After completing a thorough search of all the municipalities within each MSA, a master list of MSAs, sustainability plans, presence of indicators, and then a complete list of the indicators employed by each respective area was assembled.

In order to assess the best practices and common trends among sustainability indicators, each indicator found in an MSA was compared to the baseline indictor set known as the International Urban Sustainability Indicator List (IUSIL). The IUSIL was used in a matrix format to compare the MSAs' lists of indicators with those of the international norms. Then, each indicator on the IUSIL was compared it to each indicator on the individual MSA lists. After this comparison, common statistical measurements were applied to both sets of data, such as mean median, mode. For the overall list of MSAs and their sustainability plans, the total number of MSAs with and without plans present was quantified. In addition, the total number of people living in each MSA with and without plans was quantified. Lastly, similar measurements on the compliance of indicators to the IUSIL were calculated.

Once both of these statistical analyses were completed, three MSAs were selected to interview. Based on specific criteria and availability, Indianapolis, Indiana; Broward County, Florida; and Tacoma, Washington were selected for interviews. Structured interviews were conducted with each selected MSA. These interviews were done over the phone and were recorded with permission from the candidates. Then, the findings from these interviews were summarized and categorized into this report.

Research Lens

It is important to point out the purpose of this study and the researcher's vantage point for analyzing the results. The researcher was the Education Coordinator for the San Antonio River Authority (SARA), a Texas state-created, special jurisdiction agency with a mandate to protect the San Antonio River. He was also writing and researching this topic as part of his graduation requirements in pursuit of my Master's of Science in Interdisciplinary Studies in Sustainability from Texas State University. Both his role as student as and as Education Coordinator mean that he had a vested interest in the outcome of this research. SARA has committed to measure and reach a goal in San Antonio's SIs, known as SA2020. The researcher was particularly interested in sustainability indicators and sustainability plans because it allowed him to compare SA2020 to sustainability plans in other cities and it allowed him to assess sustainability indicator use nationally. It is through both of these lenses that he collected and analyzed the results of this study.

Selection of Sample

The 2010 census data (http://www.census.gov/population/metor/data/) formed the basis of the sample used in this study. The research focused on the 40 largest metro areas in the United States (USCB, 2013). These 40 metropolises represent nearly half of the United States population. A metro area is comprised of a central urban core and adjacent population centers. Some metro areas include multiple counties, and the core's adjacent population centers are determined by frequency of transportation to and from work within the urban core. Starting with this list of cities provided a contained population from which to select a sample. Other large municipalities throughout the country can use the findings here because of the similarities between the 40 largest MSAs and the other metro areas in the United States.

To create a list of cities with SIs in place, the SI indices were cross-referenced with the census data. The indices most relevant for this study were thought to be the International Council of Local Environmental Initiatives (ICLEI) participating cities, Global City Indicators Program (GCIP) participating cities, and other Local Agenda 21 initiatives. This assumption turned out to be false, because a city's participation in these organizations is not kept current. This caused each MSA to be researched individually and comprehensively to find their sustainability plans.

In order to evaluate hypothesis 3, a methodology similar to Shen et al.'s (2011) methodology was used (discussed in more detail below). For the selection of this sample, the indicators present in the identified sustainability plans were identified. To be included in the sample, the cities' sustainability plans had to have environmental, social, and economic components, a description of individual practices and a complete list of indicators clearly defined. The purpose of this part of the study was to identify commonalities among indicator sets and, in the end, propose the use of a framework for a City Sustainability Index (Mori & Christodoulou, 2012).

Interviews

In order to select the candidates for the interview, a more careful process took place. Following in the footsteps of Gahin (2003), Raimond dit Yvon (2013), and Rosenström (2009), a case study approach was used to assess the use of the SIs in selected cities. To select these cities, a series of criteria was used to judge available cities. Criteria such as location, geography, length of time in existence (of the plan), demographics, and even political orientation were taken into consideration so a true spectrum of cities' plans can be assessed. Specifically though, Gahin's (2001) selection criteria was used to ensure the sample cities are representative of the population. The criteria are defined like this:

- **Size:** The geographical area using the indicators needed to be large. Limiting the sample to the 40 largest metropolitan areas meant that all the sample cities meet this requirement.
- **Length of time running:** In order to assess progress towards sustainability, the program needed to have results of some kind. For the purposes of this study, the program were required to have a report issued of the indicators for it to qualify.
- **Ability to gather data:** Persons of interest needed to exist and be available and willing to participate in the study. Also, the program had to have an easily accessible website to evaluate the indicators objectively.
- **Evidence of success:** Both the persons of interest and the data itself needed to show change. Interviewees could discuss the change and the indicators themselves needed to show it. The meaning of success here did not mean *more sustainable*, it simply meant change.
- **Geographic variety:** Programs were selected to represent different parts of the country

Three cities which met the criteria and had personnel available were selected as the interview sample. Three target cities were selected initially based on Gahin's (2001) criteria: New York City, New York; Indianapolis, Indiana; and Seattle Washington. These three MSAs represented a wide range in population size, location, and length of time using the indicators. Another 5 back-up cities were identified using the same process. The 5 back-up cities included San Antonio, Texas; Broward County, Florida (part of Miami's MSA); San Jose, California; Cleveland Ohio; and Virginia Beach, Virginia. The 3 target cities were contacted for a pre-interview. Identified key stakeholders were unable to participate in the study in New York City and Seattle. The pre-interview in Seattle led to the change to Tacoma, Washington because it falls within the same MSA and uses it own SIs. In order to replace New York City, a pre-interview was conducted in San Antonio. Unfortunately, the city was also unable to participate in the interviewing process. Moving through the list of back-up cities, Broward County Department of Sustainability was contacted next. This sequential approach led to the final selection of Indianapolis, Indiana; Tacoma, Washington; and Broward County, Florida.

Institutional Review Board

The necessary paperwork for the Institutional Review Board (IRB) approval for this study was submitted as soon as the proposal was approved. The interviews being used did not need IRB approval because they met an exemption under Category 2.

Design and Development of Instruments

Hypotheses

The analysis used to investigate hypothesis 3 mirrored the work done by Shen et al. (2011) with a few minor changes. In *The application of urban Sustainability Indicators- A comparison between various practices* the Shen et al. (2011) created a new comprehensive list of SIs. They compiled all the indicators from frameworks created by the United Nations (2007), the UN Habitat (2004), the World Bank (2008), the European Foundation (1998), Research and Development (2000), and the European Commission on

Energy and Environment and Sustainable Envelopment (2004). Through this compilation, they created the "International Urban Sustainability Indicators List" (IUSIL). This list of indicators included a total of 115 indicators divided into 37 categories. The categories fell within 4 components of sustainability: environmental, economic, social, and governmental.

The IUSIL was used to perform a content analysis of the sustainability indicators in the 40 metro areas in the sample. Because indicators could be measured and defined in different ways, clear and precise indicators were needed for evaluation. The indicators from the sample SIs were listed and categorized. The sample metro areas were then compiled into a matrix with the IUSIL list. A simple "X", "O", or "-" key was used to show where there is exact overlap (X) of indicators, the same concept with different terms (O), or there is no overlap of indicators (-). (The IUSIL list can be found in Table 4, Table 5, Table 6, and Table 7.)

In order to ensure that there was little bias in the categorization of indicators, the same strategies used in Persson et al. (2012), Tanguay et al. (2009), and Raimond dit Yvon (2013) were employed. These authors proposed a reductionist approach to categorization. The "Survey Based Approach", as it is called, required that the most frequently used indicators and the simplest expression of those most used be found and used in the comparison. By replicating this procedure, Raimond dit Yvon (2013) was able to establish 5% error in categorization.

Interviews

An adapted version of Seidman's structured interview was used (Seidman, 2007). He recommended three 90-minute interviews. His purpose behind this structure was to capture life history, the details of an experience, and to reflect on the meaning. Although he argued that one must "respect the structure" of the interview, the focus of *these* interviews was on the phenomenon of SI use and development (Seidman, 2007, p. 23). The structure of the proposed interviews did, however, leave some room for alternatives. The 90-minute time frame was changed to a simpler 20-minute interview. This was done to accommodate the schedules and relative unavailability of potential interviewees. Within this structure, a modified research instrument developed by Gahin (2001, 2003) was used to conduct the case study research. She created a structured interview methodology to capture data. The instrument approached questioning through the sequence of creation history, structure, and then success.

There were also specific questions about the outcomes of the SI programs in her original tool. She designed the tool around three specific outcome typologies: "raising awareness, influencing decisions, and tracking progress" (Gahin 2001). These outcome typologies were congruent with three typologies of research outlined above: sound science (tracking progress), community involvement (raising awareness), and influencing decisions (policy implications). The questions that focused on outcomes were also used to identify who these outcomes were affecting, and indirectly, to identify the factors affecting these outcomes. A pilot interview was conducted with the NashvilleNext program. This was done to test the applicability of the original tool. Although Nashville does not currently use SIs, many of the questions in the original tool were geared towards the use of a Sustainability Plan in general. An employee of the City of Nashville answered the relevant questions. During this first interview, it was found that the questions in the original tool were often too confusing and too long-winded. In addition, even though this was only a partial use of the tool, the interview lasted longer than hour. Based on pre-interview screenings with the selected MSAs, it was clear that the identified interviewees did not have this kind of time to dedicate to this project. Therefore, the number of questions in Gahin's original tool was reduced and questions were worded more efficiently. The final interview tool can be found in Table 8 Interview Instrument.

Data Collection

Hypotheses

The data collection for the IUSIL meta-analysis began in mid-December 2013. Metro areas when Sustainability Plans and SIs were identified, and a list was compiled of all the plans and their indicators. Other identifying information such as name, date of inception, vision, focus area, and monitoring interval were included in this master list (See Table 9).

In order to find and collect this data, thorough Internet searches of all the MSA's websites were conducted. In addition, scholarly articles mentioning the use of indicators were searched. The search always began with a Google search containing the key terms "sustainability plan" + [city name]. Because each MSA contained numerous cities, counties, and other municipal governments, this was an extensive process. If the original query did not produce any results, other search methods were used. After some searches began to yield results, trends about the names of the plans, authors of the plans, and municipal website layout began to emerge. These emergent trends enabled the researcher to search for comprehensive plans, climate action plans, or other various plan types that qualify as sustainability plans. The criteria used to ensure a plan met the "sustainability plan" definition included the balance of environmental, economic, and social components in the plan. Many of the plans also had governance components.

Because some MSAs had multiple cities within them, a strategy was employed to ensure SIs were found if they existed. For this, the largest urban core within the MSA was searched first. If it was found that this urban core had SIs, then the search stopped. If the largest (most populated) urban core within the MSA did not use SIs, then the search continued into the smaller suburban or adjacent urban cores within the same MSA. For some MSAs, a set of SIs was found for multiple jurisdictions within the extent of the area. In these cases, the largest municipality's set of SIs was ranked.

The categorization of the data took place next, and was compiled into a matrix with the IUSIL list of indicators. This table created a complete visualization of the 40 largest municipalities' SIs in America compared objectively next to one another.

Interviews

The interviews were conducted using a case study approach. For the purposes of this study, a case study is defined as "the intensive (qualitative or quantitative) analysis of a single unit or a small number of units (the cases), where the researcher's goal is to understand a larger class of similar units (a population of cases)" (Seawright & Gerring, 2008; Young, 2012, p.18). The case study approach facilitated a more indepth examination of the data and uncovered results that might not be an example of the entire population of programs, but could be relevant to many MSAs.

A total of 4 interviews were conducted, one test interview and 3 interviews with MSAs. The researcher conducted the interviews by phone and recorded the interviews digitally so that a complete transcription could be written later. The researcher took notes on his computer while conducting the interview and also summarized the data immediately afterwards. Because of this, and because of unique unforeseen circumstances, the interview questions were altered somewhat during the interview. Comparable results from each respondent were sought, so care was taken to avoid major alterations in the questions, but it was impossible to follow the interview protocol precisely because only particular questions were relevant to each MSA.

Data Analysis

Hypotheses

In order to address the first two hypotheses, the number of MSAs using Sustainability Plans and the number of MSAs using SIs were counted. In addition, the number of people living in each MSA using and not using the respective criteria was counted. A simple proportional analysis was conducted based on the "whole" being the 40 MSAs, and based on the "whole" being the entire US population, respectively.

The methods for analysis in regards to the IUSIL matrix were not complex. Because the categories are divided up into the four sustainability categories, a bar chart showing the overall composition of the identified programs' indicators was created. An economic, environmental, social and governmental indicator bar chart was created to show overall compliance with the IUSIL indicators for each category. Overall compliance with the IUSIL of each selected program was determined using the reductionist approach discussed above. Then, an evaluation of how much overlap existed among indicator sets and with the IUSIL list was conducted. In addition, SIs were evaluated based on their balance of environmental, economic, social and governmental indicator usage. The more balanced all three were, the more sustainable overall (Berke & Conroy, 2000; Neuman, 1998).

Interviews

For the interviews, all of the results were compiled into a matrix for each case study. Responses were then compared across each row. After that, all of the results were summarized using a reductionist approach.

Assumptions and Limitations

The limitations to these methods involved the fact that they did not incorporate demographic data. Future research could include a demographic focus in association with the identified sustainability plans and SIs. In order to be a true case study, the demographic statistics of each interviewed city would be useful in supplying the extent of data needed. Another limitation of this research was the small sample size of MSAs that were interviewed. The small sample size of interviewed cities made the results of the interviews less transferrable to other large US cities. Having a larger sample size would have ensured validity in the results. In addition, the sample of cities selected was among the largest in the US. Because of this, the results in this study cannot easily be generalized to smaller cities or rural areas in the US.

A major assumption of this research was that all the data required could be found on the Internet. There was a chance that some MSAs could have had effective sustainability plans and used indicators, but they had not been published online, and were therefore inaccessible.

4. RESULTS

Assessment of Cities

This section addresses the results for the first two hypotheses. These results show that the majority of large US Metropolitan Statistical Areas (MSAs) have sustainability plans. The results also indicate that the majority of the US MSAs sampled use Sustainability Indicators to measure their progress towards their sustainable goals.

Hypothesis 1

In order to test the hypothesis 1 "a majority of the top 40 largest US metro regions have formal sustainability plans" the research focused on all of the 40 largest US metro regions (also known as Metropolitan Statistical Areas, or MSAs). Table 1 lists the 40 largest US Metropolitan Statistical Areas based on the US census data from the 2010 census. It includes codes that have been assigned to each of the MSAs so that they can be easily identified. It also includes the number of people that live in each area.

Table 1 Metropolitan Statistical Area population (number of people).

Metropolitan Statistical Area	MSA Code	Population as of 4/1/2010	Population Rank
New York-Newark-Jersey City, NY-NJ-PA	NYC	19,567,410	1
Los Angeles-Long Beach-Anaheim, CA	LA	12,828,837	2
Chicago-Naperville-Elgin, IL-IN-WI	CHI	9,461,105	3
Dallas-Fort Worth-Arlington, TX	DFW	6,426,214	4
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	PHI	5,965,343	5
Houston-The Woodlands-Sugar Land, TX	HOU	5,920,416	6
Washington-Arlington-Alexandria, DC-VA-MD-WV	WAS	5,636,232	7
Miami-Fort Lauderdale-West Palm Beach, FL	MIA	5,564,635	8
Atlanta-Sandy Springs-Roswell, GA	ATL	5,286,728	9
Boston-Cambridge-Newton, MA-NH	BOS	4,552,402	10
San Francisco-Oakland-Hayward, CA	SF	4,335,391	11
Detroit-Warren-Dearborn, MI	DET	4,296,250	12
Riverside-San Bernardino-Ontario, CA	RSB	4,224,851	13
Phoenix-Mesa-Scottsdale, AZ	PHX	4,192,887	14
Seattle-Tacoma-Bellevue, WA	SEA	3,439,809	15
Minneapolis-St. Paul-Bloomington, MN-WI	MIN	3,348,859	16
San Diego-Carlsbad, CA	SD	3,095,313	17
St. Louis, MO-IL	STL	2,787,701	18
Tampa-St. Petersburg-Clearwater, FL	TSP	2,783,243	19
Baltimore-Columbia-Towson, MD	BAL	2,710,489	20
Denver-Aurora-Lakewood, CO/1	DEN	2,543,482	21
Pittsburgh, PA	PIT	2,356,285	22
Portland-Vancouver-Hillsboro, OR-WA	POR	2,226,009	23
Charlotte-Concord-Gastonia, NC-SC	CHA	2,217,012	24
Sacramento--Roseville--Arden-Arcade, CA	SAC	2,149,127	25
San Antonio-New Braunfels, TX	SAT	2,142,508	26
Orlando-Kissimmee-Sanford, FL	ORL	2,134,411	27
Cincinnati, OH-KY-IN	CIN	2,114,580	28
Cleveland-Elyria, OH	CLE	2,077,240	29
Kansas City, MO-KS	KAN	2,009,342	30
Las Vegas-Henderson-Paradise, NV	LAV	1,951,269	31
Columbus, OH	COL	1,901,974	32
Indianapolis-Carmel-Anderson, IN	IND	1,887,877	33
San Jose-Sunnyvale-Santa Clara, CA	SJO	1,836,911	34
Austin-Round Rock, TX	AUS	1,716,289	35
Virginia Beach-Norfolk-Newport News, VA-NC	VB	1,676,822	36
Nashville-Davidson--Murfreesboro--Franklin, TN	NAS	1,670,890	37
Providence-Warwick, RI-MA	PRO	1,600,852	38
Milwaukee-Waukesha-West Allis, WI	MIL	1,555,908	39
Jacksonville, FL	JAC	1,345,596	40

A graphical representation of these data can be seen in Figure 4. This graph shows the relative size of each MSA stacked on top of one another. The colors represent the presence of a formal Sustainability Plan (green) or the lack of a formal Sustainability Plan (red). Only 5 of the 40 largest MSAs lacked a formal Sustainability Plan. The metro areas that make up this 12.5% were Boston, Massachusetts; Kansas City, Missouri; Las Vegas, Nevada; Columbus, Ohio; and Providence, Rhode Island. While these 5 metro areas did not have a formal plan, they all had information related to sustainability on their city websites. Boston, for instance, had a Climate Action Plan that dealt solely with green house gas emissions, and therefore was not included. (In Table 2, data showing the names of each plan indicate that there were other Climate Action Plans included because the categories of those plans included areas of the economy, people's health and wellness, and other aspects of the environment beyond greenhouse gas emissions). Columbus, Ohio was another interesting case. While the area lacked any form of a Sustainability Plan, Figure 9 shows that the city did participate in the STAR Communities Index.

The results in Figure 5 indicate that 35 out of 40, or 87.5%, of the largest US MSAs had created and were using Sustainability Plans. Who used the plans, who created the plans, and the level of detail in each plan varied widely.

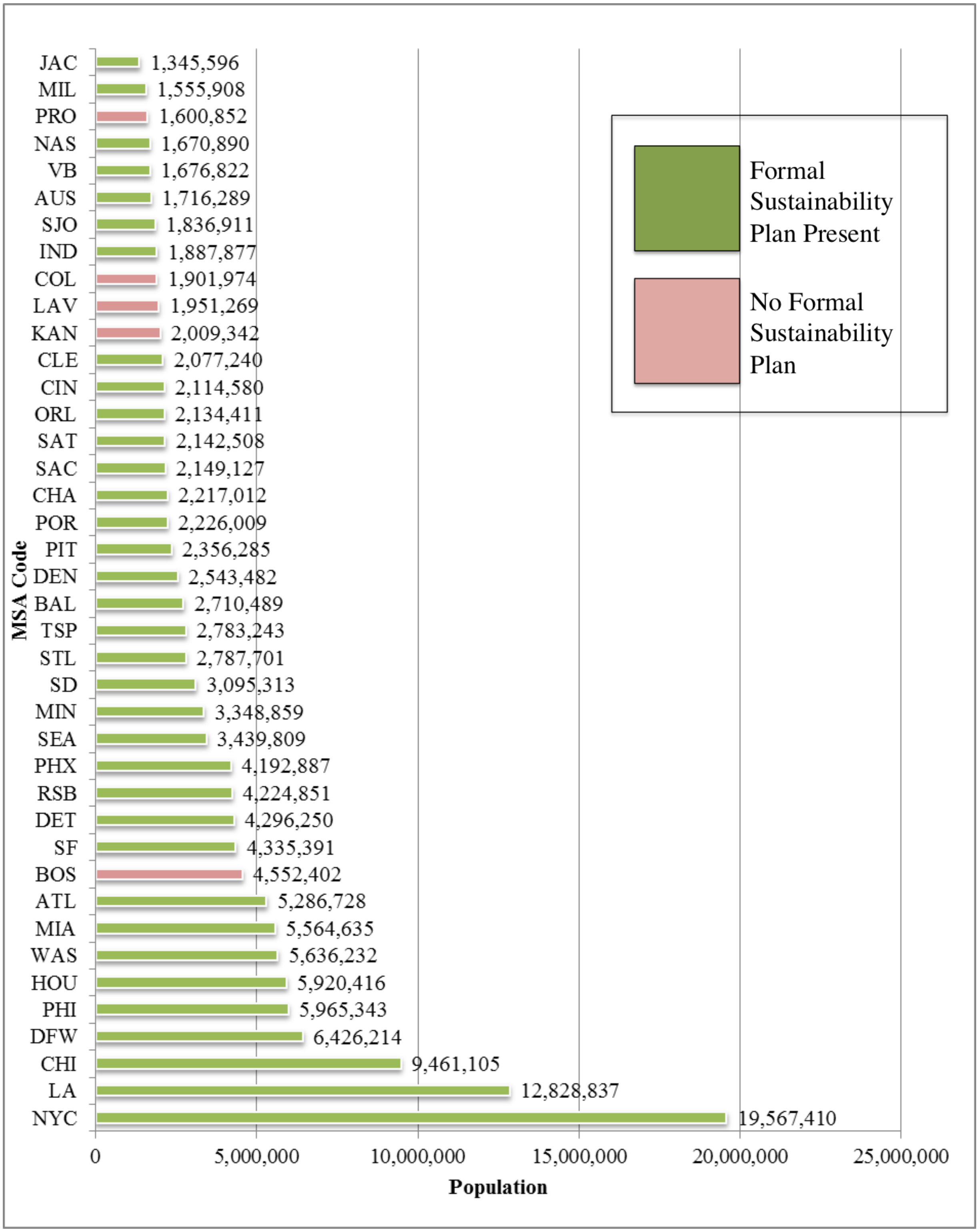

Figure 4 The 40 Largest US Metro Areas with and without a formal sustainability plan.

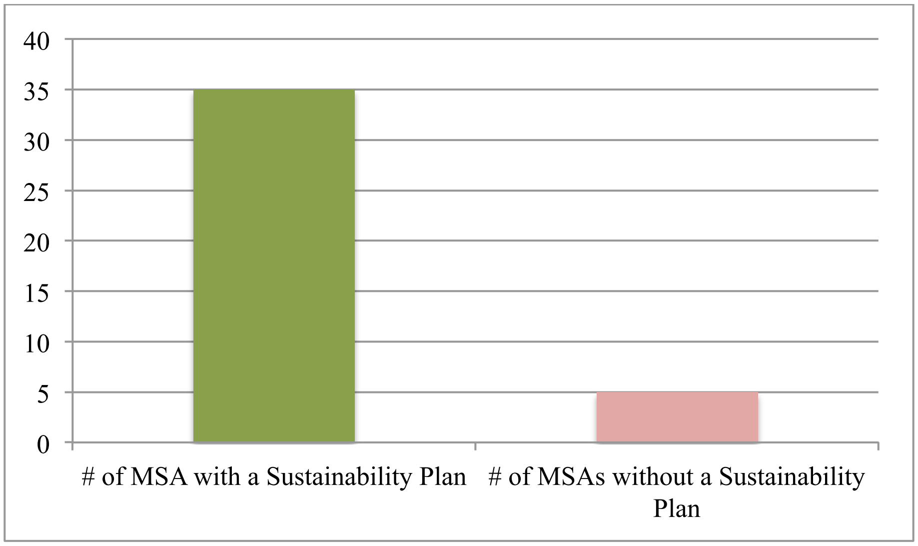

Figure 5 The proportion of MSAs with and without formal Sustainability Plans.

Figure 6 shows the disparity in the number of people living in MSAs that have a Sustainability Plan and those that do not. While 12.5% of the areas did not have plans, only 8% of the people living in the 40 largest MSAs did not live in a place that had created a plan. Of the 155,538,499 people living in these 40 MSAs, 92% lived in a place that used a Sustainability Plan.

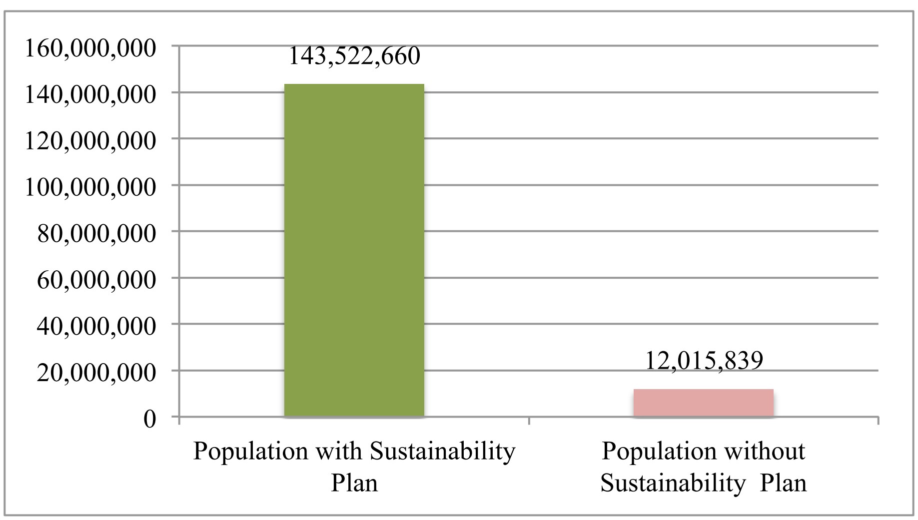

Figure 6 The proportion of populations living in the 40 largest MSAs.

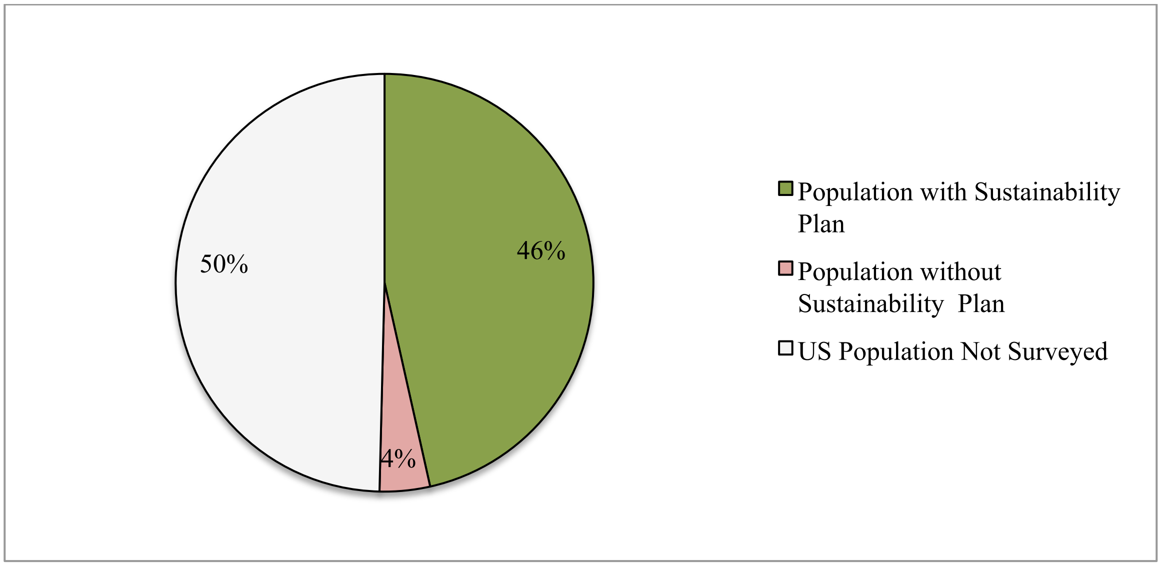

Figure 7 Proportion of US MSAs surveyed to the total US population.

Figure 7 and Figure 6 reveal the impact of this survey. Half of the US population was accounted for in this analysis, based on total population numbers from the 2010 census. The 40 largest MSAs account for 155.5 million people in the United States. Therefore, nearly half of the US population had a Sustainability Plan being used where they lived.

Hypothesis 2

Hypothesis 2 states, "A minority of the top 40 largest US metro regions use Sustainability Indicators to measure their plan's success." The data gathered to test this hypothesis indicated that it was not supported. In fact, 22 of the 40 largest MSAs used Sustainability Indicators to measure success and failures in particular areas of sustainability. Figure 8 shows the variance between the number of MSAs that used Sustainability Indicators and those that did not. Fifty-five percent of those surveyed did use these measurable tools in some way.

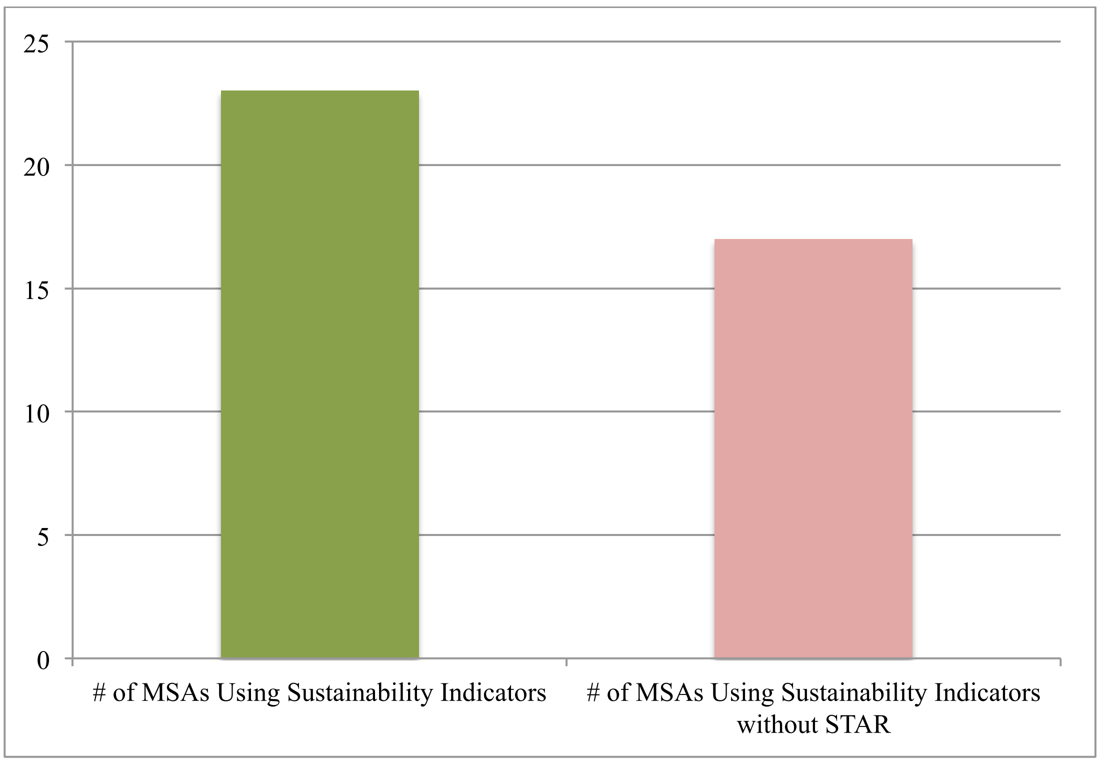

Figure 8 The # of MSAs using Sustainability Indicators versus the # of MSAs not using Sustainability Indicators.

Table 2 MSAs with their Sustainability Plan Titles and Use of Sustainability Indicators.

MSA Code	Sustainability Plan	Using Indicators as Part of Plan	Developing Indicators OR Using Indicators Separate of Plan	Targets, but no indicators
NYC	PlaNYC	Yes	-	-
LA	Vision 2021 LA	No	No	No
CHI	Sustainable Chicago 2015	No	No	Yes
DFW	forwardDallas	No	No	No
PHI	GreenWorks Philadelphia	Yes	Yes*	-
HOU	Our Great Region 2040	No	Yes*	-
WAS	Sustainable D.C.	Yes	Yes*	-
MIA	Green Print Miami	No	Yes*	Yes
ATL	Plan 2040	Yes	Yes*	-
BOS	-	No	No	No
SF	San Francisco General Plan	No	No	No
DET	Detroit Future City	No	No	No
RSB	Green Riverside	No	Yes*	No
PHX	SustainPHX	No	Yes*	No
SEA	Strategic Climate Action Plan	Yes	Yes*	-
MIN	City of Minneapolis Sustainability Indicators[1]	Yes	-	-
SD	San Diego General Plan	No	No	Yes
STL	OneSTL	Yes	Yes*	-
TSP	Tampa Comprehensive Plan	No	No	No
BAL	Cleaner Greener Baltimore	Yes	Yes*	-
DEN	Green Print Denver	No	No	No
PIT	Climate Action Plan 2.0	No	No	No
POR	The Portland Plan	Yes	Yes*	-
CHA	Charlotte 2030	No	No	No
SAC	Sustainability Implementation Plan	No	No	Yes
SAT	SA2020	Yes	-	-
ORL	Community Action Plan	Yes	Yes*	-
CIN	Green Cincinnati Plan	Yes	-	-
CLE	Sustainable Cleveland 2019	Yes	Yes*	-
KAN	-	No	No	No
LAV	-	No	No	No
COL	-	No	Yes*	No
IND	SustainIndy	No	Yes*	No
SJO	Green Vision	Yes	-	-
AUS	CAN Strategic Framework	Yes	Yes*	-
VB	Community Plan for a Sustainable Future	Yes	-	-
NAS	NashvilleNext	No	Yes[2]	No
PRO	-	No	No	No
MIL	ReFreshMKE	No	No	No
JAC	Community Indicators Project[1]	No	Yes[1]	-

*Indicates participation in the STAR Community Index
[1]Indicates that the MSA is using numerous indicators that are not part of a specific Sustainability Plan
[2]Indicates that the MSA is developing Sustainability Indicators

Figure 9 and Table 2 discuss the breakdown of each MSA. Many of the MSAs used Sustainability Indicators as part of their formal Sustainability Plan (shown in green, Figure 8). These MSAs included New York City, New York; Minneapolis, Minnesota; San Antonio, Texas; Cincinnati, Ohio; San Jose, California; Virginia Beach, Virginia; and Jacksonville, Florida. The STAR Community Index has become popular among the largest metro areas in the US since 2013. Some cities participated in using STAR along with their own existing SIs (Figure 10 and Figure 11). These MSAs included Philadelphia, Pennsylvania; Washington D.C.; Atlanta, Georgia; Seattle, Washington; St. Louis, Missouri; Baltimore, Maryland; Portland, Oregon; Orlando, Florida; Cleveland, Ohio; and Austin, Texas. Some areas did not use Sustainability Indicators as part of their Sustainability Plan, but did participate in the STAR Community Index program. These included Houston, Texas; Miami, Florida; Riverside, California; Phoenix, Arizona; Columbus, Ohio; and Indianapolis, Indiana.

Nashville, Tennessee did not use indicators yet, although they were being developed. Jacksonville, Florida used hundreds of indicators to track many different categories. While they were listed as using Sustainability Indicators, their list of indicators was not assessed against the IUSIL. The MSAs that were compared to the IUSIL were the 16 original sets of indicators (minus Jacksonville). The STAR Index was assessed once, although many of the MSAs use it as their Sustainability Indicators. The IUSIL assessment is shown in Table 4 through Table 7.

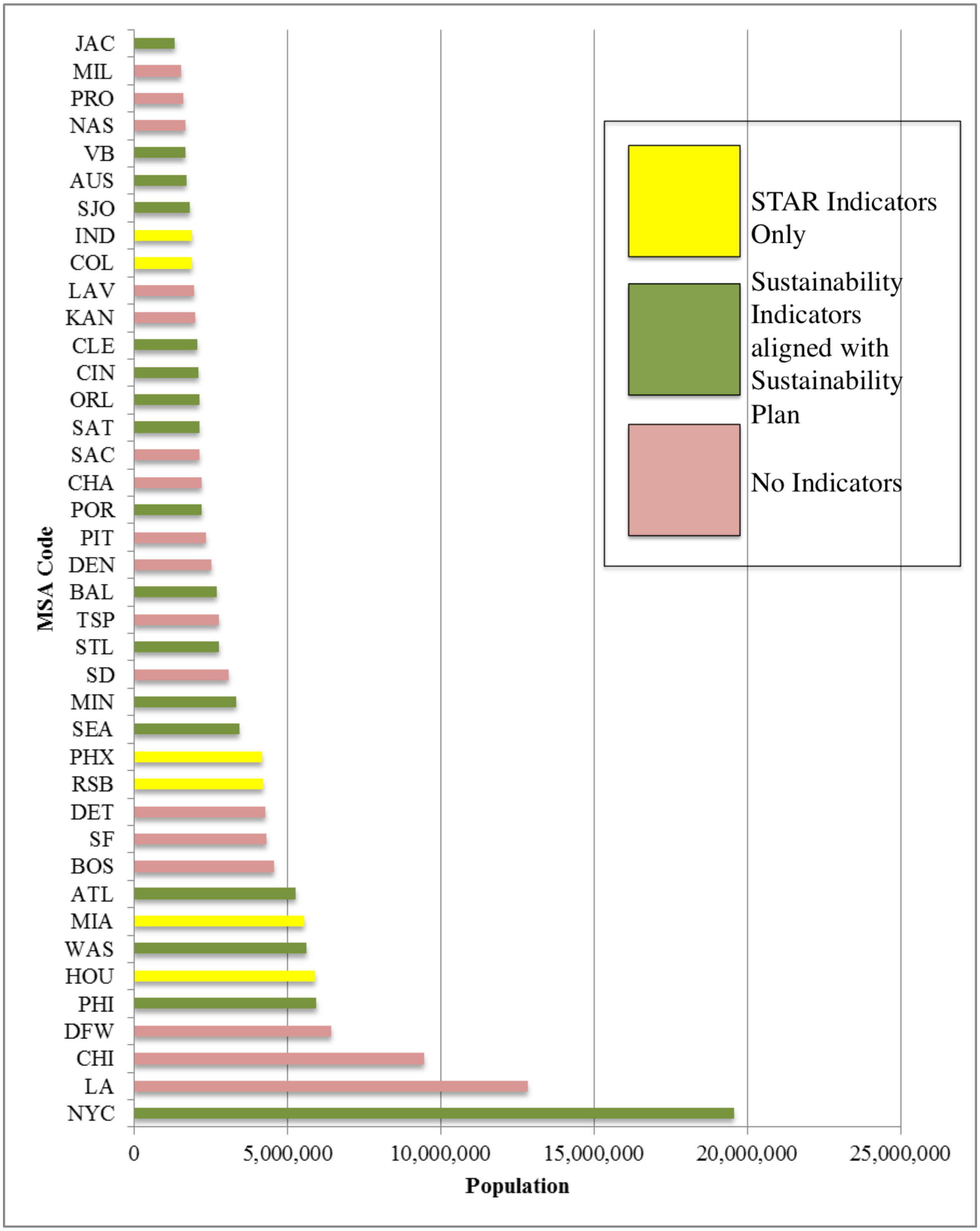

Figure 9 MSAs using Sustainability Indicators.

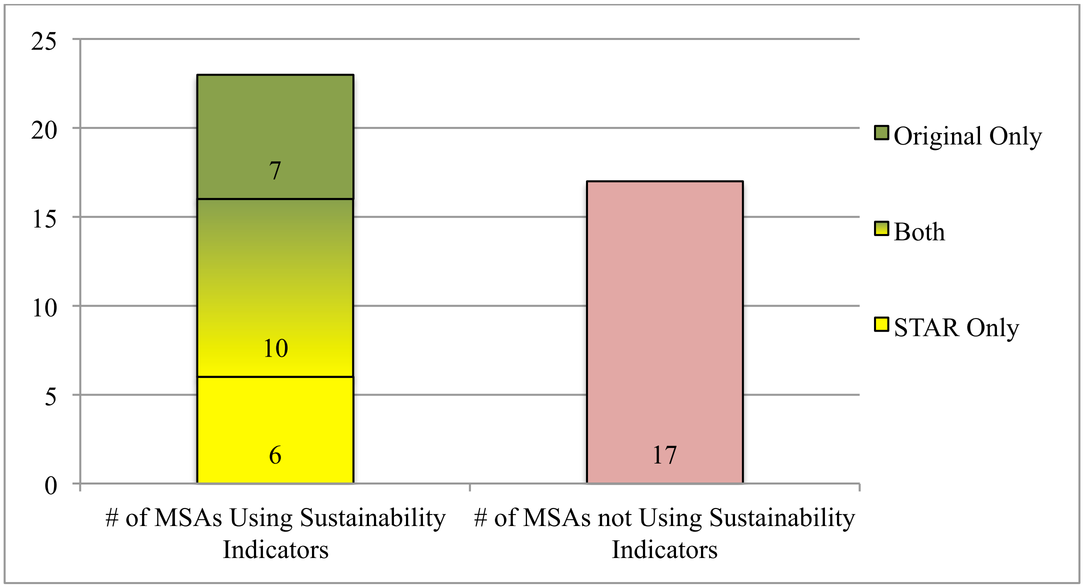

Figure 10 The # of MSAs using Sustainability Indicators versus the # of MSAs not using Sustainability Indicators breakdown.

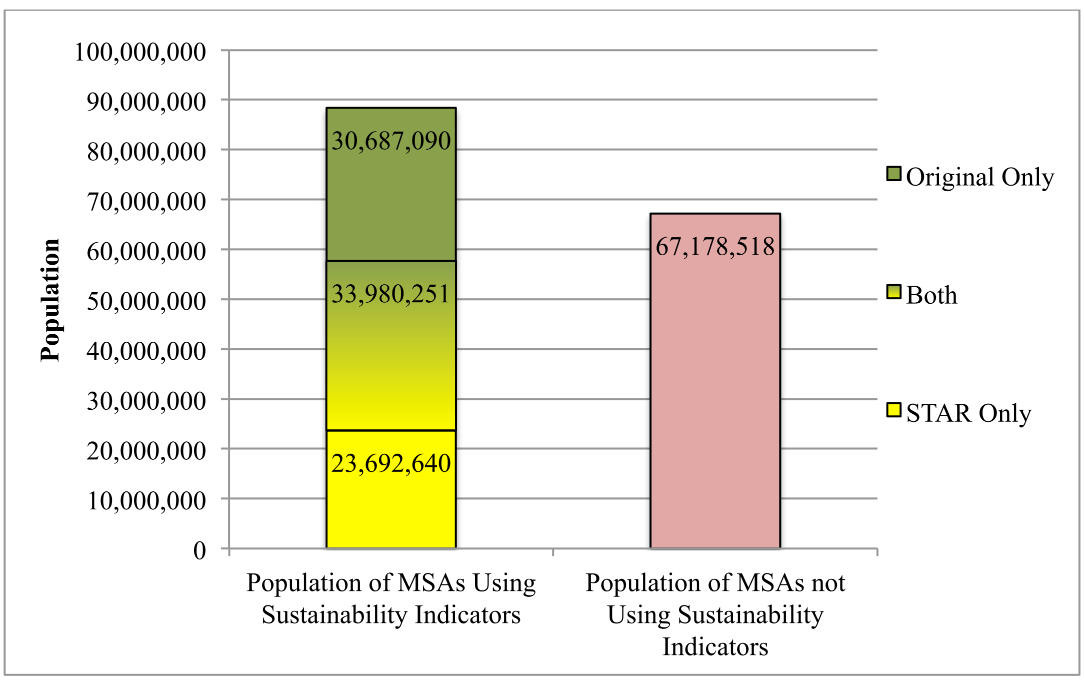

Figure 11 The population of MSAs using Sustainability Indicators versus the population of MSAs not using Sustainability Indicators.

Figure 10, Figure 11, and Figure 12 show a break down of the MSAs that use Sustainability Indicators. Figure 10 indicates that the majority of the US MSAs surveyed did in fact use Sustainability Indicators. Of the 40 largest metro areas in the US, 23 used these tools, or nearly 58%. The percentage of different numbers of jurisdictions using these tools was similar to the percentage of the population surveyed. Fifty-seven percent of the total population living in the 40 surveyed MSAs lived in a place that used Sustainability Indicators. This can be seen in Figure 11. Therefore, a majority (more than half) of the metro areas surveyed used Sustainability Indicators.

These results can be deceptive though, because one may wonder how significant these 40 places actually are. Figure 12 reveals that, based on the sample size, at least 29% of US citizens lived in a place that used Sustainability Indicators.

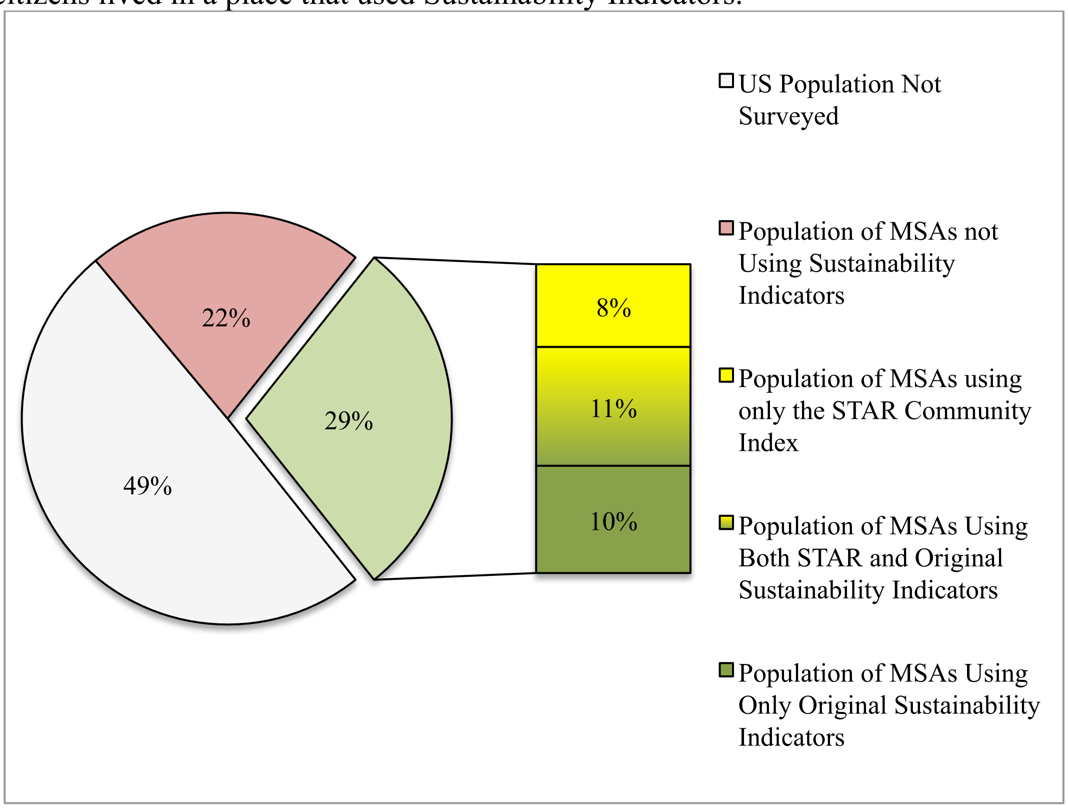

Figure 12 Proportion of US population living in areas that use Sustainability Indicators.

Assessment of Sustainability Indicators

Hypothesis 3

This section displays the results from a comparison done between the IUSIL and the Sustainability Indicators used by each of the 23 US MSAs that were found to be using them. Overall, the comparison found that there was a 17% match of Sustainability Indicators developed by MSAs and the IUSIL. Table 3 shows the 23 MSAs that used Sustainability Indicators had an average of 17% of their unique indicators in common with the IUSIL. The range was from 38% of the STAR Community Index indicators being shared with the IUSIL to 7% of the indicators shared for Portland, Oregon and San Jose, California. This table also indicates that the environmental indicators had the most overlap on average. About 24% of all indicators surveyed matched up with the environmental category of the IUSIL. On the other hand, only 11% of the indicators were found to be in common with the economic category of the IUSIL.

These indicators and their alignment are also expressed in Tables 4-7. Each measurable indicator from the IUSIL is listed and an “X”, “O”, or “-“ indicate the level of congruence between a MSA’s own indicator and the one on the IUSIL. Before those tables, however, Figures 13 and 14 show the relative abundance of matches for each MSA. These data along with data from Figure 9 and Table 2, indicate which MSAs were included in the STAR Category. The six MSAs that used only the STAR Community Index for their Sustainability Indicators were Houston, Texas; Miami, Florida; Riverside, California; Phoenix, Arizona; Columbus, Ohio; and Indianapolis, Indiana. While there were 10 other communities that used both their own Sustainability Indicators and the STAR, those MSAs were all listed individually in Table 2.

Table 3 Number and Percentage of Matches between the IUSIL and MSA's Sustainability Indicators.

	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR	Mean	Median	Mode
Total Environment Matches	11	7	12	4	19	11	10	12	4	5	16	7	13	6	1	13	26			
Total Economy Matches	1	2	2	4	4	2	6	2	1	4	5	2	3	2	1	6	5			
Total Social Matches	9	3	2	8	13	13	17	6	3	14	6	2	4	2	9	11	18			
Total Governance Matches	0	1	1	0	0	2	2	2	1	3	0	1	0	0	1	0	2			
Total Matches	21	13	17	16	36	28	35	22	9	26	27	12	20	10	12	30	51			
Possible Environmental Indicators	44																			
Possible Economy Indictors	27																			
Possible Social Indicators	57																			
Possible Governance Indicators	7																			
Total Possible Indicators	135																			
	0	16	27	9	43	25	23	27	9	11	36	16	30	14	2	30	59	24	25	25
	0	7	7	15	15	7	22	7	4	15	19	7	11	7	4	22	19	11	7	7
Ratio of Matches (%)	16	5	4	14	23	23	30	11	5	25	11	4	7	4	16	19	32	14	14	4
	0	14	14	0	0	29	29	29	14	43	0	14	0	0	14	0	29	13	14	0
	16	10	13	12	27	21	26	16	7	19	20	9	15	7	9	22	38	17	16	9

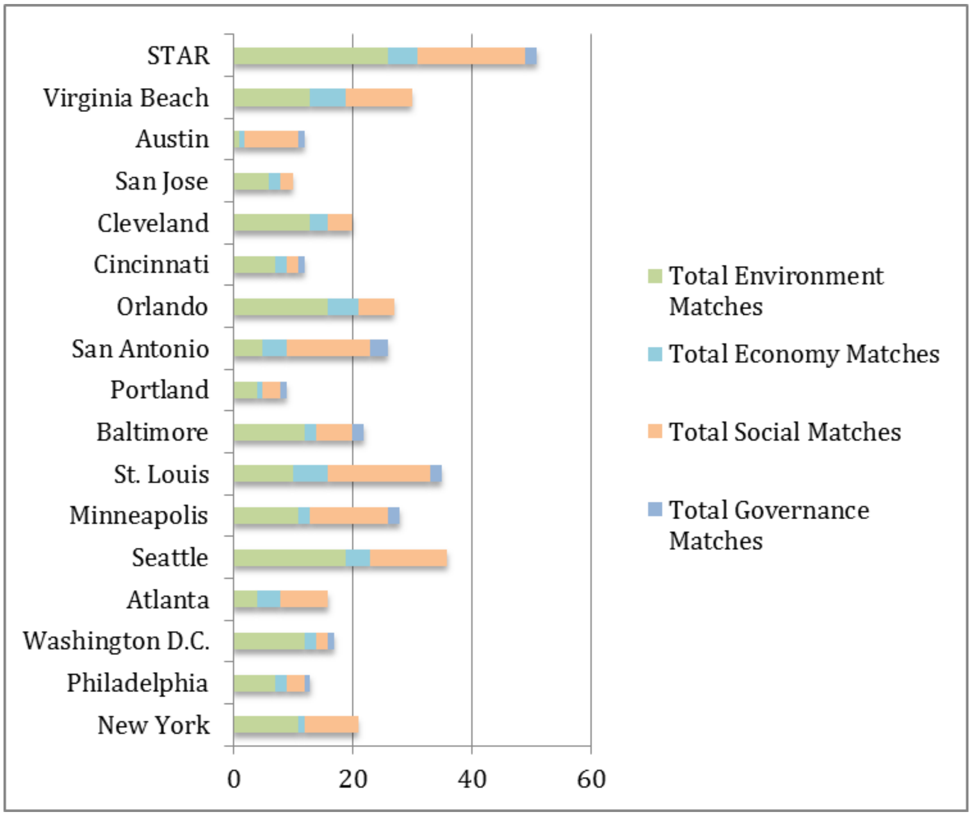

Figure 13 Distribution of matching indicators for each MSA.

While the percentages of conformance were listed in Table 3 above, the actual numbers of matches are shown in Figure 13 For the purposes of this chart, a match includes both an "X" and "O", meaning it includes exact matches and similar intentions all grouped together. The data here reveal that the STAR Index had over 50 total matches, and therefore had the most matches. This means that the STAR Index had the most indicators in common with the IUSIL. Seattle, Washington; St. Louis, Missouri; and Virginia Beach, Virginia all created their own list of indicators. These three MSAs each had 30 or more indicators in common with the IUSIL. The MSAs with the fewest numbers of indicators in common with the IUSIL were Portland, Oregon; San Jose, California; and Austin, Texas.

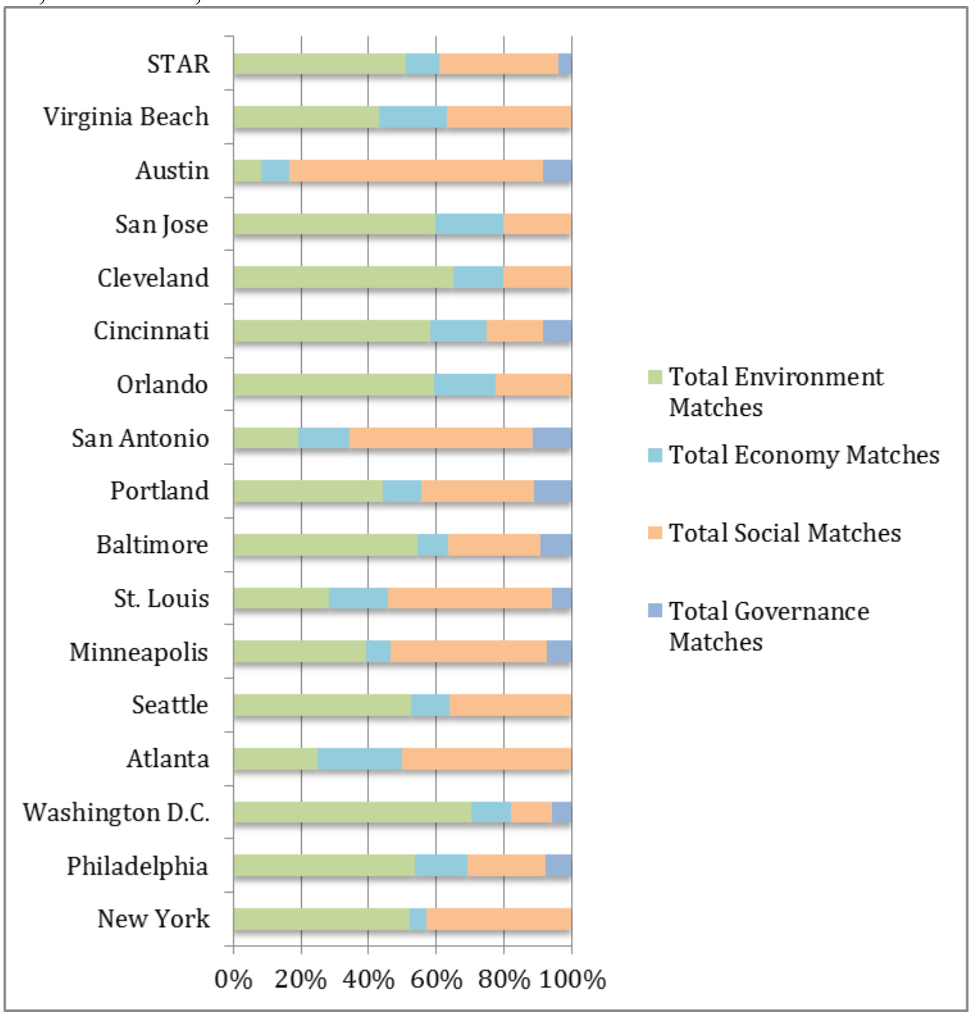

Figure 14 Relative proportion of matching indicators for each TBL category.

Figure 14 shows each MSA's matching indicators divided proportionally among the IUSIL's 4 categories. The IUSIL included indicators in 4 different categories, Environmental, Economic, Social, and Governance. Atlanta, Georgia; St. Louis, Missouri; San Antonio, Texas; and Virginia Beach, Virginia had the most even distribution of indicators. New York City, New York; Washington D.C.; and Cleveland, Ohio had the least balanced indicators (See Figure 14).

Table 4 IUSIL environmental indicator comparisons.																	
X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
Environmental																	
En1 Geographically balanced settlement																	
En1-1 Population growth	-	-	X	-	O	-	-	-	-	-	-	O	X	-	-	-	-
En1-2 Planned settlements	-	-	-	-	O	-	-	-	O	-	O	-	-	O	-	-	X
En2 Freshwater																	
En2-1 Proportion of total water resources used	X	-	-	-	O	-	-	-	-	-	O	-	-	-	-	O	X
En2-2 Water use intensity by economic activity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
En2-3 Presence of fecal coliforms in freshwater	X	-	O	-	O	O	O	O	O	-	O	O	O	-	-	O	X
En2-4 Biochemical oxygen demand in water bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
En3 Wastewater																	
En3-1 Percentage of city population served by wastewater collection	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-
En3-2 Percentage of wastewater receiving no/primary/secondary/tertiary treatment	-	-	-	-	-	-	-	-	-	-	O	-	-	O	-	-	O
En4 Quality of ambient air and atmosphere																	
En4-1 Number of times the limit values for selected air pollutants are exceeded	-	X	X	X	O	X	X	X	-	-	X	-	X	-	O	X	X
En4-2 Existence and level of implementation of air quality management plan	-	-	O	-	-	-	X	-	-	-	-	-	-	-	-	-	X

Table 4 (cont.)

X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
En4-3 Emissions of greenhouse gases	X	X	X	-	O	X	X	X	X	X	X	-	X	X	-	-	X
En4-4 Consumption of ozone depleting substances	-	-	-	-	O	-	-	-	-	-	-	X	-	-	-	-	-
En5 Noise pollution																	
En5-1 Share of population expos ed to long-term high level of environmental noise	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
En5-2 Noise levels in selected areas	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X
En5-3 Existence and level of implementation of a noise action plan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
En6 Sustainable land use																	
En6-1 Artificial surfaces as a percentage of the total municipal area.	-	-	O	-	O	O	X	-	-	-	-	-	X	-	-	O	X
En6-2 Extent of derelict and contaminated land	X	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
En6-3 Number of inhabitants per Km2	-	-	-	-	O	-	-	-	-	O	O	-	-	-	-	-	X
En6-4 Quota of new edification taking place on virgin area and quota taking place on derelict and contaminated land in % per year.	-	-	-	-	O	-	X	-	-	O	O	-	-	-	-	-	-

Table 4 (cont.)																	
X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
En6-5 Restoration of urban land																	
a) Renovation, conversion of derelict buildings	-	O	-	-	O	-	-	-	-	-	-	-	X	-	-	-	X
b) Redevelopment of derelict land for new urban uses	O	O	-	-	O	X	-	-	-	-	-	-	X	-	-	-	X
c) Cleansing of contaminated land	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
En6-6 Protected areas as a percentage of total municipal area	-	O	-	-	-	-	-	-	-	-	O	O	-	-	-	O	X
En6-7 Land affected by desertification	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
En6-8 Area under organic farming	-	O	O	-	O	O	-	-	-	-	X	-	O	-	-	-	X
En6-9 Proportion of land area covered by forests	-	-	O	-	X	O	O	O	-	-	O	-	-	O	-	O	-
En7 Waste generation and management																	
En7-1 Percentage of city population with regular solid waste collection	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
En7-2 Percentage of solid waste disposed to sanitary landfill/incinerated and burned openly/disposed to	O	X	X	-	X	O	X	X	-	-	X	-	X	X	-	X	O

Table 4 (cont.)																	
X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
open dump/recycled/other																	
En7-3 Total solid waste generation per capita	O	-	X	-	-	X	-	X	-	X	X	X	X	-	-	X	X
En7-4 Generation of hazardous waste	O	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
En7-5 Waste treatment and disposal	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
En7-6 Management of radioactive waste	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
En8 Effective and environmentally sound transportation systems																	
En8-1 Travel time	-	-	-	O	X	-	-	X	-	X	-	-	-	-	-	X	-
En8-2 Transport modes	X	-	X	O	X	-	X	O	O	-	X	X	X	X	-	X	X
En8-3 Energy intensity of transport	-	-	-	O	-	-	-	-	-	-	-	O	-	-	-	-	-
En9 Mechanisms to prepare and implement environmental plans																	
En9-1 Local environmental plans	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	X
En9-2 Latest approval date of Master Plan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X

Table 4 (cont.)																	
X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
En10 Biodiversity																	
En10-1 Proportion of terrestrial area protected	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	X	X
En10-2 Management effectiveness of protected areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
En10-3 Area of selected key ecosystems	-	-	O	-	-	-	-	O	-	-	-	-	-	-	-	X	X
En10-4 Fragmentation of habitats	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
En10-5 Change in threat status of species	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
En10-6 Abundance of selected key species	-	-	-	-	X	-	-	O	-	-	-	-	X	-	-	-	-
En10-7 Abundance of invasive alien species	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X

Error! Reference source not found. reveals the overall congruence of the environmental indicators. It shows that some IUSIL indicators were not very representative of the US MSA's sustainability goals. There were several indicators that did not appear once in any of the MSA's lists. EN5-1, EN6-7, and EN10-5 were not represented on any of the individual SI lists for the 23 MSAs using them. Only 7% of these were not listed by any MSA.

Table 5 below displays the same information for the economic category of the IUSIL. None of the following IUSIL economic indicators were found on any of the MSA's lists: EC1-1, EC1-2, EC1-3, EC2-1b, EC2-1c, EC2-1d, EC2-1e, EC2-2d, EC2-3b, EC2-3c, EC3-2, EC3-4, and EC5-1. Thirteen of 27 possible indicators (Table 3), or 48% of the economic indicators were not included.

Table 5 IUSIL economic indicator comparisons.

X=Included O=Similar -=Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
Economic																	
Ec1 Consumption and production patterns																	
Ec1-1 Material consumption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec1-2 Material intensity of the economy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec1-3 Domestic material consumption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec1-4 Annual energy consumption, total and by main user category	-	O	O	-	O	-	O	X	-	-	O	-	-	X	-	-	X
Ec1-5 Share of renewable energy sources in total energy use	-	X	X	-	-	X	X	-	-	X	X	X	X	X	-	X	X
Ec1-6 Intensity of energy use, total and by economic activity	-	-	-	-	-	-	-	-	-	O	O	X	-	-	-	X	-
Ec2 Economic development																	
Ec2-1 Macroeconomic performance																	
a) Gross domestic product (GDP) per capita	-	-	-	O	-	-	O	-	-	-	-	-	O	-	-	-	-
b) Gross saving	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c) Investment share in GDP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 5 (cont.)																	
X=Included O=Similar -=Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
d) Adjusted net savings as percentage of gross national income (GNI)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
e) Inflation rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec2-2 Employment																	
a) Employment-population ratio	-	-	-	O	X	-	X	-	O	X	-	-	-	-	X	-	X
b) Vulnerable employment	-	-	-	-	O	O	X	-	-	-	-	-	-	-	-	-	-
c) Labor productivity and unit labor costs	-	-	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-
d) Share of women in wage employment in the non-agricultural sector	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec2-3 Information and communication technologies																	
a) Internet users per 100 population	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	O
b) Fixed telephone lines per 100 population	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c) Mobile cellular telephone subscribers per 100 population	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 5 (cont.)

X=Included O=Similar -=Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
Ec2-4 Research and development																	
a) Gross domestic expenditure on Research and Development as a percent of GDP	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec2-5 Tourism																	
a) Tourism contribution to GDP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Ec3 Finance																	
Ec3-1 Debt service ratio	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Ec3-2 Tax collected as percentage of tax billed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec3-3 Own-source revenue as a percent of total revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O	O
Ec3-4 Capital spending as percentage of total expenditures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ec4 Water																	
Ec4-1 Price of water	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-
Ec4-2 Domestic water consumption per capita	X	-	-	X	X	-	-	X	-	-	X	-	-	-	-	X	-
Ec5 Strengthen small and microenterprises																	

Table 5 (cont.)																	
X=Included O=Similar -=Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
Ec5-1 Informal employment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6 IUSIL social indicator comparisons.

X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
Social																	
So1 Energy Access																	
So1-1 Percentage of city population with authorized electrical service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So1-2 Total electrical use per capita	X	-	-	-	-	-	X	X	-	-	X	-	-	X	-	-	-
So1-3 Number and duration of electrical interruptions per year per customer	O	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So2 Water Access																	
So2-1 Percentage of city population with potable water supply service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So2-2 Number of interruptions in water service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So3 Education																	
So3-1 Percentage of children completing primary and secondary education	-	-	-	O	X	X	X	X	X	X	-	-	-	-	X	X	X
So3-2 Percentage of school aged children enrolled in schools (by gender)	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	X	-
So3-3 Student/teacher ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So4 Health																	
So4-1 Mortality																	
a) Under-five	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-
b) Mortality rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
c) Life expectancy at birth	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-
d) Healthy life expectancy at birth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So4-2 Health care delivery																	

Table 6 (cont.)																	
X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
a) Percent of population with access to primary health care facilities	-	-	-	-	-	-	-	-	-	O	-	-	-	-	O	-	X
b) Contraceptive prevalence rate	-	-	-	-	-	O	-	-	-	O	-	-	-	-	-	-	-
c) Immunization against infectious childhood diseases	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So4-3 Nutritional status																	
a) Nutritional status of children	-	-	-	-	-	O	-	-	O	O	-	-	-	-	-	-	-
So4-4 Health status and risks																	
a) Morbidity of major diseases such as HIV/AIDS, malaria, tuberculosis	-	-	-	-	-	X	-	-	-	0	O	-	O	-	O	-	-
b) Prevalence of tobacco use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
c) Suicide rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So5 Safety																	
So5-1 Number of homicides per 100,000 population	-	-	-	-	-	X	-	-	-	O	-	-	-	-	-	-	X
So5-2 Number of sworn police officers per 100,000 population	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-
So5-3 Violent crime rate per 100,000 population	-	-	-	-	-	X	X	-	-	-	-	-	-	-	X	X	X
So6 Fire & Emergency Response																	
So6-1 Number of firefighters per 100,000 population	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So6-2 Number of fire related deaths per 100,000 population	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	O

Table 6 (cont.)																	
X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
So6-3 Response time for fire department from initial call	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
So7 Poverty																	
So7-1 Income poverty																	
a) Proportion of population living below national poverty line	-	-	-	X	X	-	X	-	-	X	-	-	O	-	X	-	X
b) Proportion of population below $1 a day	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So7-2 Income inequality																	
a) Ratio of share in national income of highest to lowest quintile	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-
So8 Transportation																	
So8-1 Km of transportation system per 100,000 population	O	O	-	-	O	-	O	O	-	-	O	-	-	O	-	X	X
So8-2 Annual number of public transit trips per capita	-	-	-	-	-	-	X	X	-	X	O	X	-	-	X	X	-
So8-3 Commercial Air Connectivity	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
So8-4 Average travel speed on primary thoroughfares during peak hours	-	-	-	O	X	-	-	X	-	X	-	-	-	-	-	-	-
So8-5 Transportation fatalities per 100,000 population	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So8-6 Number of daily trips and time taken per capita by type of trip and by mode of transport	O	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-

Table 6 (cont.)

X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
So8-7 Total average daily distance covered per capita by type of trip and by mode of transport	O		O	O	O	O	O	-	-	O	-	-	-	-	-	-	-
So8-8 Mode of transportation used by children to travel between home and school	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So9 Natural hazards																	
So9-1 Percentage of population living in hazard prone areas	-	-	-	-	-	-	O	-	-	-	O	-	-	-	-	X	X
So9-2 Human and economic loss due to natural disasters	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-
So9-3 Disaster prevention and mitigation instruments	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	O
So10 Adequate housing																	
So10-1 Durable structures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
So10-2 Overcrowding	O	-	-	-	O	-	-	-	-	O	-	-	-	-	-	-	X
So10-3 Right to adequate housing	O	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X
So10-4 Housing price and rent-to-income	X	-	-	X	X	X	X	-	-	-	-	-	-	-	X	X	X
So11 Shelter																	
So11-1 Percentage of city population living in slums	-	-	-	-	O	O	O	-	-	-	-	-	-	-	O	-	-
So11-2 Area size of informal settlements as a percent of city area and population	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-	-
So12 Security of tenure																	
So12-1 Secure tenure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So12-2 Authorized housing	-	-	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-
So12-3 Evictions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So13 Access to credit																	

Table 6 (cont.)

X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
So13-1 Housing finance	-	-	-	-	O	O	-	-	-	-	-	-	-	-	-	-	-
So14 Access to land																	
So14-1 Land price -to-income	-	-	-	O	O	-	-	-	-	-	-	-	X	-	-	-	-
So15 Promote social integration and support disadvantaged groups																	
So15-1 Poor households	-	-	-	-	O	O	O	-	-	-	-	-	-	-	-	-	X
So16 Culture																	
So16-1 Number of cultural establishments per 100,000 population	-	-	-	X	-	O	-	-	-	-	-	-	-	-	-	O	O
So16-2 City expenditures on culture as a percentage of overall city budget	-	-	-	-	-	-	O	-	-	X	-	-	-	-	-	X	O
So17 Recreation																	
So17-1 Square meters of public recreation facility space per capita	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	O	-
So17-2 City expenditures on public recreation as a percentage of overall city budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
So18 Availability of local public green areas and local services																	
So18-1 Citizens' access to nearby public green areas and basic services	O	-	-	-	O	-	X	X	-	O	O	-	X	-	-	-	-

above reveals the total matches, similar matches, and non-matches for the social category of the IUSIL. SO1-1, SO2-1, SO2-2, SO3-3, SO4-1d, SO4-2c, SO4-4c, SO6-1, SO7-1b, SO8-3, SO8-5, SO8-8, SO12-1, SO12-3, and SO17-2 did not match any indicators in the MSA's lists. A total of 15 indicators were ignored by the 40 largest MSAs in the US. This was a total of only 26% of the Social Indicators.

Only 2 out of 7 governmental indicators were not matched by any MSA SI program (See Table 7). This 28% of indicators included GO3-1 and GO3-2. These two indicators dealt with government corruption. Other themes that were not matched by the MSA's Sustainability Indicators included macroeconomic indicators, access to basic needs (electricity, phone, and water), and government spending.

Figure 15 on the other hand lists all of the indicators that are matched more than twice. It shows the frequency of the most matched indicators. EN4-3, which focused on the measurement of the amount of greenhouse gas emissions from an area, was the environmental indicator with the most exact matches. Twelve MSAs had this exact indicator in their own list of Sustainability Indicators. EN2-3, which targeted the presence of fecal coliform bacteria in bodies of freshwater, had the most similar intentioned matches. In the realm of economics, EC1-5 had the most exact matches with 11. This indictor measured the amount of renewable sources of energy as a percentage of the overall energy consumption for a place. EC1-4 had the most similar matches with 5 This similar indicator measures the total energy consumed within an area. For social indicators, SO3-1 had the most exact matches with nine. This indicator was also known as the graduation rate. Many MSAs had similar indicators to SO8-7. The number of miles traveled by a certain transportation mode was included eight times. The governance indicators had much fewer matches. Indicator GO1-2 which measures voter participation, had the most exact matches. GO1-1 had the most similar matches for this category. It focused on citizen participation, and could be interpreted in a variety of ways such as diversity of elected officials, number of people who have learned about sustainability initiatives, or the number of people at a particular event.

Table 7 IUSIL governance indicator comparisons.

X=Included O=Similar - =Not Included	New York	Philadelphia	Washington D.C.	Atlanta	Seattle	Minneapolis	St. Louis	Baltimore	Portland	San Antonio	Orlando	Cincinnati	Cleveland	San Jose	Austin	Virginia Beach	STAR
Governance																	
Go1 Participation and civic engagement																	
Go1-1 Citizens participation	-	O	O	-	-	O	O	O	O	X	-	O	-	-	-	-	X
Go1-2 Voters participation	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	-	X
Go1-3 Civic associations	-	-	-	-	-	O	-	-	-	X	-	-	-	-	-	-	-
Go2 Transparent, accountable and efficient governance																	
Go2-1 Transparency and accountability	-	-	-	-	-	-	-	O	-	-	-	-	-	-	-	-	-
Go3 Government																	
Go3-1 Corruption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Go3-2 Percentage of population having paid bribes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Go4 Sustainable management of the authorities and businesses																	
Go4-1 Share of public & privat organizations adopting and using environmental and social management procedures	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-

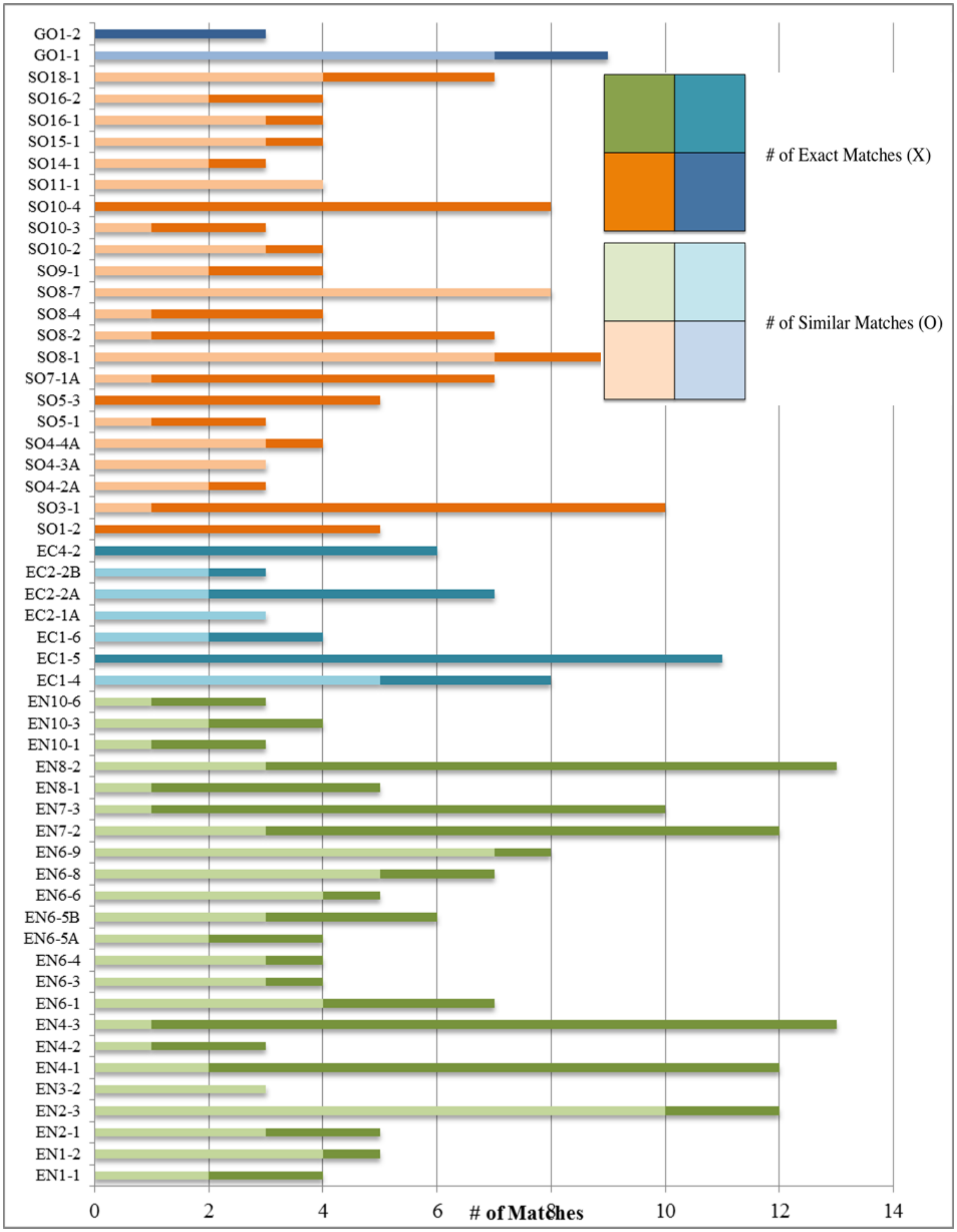

Figure 15 Frequency of the most common indicators from the IUSIL.

Interviews

The interviews that were conducted vary in results and comparability. The MSAs chosen for interviews are at different stages of Sustainability Indicator development and use. Therefore, codes could not be easily applied to the responses because only certain questions were relevant to each MSA.

Indianapolis, Indiana

The city of Indianapolis, Indiana is the heart of the rust belt of the United States (Figure 16 and 17). With a history of industry and manufacturing, the city of Indianapolis has long been at odds with the environment. Built alongside the banks of the White River, this city has evolved through numerous floods and environmental impacts. The city hosts the Indy 500 and has a long track record of being an automobile industrial hub. Today, the metropolitan statistical area is just over 3,000 square miles in size. Within this statistical area, there are 1,756,24 people living at a density of 455.6 people/square mile (USCB 2013). With the city projected to continue growing at about 8% every 10 years, a focus on sustainability is needed in this city now more than ever. The mayor in Indianapolis has taken the initiative to focus resources and attention on improving water quality, green space, economic and social wellbeing.

The Indianapolis sustainability plan has not yet been officially created. SustainIndy is the city government's effort to prioritize sustainability at the municipal level as well as throughout the region. SustainIndy is both the sustainability initiative in Indianapolis, and the website itself. The effort to measure Indianapolis' sustainability success and failures started in 2012 when they became a pilot community for the STAR Community Index. The city spent a year gathering data to feed into the STAR Index. In November 2013, the data were submitted to the ICLEI. In the first few months of 2014, Indianapolis received their results and found out they are a 3 Star Community. This means that they received a score in 365.3 out of 720 possible points. The range for a 3 Star Community is 200-399.

Figure 16 Indianapolis, Indiana Map

Figure 17 Indianapolis, Indiana Skyline

Why do you use indicators?

SustainIndy plans to create a citizen-lead Sustainability Plan in the next couple of years. They want to use the data gathered using the Sustainability Indicators in the STAR Framework to shape their plan. "We are close to a 4 Star Community," one respondent said. Before this process started, Indianapolis did not have a way to "track and report [our] sustainability progress." Therefore, these indicators are being used to measure and track the things the city is doing well. Not only that, the indicators will be used to help shape the sustainability plan that is about to be created. As stated in the interview, "We are doing really well on the hallmark sustainability items of 'green infrastructure' and environmental stuff. We have start looking at 'Sustainability 2.0'. We have to start looking at equity." With this knowledge, Indianapolis can focus on these "Sustainability 2.0" areas, and work to become a 4 Star Community in the coming years. The plan will reflect where the city has done well and where it needs to grow. This could not be done if there were not measurements being made. The indicators are being used to make the plan, and through the plan, make the city more sustainable over time.

Who is using/will use the indicators?

The indicators are going to be used as a direct input into the planning process going forward. Therefore, the citizens of Indianapolis will be using these metrics to shape the plan. The indicators are providing a 30,000 ft. view of movement towards or away from sustainability goals. Not just citizens use the indicators, but also various departments of the city government along with other entities throughout the city. "We have to start looking at sustainability in a more holistic way," was the viewpoint of the interviewee.

The mayor is already on board, as well as the library system. Mentioning the indicators as an internal topic of discussion, the Mayor of Indianapolis is excited about using this measurement tool. The library system has also committed to integrating the Sustainability Indicators into their own sustainability plan, currently being developed. While these high levels of government are using the indicators already, the indicators will not be much used for guiding policy. Indianapolis would rather use the metrics to lay a "blueprint" for the citizens and the governmental departments as opposed to creating ordinances or policies. "We will differ from STAR in this regard," said the respondent, "We want to lead by example." The audience is government officials, but solely for the purpose of leading by example, not implementing policies. The indicators will also reach citizens and be used by them to plan for the future.

Tacoma, Washington

Tacoma, Washington, otherwise known as "The City of Destiny" is built along the Puget Sound in between Seattle and Olympia, Washington. Being on the bay, and next to the Northern Cascade Mountains made this city the perfect ending point for the Northern Pacific Railroad in the 19th century. With a long history of being a shipping hub both on the coast, and with the railroad, while Tacoma has been at the center of many American industries it is often overshadowed by its larger neighbors of Seattle and Vancouvor. Today, Tacoma is 49 square miles and contains a mostly white population of right around 200,000 (USCB 2013).

Tacoma is part of the Seattle metropolitan statistical area, and therefore qualified for the interview. The community participated as a STAR Beta Community and has had fairly comprehensive Climate Action Plan since 2008. After that plan was created, the Tacoma Office of Sustainability was created in 2009. The existing Climate Action Plan based some of its organization on a Greenhouse Gas Inventory, which has been providing measurements of emissions since 2007. Since 2013, Tacoma has been feeding data into the STAR Community Index, and in the first few months of 2014, Tacoma was informed that they are a 4 Star Community. A score of 450.9 puts them into the 4 Star range of 400-599. While the city has experience using more traditional indicators, such as the Greenhouse Gas Inventory, its participation in the STAR Community Index is their first foray into true Sustainability Indicators.

Figure 18 Tacoma, Washington Map

Figure 19 Tacoma, Washington Skyline

Why do you use indicators?

The respondent emphasized that Tacoma is doing many good things in terms of sustainability. The respondent indicated, "We often get overshadowed by Portland and Seattle. Our own citizens don't realize the good being done here in Tacoma sometimes." These holistic indicators are being used to raise awareness of what is happening right here in Tacoma. "This process has made me proud of my community," said the interviewee. Now, that feeling of pride is being exported into the community. A banner declaring, "4 Star Community" is being brought to community events in order to raise awareness. This banner's use has another goal beyond increasing regional pride, it is also starting conversations. The hope is that people will be curious what being a "4 Star Community" means. This creates a discussion of the Sustainability Indicators, and therefore raises civic engagement.

The other use of indicators is to simply measure progress. Often times, the people working in the weeds get so caught up just trying to implement sustainability programs and practices. This tool allows these people to understand if all of those collective actions are making a difference. "Are we moving the needle?" is what the respondent asked. The indicators reveal that Tacoma is doing well in parks and open space, is progressive with its utilities, and has a vibrant art community. They also show that the city needs to work on job creation and equity among its citizens. This knowledge is guiding policy, which gets to the aim of Tacoma's Sustainability Department: start with what *we* can actually control. After those controllable changes are made, then the community can make up the slack.

Who is using/will use the indicators?

The Sustainability Department is currently using the Sustainability Indicators from the STAR Community Index. This department is influencing other municipal departments to respond to the areas of need, as discovered using the indicators. In the future, the indicators will be used by the citizens and by other community groups/coalitions. School districts, art commissions, and other key partners are learning about the indicators now. These community organizations will be able to fill the gap that the city is unable to fill. Council members are proud of the success measured by the indicators as well, and are talking about them because of that. In addition, media has started to pick up on their use, and an article has been written about the "First 4 Star Community" in Washington. In summary, the indicators are being used by the government first to raise awareness and create policies, then they will be used by community groups to close the gap.

Broward County, Florida

Southern Florida, including Broward County sits just to the east of Everglades National Park, one of America's most diverse and fragile ecosystems. To its west, the Atlantic Ocean takes center stage for this historically agricultural county. Where suburbia meets ecological biodiversity, Broward County will have a big need for sustainable development moving forward. Being the 10th most populous county in the US with 1.7 million people, and having used most of the developable land in the county already, a holistic approach to future development is needed (USCB 2013).

Broward County contains the city of Ft. Lauderdale, which is part of Miami's metropolitan statistical area, and it therefore qualifies for the interview. With numerous plans, including a prominent Climate Action Plan, in place, the County decided to participate in the STAR Community Index. Again, serving as a pilot community, the County received its score early in 2014. Their score of 436.6 places them as one of only three 4 Star Communities.

Figure 20 Broward County, Florida

Figure 21 Ft. Lauderdale Skyline, part of the Miami MSA

Why do you use indicators?

Broward County has been working towards various goals concerning the environment, the economy, and society for quite some time. Numerous plans exist for each of these categories of the triple bottom line. Until now, there has not been a way to know if these plans have been successful. "We are making an assessment of our investments to date," the respondent said. While the most recent Climate Action Plan includes as many of the components of sustainability, the broad goals that it set for the county were not measurable. The Sustainability Indicators in the STAR Index provide a benchmark for the community. This data will not be used to influence future plans and policies. The indicators show that Broward County has been successful at moving towards sustainability. In the area of natural resources, the county scored highly. In terms of economic development, there is room for improvement. "The Climate Action Plan coupled with aggressive policies" has been successful so far, according to the respondent and the STAR score. However, it has not just been the results of the Climate Action Plan. "The STAR Index measures many other things outside the realm of the Climate Action Plan," said the interviewee. The tool will be used to shape the direction headed into the future.

Who is using/will use the indictors?

The plans being implemented so far are countywide plans. There are task forces centered on different components of sustainability for each of the existing plans. These task forces make policy recommendations as well as implement the work required to execute the plans. The people on these task forces will be the first audience of the Sustainability Indicators. Not only will these county government officials use the metrics in their planning processes, other community groups are now part of the action. "We had to reach out to a wide variety of agencies that we don't normally work with in order to get the broader spectrum of data required for the STAR Index," said the respondent. These agencies work on programs centered on social components of sustainability, and have traditionally been left out of the planning process in Broward County. The intended audience for these indicators in this MSA is decision-makers and policy-influencers. In addition, community groups working towards social goals will use the indicators.

Trends

In all three cases, government officials are at least part of the intended audience. The end goal of policy change is more directly intended in Tacoma and Broward County. In Indianapolis and Tacoma, there is a strong desire to get the community interested in the outcomes of the measurements. Another common thread throughout all the places is the fact that sustainability has traditionally been thought of as only relating to the environment. But after joining the STAR communities, these communities are looking more holistically at the issue of sustainability and are beginning to see equity and social concerns as the newest hurdle to leap on the path towards sustainability.

5. DISCUSSION

Introduction

The question of design, use, implementation of sustainability plans and Sustainability Indicators in the United States is a big one. Being that even among the 40 largest metro areas in a single country there is great disparity among governance objectives, urgent needs, and citizen desires, each MSA has different uses for Sustainability Indicators. In the following section, discussions are made regarding the overall use of sustainability plans and Sustainability Indicators. In addition, this section will assess the use of the IUSIL as a comprehensive list of indicators that can be used across the country to measure progress towards sustainability.

Assessment of Cities

The assessment of cities, or MSAs, indicated a majority of the US MSAs sampled use both a formal Sustainability Plan and Sustainability Indicators. While this paper hypothesized that most cities use a Sustainability Plan, it did not foresee a majority of cities using Sustainability Indicators. These results are good news for the citizens of the United States because they reveal that almost half of the population lives in places planning for sustainability. While the proportion of the population living in cities using Sustainability Indicators is less than those living with plans, it is still more than expected and thus results in good news.

Hypothesis 1

Hypothesis 1 states, "A majority of the top 40 largest US metro regions have formal sustainability plans." The results of this research indicate that this hypothesis is correct. The reason for this harkens back to the results of the Green Survey, which indicated, "4/5 big cities report that *sustainability* is among their top five priorities" (Living Cities). Fitting in with Agenda 21's mandate to plan for sustainable development and to plan for it locally, these plans are forging a more environmentally friendly, equitable, and prosperous future (United Nations, 1993). Nearly half of the country's population lives in a place with a Sustainability Plan in place. The other half of the population was not surveyed during this research, so it is not possible to say the full extent to which these plans are impacting all urban Americans. However, it is possible to declare a successful use of the plans among the largest metro areas in the country.

Hypothesis 2

Hypothesis 2 states, "A minority of the top 40 largest US metro regions use Sustainability Indicators to measure their plan's success." Based on the results in this research, this hypothesis is incorrect. 23 out of 40 surveyed MSAs use Sustainability Indicators to measure progress. This is even better news than the results presented for Hypothesis 1. Having a Sustainability Plan is a good start, but until metrics are assignment and progress can be quantified, the plans are less effective. Therefore the widespread use of Sustainability Indicators in America is a step in the right direction for achieving some of the broad and ambitious goals laid out in many of the Sustainability Plans.

With nearly a third of the US population already having sustainability progress measured where they live, there is a positive outlook for the future of the country. In addition, the use of Sustainability Indicators versus single-focused traditional indicators for progress reveals a trend for a more holistic view of progress. Incorporating environmental, economic, and social progress measurement together will create a more equitable, livable, and viable nation. These results fit in with the third leg of the Agenda 21 mandate of measuring progress toward the goals laid out in the plans (United Nations, 1993).

Assessment of Indicators

The assessment of indicators takes a closer look at the use of Sustainability Indicators in large US MSAs. The following section includes a discussion of the 3rd Hypothesis.

Hypothesis 3

Hypothesis 3 states, "There are common trends and best practices among the US metro regions using SIs." In order to test this hypothesis, a comprehensive list of indicators developed by several international agencies known as the IUSIL was used (Shen, et al., 2011). By comparing all the indicators developed by each MSA to this list, a breakdown of common trends and best practices emerged.

The most common indicators involve commonly accepted, already widely used metrics for assessing progress towards equally as common goals. For example, greenhouse gas emissions, fecal coliform, and the proportion of renewable energy in an energy portfolio are already widely used. Therefore, these easy to measure indicators make a good basis for an integrated Sustainability Indicator Framework. For social and governance uses, graduation rates and voter participation provide a good starting point for commonly accepted Sustainability Indicators.

These trends also indicate that macroeconomic measurements are less favorable in the US. In fact, many of the indicators from the IUSIL that were not matched at all are more useful for developing cities or counties. In America, there are different priorities based on our current level of development. In addition to the IUSIL Indicators that were not matched, there were several indicators that appeared on the MSA's lists that were not mentioned on the IUSIL. For example, many of the MSAs measure their economic prosperity through the growth of one or two specific sectors that are desired in their community. This sector is most often the "Green Economy". In addition, many MSAs use indicators for measuring the quality of existing infrastructure. It makes sense that these indicators would not be on the IUSIL because the IUSIL seems more relevant for developing places. Countries or cities struggling to provide basic needs to their citizens do not need to focus on "Green Tech" jobs or potholes. The IUSIL focuses on the basic needs of people, the environment, and the economy. Americans often have these basic needs met, and therefore are focusing on higher level sustainability goals, and therefore are measuring progress towards these different goals.

Another trend that can be gleaned from these data is in the differing uses, applications, and users of the Sustainability Indicators. As discussed previously, there are three schools of thought on the use of Sustainability Indicators. They can be used for sound science, community involvement, or policy influence (Gahin, 2003). It appears that most often, the Sustainability Indicators take on all of these roles at different stages of their implementation. Rather than being mutually exclusive, these three uses work in tandem to achieve overall sustainability goals. That also means that the end-users of the Sustainability Indicators are changing throughout their development, implementation, and measurement. In the three case study examples provided, it was clear that the indicators themselves as well as the data they produce were being used by a variety of stakeholders at different stages of their implantation.

Recommendations

Based on the results and trends identified above, there are some recommendations for the use of Sustainability Indicators in the US. The data produced by this study are useful for citizens, planners, and decision makers. Here are the biggest takeaways from this study:

- There are numerous indicators that are nearly universal. Almost any community can measure greenhouse gas emissions, water pollution, renewable energy percentages, graduation rates, and voter turnout. If communities start using the same metric to measure these, then best practices and lessons learned will be easier to share between communities.

- While some indicators can be shared by all effectively, many communities have unique goals and challenges that they are facing. The ability to tailor indicators for a particular community's needs is vital for user buy in. Whether the target audiences for the indicators are policy-makers or average citizens, the user must feel some ownership over the sustainability goal and the metric used to measure progress towards it.
- Communities are ready to look at the true triple bottom line when it comes to sustainability at this point. There is, however, a lack of balance among the environment, economy, and society still evident in the indicators being used today. More knowledge needs to be gained in the effectiveness of some of the newer indicators that are assessing quality of life and microeconomic factors.
- Equity is seen as the new frontier for sustainability. More research needs to be done to assess the effectiveness of the indicators currently used to measure equity.
- Until all communities use a common set of indicators, it is difficult to assess the effectiveness of any set of indicators. This paradox rests on the fact that one cannot measure the effectiveness of something that is not being measured. Qualitative analysis is possible, and should be pursued, but it does not address the empirical question of effectiveness of Sustainability Plans or Sustainability Indicators.
- The IUSIL is not an effective list of indicators for use in American cities. With an average compliance rate of 17%, there is simply not enough evidence to warrant cities using these indicators.

- The STAR Community Index, however, does a good job of providing a comprehensive list of Sustainability Indicators. By including points for both outcomes and actions, municipalities can meet local needs while also contributing data and knowledge to the broader sustainability goals of the country. In addition, the Innovation and Process Credits encourage customization and localization, ensuring user buy in.

Future Research

The results from this study show that cities use sustainability plans and sustainability indicators. There are however, big questions that remain unanswered. Here are some ideas for future research:

- This study only focused on the 40 largest MSA in the United States. Other research could expand beyond these 40 and try to discover if other large MSA use sustainability and indicators.
- Because of the sample used in this study, little is know about small or rural cities and towns across the country. Future research could ask about the use of plans and indicators in the smaller places.
- This research used metropolitan statistical areas to focus. Within each MSA, there are often multiple cities, counties, and townships. Future research could explore if there are more sustainability plans or indicators being used by any other jurisdiction within the MSA.
- The issue of scale is a big one. This study focused on cities, which is where Agenda 21 suggests sustainability plans should be tracked and measured. Future research could assess the impacts of cities on other levels of government and vice versa.

- Other future research could try to ask about triggers or tipping points that have led to the use of sustainability plans or indicators in cities. Are there any particular triggers that cause a place to create and measure such a plan (regulation, mayoral input, community desire)?
- More in-depth evaluation of cities that are using SIs or cities that are not using SIs could be done. This research does not answer the question *why*, and moving forward, future research could address *why* there is more congruence between environmental indicators than economic? *Why* certain cities do not use SIs at all or certain indicators in a particular city? Many other questions could be asked trying to tease out the *why* questions, and these should be explored in future research.

6. CONCLUSION

This study looked at the 40 largest metro areas in the United States. It found that 35 of these cities use formal Sustainability Plans. It also found that 23 of these areas use Sustainability Indictors to measure progress towards the goals laid out in their Sustainability Plans. While assessing the indicators themselves, the study concludes that the use of the IUSIL is not beneficial for cities in America because of its focus on basic environmental, economic, and social needs. Rather, a more adaptable and relevant framework for cities to use is the STAR Community Index.

This study concludes that the state of sustainability planning and measuring is on a good track in the United States. With nearly half of the population living in a place that uses a Sustainability Plan and nearly a third living in a place using Sustainability Indicators, goals are set and progress is being measured. There is certainly room for improvement and growth in the integration of the plans and the indicators, and the overall use of both, but in general the country is moving in the right direction. The country is moving towards a sustainable future.

APPENDIX SECTION

APPENDIX A

Justifications For Changes to Proposal

This research project started asking a different question and it put forth different hypotheses. The previous iteration of the question and hypotheses were as follows:

"Are Sustainability Indicators in large U.S. cities making the economy, environment, and society more sustainable in those cites?"

The following hypotheses will be tested:

H1= Cities that use Sustainability Indicators (SIs) have no impact on their environment.

H2= Cities that use SIs have no impact on their economy.

H3= Cities that use SIs have no impact on their society.

H4= There are common trends and best practices among the U.S. cities using SIs.

After beginning down the path to try to answer that question, it became evident that the time and resources required to do so were not available. In addition, the original Interview Instrument was far too involved for the participants that were contacted. The proposed methodology included hour long interviews with six different people from3 different MSAs. Due to busy schedules on both the part of the interviewer and the interviewees, the tool was paired down and fewer people interviewed. Due to these unforeseen constraints, the original scope of the project was scaled back in order to provide quality results.

APPENDIX B

Interview Instrument

Table 8 Interview Instrument.

Questions	Answers		
	Is that right?	Role:	
I understand the planning project was undertaken in 20__ Is that right? Could you briefly describe your role in the project?	YES / NO		
	Stated Purpose:	Intended Audience:	Intended Outcome:
What is the stated purpose of the plan? (Who was the intended audience? What were the intended outcomes?)			
	Extent:		
To what extent were indicators (measurement criteria) used to measure the progress of the plan?			
	How (categories):		
How were the categories of the plan chosen?			
	How (indicators):		
How were the indicators for each category chosen?			

Table 8 Interview Instrument.

Questions	Answers		
	Successes:		
What do you think have been the biggest successes of the plan so far?			
	Without Indicators:		
Would these successes have been possible without indicators measuring your progress?			
	Benefits:		
In what ways do you think the plan has benefited the community?			
	Media:	Public Speeches/Political Campaigns:	School Curricula, etc.:
Are there ways the indicators have entered public life, such as being cited in the media, being mentioned in public speeches, political campaigns, or being used in school curricula, etc.?			
	Coalitions:	Organizations:	Programs:
Have any new coalitions, organizations, or programs been formed as a result of the indicators process?			
	Cited/Made use of:	Changed their programs:	
Have any existing business groups, nonprofits, citizen groups, or other private organizations cited or made use			

Table 8 Interview Instrument.

Questions	Answers		
of the indicators? Have any changed their programs or focus as a result of the indicators?			
	Planning/Decision-Making	Agendas:	Political Action:
Are the indicators being used by governmental entities in any way, such as in planning or decision-making? Have they influenced any agendas? Has any political action been taken in response to an indicator?			

APPENDIX C

Comprehensive List of Indicators

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
1	NYC	PlaNYC	2007	2030	New York City	New Housing
						Total Units of Housing
						% of housing affordable to median-income NYC household
						Vacancy rate of least expensive rental apartments
						% of new units within a 1/2 mile of transit
						Residential building energy use per capita
						% of New Yorkers that live within a 1/4 mile of a park
						# of vacant tax lots presumed to be contaminated
						# of tax lots remediated in NYC annually
						Fecal coliform rates in New York Harbor
						Dissolved Oxygen Rates

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						# of drinking water analyses below maximum containment level
						Water usage per capita
						Sustainable transportation mode share
						Change in transit volume minus change in auto traffic volume
						Vehicle revenue miles
						% of bridges meeting a state of good repair
						% of roads meeting a state of good repair
						% of transit station components meeting a state of good repair
						GHG emissions per unit of electrical power
						System reliability SAIFI
						Energy Use per capita
						City ranking in average Particulate Matter 2.5
						Change in average PM 2.5
						% of waste diverted from landfills
						Greenhouse Gas Emissions (MTCO2e)

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Greenhouse Gas Emissions (100% =2005 GHG)
						Greenhouse Gas Emissions (per GCP)
						Greenhouse Gas Emissions (per capita)
5	PHI	Greenworks Philadelphia	2009	2015	City of Philadelphia	City Government Energy Usage
						Building Energy Consumption
						# of Homes Retrofitted with Insulation, Air Sealing, and Cool Roofs
						% of energy provided by alternative energy sources
						CO2 Emissions (tons)
						# of poor air quality days
						% of waste diverted from landfills
						Acres turned green
						Acres of Open Space
						# of Markets, Gardens and Farms
						# of New Trees
						Vehicle Miles Traveled
						% of assets in a state of good repair
						% of workplaces producing green goods and services

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						% of workplaces using green technologies and praticies
7	WAS	Sustainable DC	2011	2032	D.C. Mayor's Office	# of new small businesses
						# of jobs providing green goods and services
						Obesity Rate
						% of housing meeting Healthy by Design Standards
						% of children taught about sustainability
						% of pop. exposed to sustainability initatives
						GHG Emissions
						Create Climate Action Plan
						# of new residents
						# of amenities within 20 minute walk
						% of buildings that are net-zero
						Citywide Energy Use
						Renewable Energy Use
						# of annual power outages
						Acres growing food
						% of pop. Within 1/4 mile of healthy, local food

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						% of food coming from within 100 miles of the city
						Acres of wetlands
						% of tree canopy
						% of residents within 10 minute walk of green space
						% of sustainable modes of transportation
						% of commuter trips by car
						# of unhealthy air quality days
						% of waste sent to landfills
						Tons of waste
						% of construction and demolition waste resued
						% of waste diverted from landfills
						% of waterways that are fishable and swimmable
						% of impervious cover
9	ATL	Plan 2040	2011	2040	Atlanta Regional Council	% of workers living in the Region's Core
						% of income spent on housing
						% of workers with less than a 45 minute one-way commute
						Creative Establishments per 1000

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						residents
						Exports ($)
						% of all patents in the 99 largest metros
						Patents per 10,000 population
						Location Quotient for Knowledge, Logistics, Production and Entertainment jobs
						Unemployement Rate
						Gross Metropolitian Product
						Home Price Index
						% of commuters with green commutes
						# of annual days exceeding the ozone standard
						Per capita water use
						% of transportation projects advancing on schedule
						Congestion Cost per Atlanta commuter
						Congestion Index
						Annual Hours of delay per commuter
						% of adults with at least bachelor's

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						degree
						Education Gap
						Graduation Rate
						% of 16-19 Year Olds not enrolled in school
						% of low income families enrolled in pre-k
						Obesity Rate
						% of older adults in poverty
15	SEA	Strategic Climate Action Plan	2012	-	King County	Supply and Demand of Rental Housing
						% of income spent on housing
						Homlessness
						Apartment Vacancy Rate
						Home Purchase Affordability Gap
						Home Ownership Rate
						Trend in housing costs in relation to income
						Public dollars spent on Low income housing
						Exisiting housing affordable to low income
						Real wages/worker
						Per Capita Income and Household

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Income
						% of pop. Below poverty rate
						# of new businesses
						# of new jobs
						# of new jobs that export from the region
						Education background of adult pop.
						Graduation Rate
						Land Cover Changes
						Changes in air quality
						energy Consumption
						Vehicle Miles Traveled
						Surface Water Quality
						Water Consumption
						Ground Water Quality and Quantity
						Continuity of habitat
						# of Salmon
						Pounds of waste recycled and disposed
						% of housing in urban and rural areas
						Employement in Urban and Rural Areas
						% of housing built through

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						redevelopment
						ration of land consumption to pop growth
						Trend in achieved density of residential development
						Remaining land capacity vs housing and job tarhets
						Acres of Open Space
						Ration of jobs to housing
						Acres of forest land
						Acres of farm land and average size
						Commute Lengths
						Public Transit Ridership
						% of esidents using green modes
						Congestion Times
						Number of lane miles in need of repair
16	MIN	City of Minneapolis Sustainability Indicators	2009	2014	City of Minneapolis	Infant Mortality Rate
						Low Birth Wieght
						Teen Pregnancy Rate
						HIV Case Rate
						Gonorrhea Case Rate
						Healthy Weight Rate

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Obesity Rate
						Asthma-Related Hostpitalizations
						Test all 1 and 2 yr old for lead
						Inspect all homes of children with elevated blood lead
						Citywide Greenhouse Gas Emissions
						Municipal Greenhouse Gas Emissions
						Number of Renewable Energy Projects Permits
						Increase Municipal Renewable Energy
						Days with air pollutant concentrations exceeding sustainability target
						Average benzene and formaldehyde concentrations
						Waste Collected, by Ton
						Organics Collected, by Ton
						Recyclales Recovered, by Ton
						increase on-street lanes and off-steeet trails
						% of bike commuters

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						# of bikes
						% of residents driving alone to work
						% of workers driving alone to work
						reduce average noise levels
						% of tree canopy
						# of New Trees
						amount of pollutants in runoff
						# of rain gardens
						LAURI ratings
						# of beach closings
						# of invasive species
						# of green mfg or service companies
						# of green jobs
						# of building retrofits
						# of gardens
						# of residents within 1/4 mile of healthy food
						# of cost-burdened renter household
						# of cost burdened owner household
						# of city programs creating affordable houing

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						# of homeless
						# of brownfield sites cleaned up
						Violent crime rate
						# of homicides
						# of engagement opportunities
						# of non-whites in city boards
						# of creative sector workers
						# of jobs at arts and cultural centers
						# of artists
						Graduation Rate
						ratial disparities in unemployement
						ratial disparities in pverty
18	STL	OneSTL	2013	-	Regional	# of OneSTL Members
						Number of cooperative agreements and inter-jurisdictional programs established by local governments
						Percent of residents living within the service area of active Community Development Corporations
						Percent of local governments that use the Sustainable Solutions Toolkit or St. Louis Regional Data Exchange

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Diversity of employment by sector
						Percent of residents living within a reasonable travel time to job centers
						Percent of residents living in poverty
						Percent of jobs with a median wage higher than self-sufficiency wage for a 1 adult, 1 child household
						Number of full time equivalent jobs
						Unemployment Rate
						Personal income per capita (in 2011 dollars)
						Gross Metropolitan Product - the market value of all goods and services produced in the region (2005 chained dollars)
						Ratio of white median household income to black median household income
						Proportion of household income spent on housing and transportation costs
						Percent of population that reside within 1 mile of a park or open space for rural areas or ½ mile for

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						urban areas
						Crime Rate - combined violent and property crime rates per 100,000
						Percent of adults meeting recommended exercise standard
						Percent of residents who live in stably integrated communities
						Percent of census tracts with housing stock at a variety of price points for owners and renters
						Percent of poor residents living in a concentrated area of poverty (census tracts with >40% poverty rate)
						Gini Index
						Percent of renter units and owner units affordable to households earning 80% of HUD area median family income
						Net acres of agricultural and natural resource land lost to development per net new resident

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Average number of days per year the EPA Air Quality Index exceeds 100 for ozone
						Acres of land treated for stormwater overflow using water quality best management practices
						Percent of local governments that are certified by Tree City USA
						Percent of land with tree canopy cover
						Number of watersheds with a plan or active organization
						Percent of assessed streams and rivers that are impaired (polluted)
						Percent of local governments that have an energy conservation code and/or a green construction code
						Total carbon dioxide equivalent emissions per capita
						Flood insurance claims
						Number of local governments participating in the Community Rating System by the NFIP
						Number of heat- and cold-

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						related deaths
						Percent of local governments participating in a current local hazard mitigation plan
						Percent of development in potentially hazardous areas (500 year floodplain, landslide zone, and earthquake liquefaction zone)
						Percent of local governments that have taken action to address climate change
						Percent of local governments that are certified StormReady by the National Weather Service
						Total percent of workers commuting via walking, biking, transit, or rideshare
						Percent of households within 1/4 mile of a transit stop
						Percent of jobs within 1/4 mile of a transit stop
						Measure of relationship between change in density and change in ridership at MetroLink stations

Table 9 Comprehensive List of Indicators.

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Vehicle miles traveled per capita per day
						Number of miles of bike facilities, separate and on road
						Percent of local governments with complete streets ordinances
						Annual transit boardings system-wide (MetroLink/Bus System/Call-A-Ride)
						Percent of total population that reside in a low income census tract and reside more than one mile from a supermarket/ large grocery store for urban areas or 10 miles for rural areas
						Total residential gas and electric energy use in BTUs per customer
						Percent of electricity supplied by renewable sources
						Percent of waste diverted through source reduction, recycling, reuse, or composting
						General local government debt to revenue ratio for counties

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Square footage of 3rd party verified green commercial and institutional buildings and sites (LEED, Energy Star, and Sustainable Sites)
						Percent of residents who volunteer
						Cultural/arts nonprofit revenue per capita
						Voter turnout among registered voters in the presidential election
						Percent of third grade public school students who meet or exceed reading proficiency standards
						Percent of public high school students who graduate within four years (four-year adjusted-cohort graduation rate)
						Percent of adults over 25 with a bachelor's or graduate degree
20	BAL	The Baltimore Sustainability Plan: Cleaner Greener Baltimore	2009	-	Baltimore Offfice of Sustainability	Number of Sevice Calls for Dirty Streets
						Tonage Collected from Street Sweeping
						Perception of Cleanliness

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Carrying Cost of Vacant Properties
						Greenhouse Gas Emissions
						Number of Poor Air Quality Days
						Chesapeake Bay Health Index
						Chemical Disposal in Millions of Pounds
						Various outreach Efforts (# of People)
						Energy Use (2007 Baseline)
						Billed Water Consumption
						QUARANTINE ROAD LANDFILL TONNAGE
						TOTAL RECYCLING TONNAGE COLLECTED BY DPW
						TOTAL TREEBALTIMORE TREES PLANTED
						Food Desert Map
						Population within 1/4 Mile of Green Space
						2009 MARYLAND BIOLOGICAL STREAM SURVEY WATERSHED
						The Benthic Index of Biotic Integrity

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						MTA RIDERSHIP 2008-2010
						TOP 6 'RATE MY RIDE' ISSUES
						Number of Bike Lane Miles Added
						Number of Bike Racks Installed
						Participation Rates in 4 programs
						Travel Time to Work
						Number of Federally Funded Programs
						Number of Certified Green Schools
						Various outreach Efforts (# of People)
						GreenWeek Statistics
						Baltimore Green Map
						Graducation Rate
						Baltimore City YouthWorks- Green Jobs Youth Corps
						Baltimore City Community College Degrees and Certificates
						Civic Works Bmore Green Job Training
						City Businesses Promoting Sustainability
						Smarter Cities Ranking
24	POR	The Portland Plan	2012	2035	Regional	Income Distribution

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Diversity Index
						% of Portlandiers Satisfied with Living in the City
						Graducation Rate
						Rate of Self-Sufficient Households
						Export Production Rank
						Total Jobs
						% of Portlandiers that do not drive alone to work
						Carbon Emissions
						% of Portlandiers Living in Complete Neighborhoods
						% of County Residents at a healthy weight
						% of 8th graders at a healthy weight
						% of Portlandiers that feel safe
						Portland Water Quality Index
27	SAT	SA2020	2012	2020	Mayor, Non-Profit	Economic Impact of the Arts
						Level of Attendance at Arts Programs
						Level of Funding for the Arts
						Number of National/International Press Mentions
						Number of People Employed

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Number of Cadidates Running in Municipal Elections
						% of pop. Served by neighborhood associations
						Voter Turnout - Municipal
						Voter Turnout - Midterm
						Community Perception x3
						Index Crime Rates
						Number of Community Networks
						Response Times x 3
						Validated Cases of Child Abuse x 2
						Housing Units Downtown
						Number of People Working Downtown
						Vehicle Miles Traveled
						Graduation Rate
						Intellectual Property x 3
						Job Growth x 7
						Per Capita Income
						3rd Grade Reading x 2
						Adult Educational Attainment
						College Enrollment
						Graduation Rate
						Air Quality Index-Ozone

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Energy Capacity from Renewables x 2
						Growth of Green Economy
						Material in Landfills
						Usage Rates for Energy
						Usage Rates for Water
						Domestic Violence x 2
						Number of Unsheltered Persons
						Poverty Rate
						Teen Birth Rate
						Unemployement
						Deaths because of Diabetes
						Diabetes Rate
						Health Insurance
						Preterm Birth rate
						Low Birth Weight Rate
						Housing Rennovation Permits
						New Housing Permits
						Green Space x 2
						Walkability Score
						Number of Acciednets/1000
						Pollution Emissions x 2
						Public Transportation Ridership
						Travel Time

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Greenhouse Gas Emissions
						Energy Capacity from Renewables
						Buildings meeting green building standards
						Green Buildings/1000 residents
						Electricity Consumption Per Capita
						Electricity Consumption per Household
						# of Farmers Markets
						# of Grocery Stores
						Community Supported Ag. (CSA) Participants
						Sq. ft. of Community Gardens
						# of Community Gardens
						# of Household Gardens
						Food Hubs within City Limits
						Distributors and Processing Facilities w/in City Limits
						Acres of Food Processing Land
						# of Green Jobs
						# of green courses at local universities
						# of Cleantech companies started locally

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						# of Cleantech jobs created locally
						Commercial Electricity Consumed/job
						Businesses participating in green programs
						Average household energy cost
						Completed Villages
						Emerging Villages
						Potential Villages
						Density within 1/4 mile of Transit Corridor
						Bicycle Friendly Community Score
						# of Residents in a Walkability >60 Community
						# of Residents within 1/2 mile of park
						Parkland/1000 residents
						Tree Canopy Coverage
						Street Trees/linear mile of road
						Acres of Conservation Land
						Obesity Rate
						Diabetes Rate
						Residential Recycling Rate
						Solid Waste/capita

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Yard Waste-total
						% of properties participating in recycling programs
						% of residents eligible for curbside pickup who participate
						Mode Split for Commuters
						% of pop. Within 1/4 mile of enhanced transit
						% of employees within 1/4 mile of enhanced transit
						Transit ridership/month
						On street bike lanes
						Off street bike trails
						Miles of sidewalk
						Dedicated transit routes
						"Complete Streets"
						Bike or car share program members
						Pedestrian and Cyclist Causualities
						EV charging stations
						Days/year of poor quality air
						Days/year of not meeting"good" quality air
						Asthma Rates
						Water/capita

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						Residential Water Rate
						% of waste water used for secondary purposes
						# of lakes with good quality (Trophic State Index)
						Ranking on FEMA's Community Rating
29	CIN	Green Cincinnati Plan	2013		City	Energy Intensity per capita
						Energy intensity per $1000 in GDP
						# of LEED Certified Project
						# of Energy Star Certified Buildings
						Total Megawatts of Renewable Energy Insalled
						New Megawatts of Renewable Energy Capacity
						# of new renewable energy installations
						Gallon of gas/deisel sold in the region
						Number electric/hybrid vehicles sold in region
						# of Public Transit Riders
						Means of Transportation to Work

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						# of Carpoolers
						Tons landfilled per capita
						# of acres classified as preserves or parks by OKI
						Population Benchmark compared to similar cities
						-
						# of miles in compliance with the Clean Water Act
						# of Participants in the Great Outdoor Weekend
						Being Developed
30	CLE	Sustainable Cleveland 2019	2009	2019	City	# of Clean Economy Jobs
						Clean Economy Jobs/Total Jobs
						Creating Better Paying Jobs
						# of Businesses reporting Global Reporting Initiative, Green Plus, and the Carbon Disclosure Project
						Gross Metropolitian Product
						Median Income
						Summit Participants
						Working Group Engagement
						Education Attainment Age 35+
						Population

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						% of Persons with Diabetes
						% of Persons with Hypertension
						% of Persons with Obesity
						Number of National/Local Media Stories
						Cost of Living
						Number of Businesses per zip code
						Blight and Vacancy Transformations
						Impervious Surfaces (acres)
						# of Green Buildings
						Proximity to green space
						# of people/commute mode
						Walkability Score
						# of Farmers Markets
						# of Community Gardens
						Acres Restored
						Water Advisories
						# of Fish Species
						Air Quality Index (number of days in each category)
						Megawatts of Renewable Energy
						Amount of Trash per capita
						Amount of recycling per capita

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Emissions by source
						Emissions by Sector
35	SJO	Green Vision	2007	2022	City of San Jose	# of Clean Tech Jobs
						Clean Tech Workers Trained
						Cumulative Venture Capital Invested Locally
						Companies Locating or Expanding in San Jose
						Per Capita Energy Use
						Municipal Energy Use
						% of Energy Produced by Renewables
						Megawatts of Solar Energy
						Square feet of certified green building space
						# of LEED and BIG Green Point Projects completed
						% of trash diverted from landfills
						Waste converted to energy (tons)
						Waste converted to energy (kWh)
						Average Daily Use Recycled (gallons)
						# of recycled water customers
						Transportation Mode Shift

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						% of Housing in Identified Growth Areas
						% of Alternative Fuel Vehicles in the public fleet
						Annual Fuel Consumption
						Green House Gas Emissions
						Total Fleet Fuel composition
						New Trees Planted
						# Smart Streetlights
						Streetight Energy Use
						Miles of Trails-Off Road
						Bikeway Trails-On Road
36	AUS	CAN Stregic Framework	2009	-	Community Advancement Network (CAN)	Crime rate per 100,000 pop.
						Proportionality of jail bookings across all races and ethnicities
						% Voter Turnout
						% of residents who are low income
						%of Cost burndened households (pay 30% or more of income for housing)
						Vehicle Miles Traveled (per capita)
						# of people identified in the annual point-in-time homeless count

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						% under age 65 who have no health insurance
						% of adult who are smokers
						% of adults who are obese
						Attainment of national ambient air quality standards
						% of children kindergarden ready
						% highschool graduation
						% of graduates who are college ready
						Unemployement Rate
37	VB	Envision 2040 Plan	2010	2040	City of VB	Hours of volunteer service
						% of citizens who visited a museum, aquarium, or City-sponsered cultural activity
						# of citizens who participate in youth and adult sports leagues
						% of eligible residents receiving SNAP benfits
						% of eligible people enrolled WIC program
						Infant Mortality Rate for low-income residents
						% of residents whose monthly

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						housing expensices exceed 30% of household income
						% of residents who visited a City Park in the Past 12 months
						Violent Crime Rate (per 1,000 population)
						# of city-sponsered arts and cultural events
						Programs funded by the Arts and Humanities Commission
						Combined audience attendance at performances sponsered by the Arts and Humanities Commission
						Number of visitors to the Historic Houses
						# of Vistors
						Tourists who are repeat vistors
						Total City and State Tax revenue from tourism (in millions)
						Year round hotel occupancy rate
						Kindergarten children needing reading remediation
						# of children readed through the City's -

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						Enrollment at the Virginia Beach Higher Education Center
						% of 3rd Graders passing their Standards of Learning test in Reading
						High School Graduation Rate
						Dropout Rate (Grades 7-12)
						# of industry certifications eanred by students
						# of jobs in the tourism industry
						Economic impact of Agriculture
						Economic Impact of Aquaculture and Fisheries
						Percent of the Labor Force in the armed services
						# of new high tech companies
						# of new high tech jobs
						Residents >25 who have a graduate or professional degree
						Residents >25 who have an undergraduate degree
						Cost of living compared to U.S. average
						Average weekly wage compared to

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						US average
						% of street system meeting minimum physical condition rating
						% of roads in the two lowest grades for transportation efficiency
						Average commute time
						Public transit ridership
						Miles of exisiting bikeways/trails
						Walking or biking trips as a % of all transportation modes
						Number of free city wi-fi hotspots
						# of Orange and Red Air Quality Days
						% of urban tree canopy coverage
						Potable water consumption per resident
						% of waterways that meet or exceed Total Maximim Daily Load requirements
						# of beach closings oradvisory days
						Acrea of leasible shellfish beds
						# of septic systems systems north of the Green Line
						Number of curb miles or street

Table 9 Comprehensive List of Indicators.						
Rank	**MSA Code**	**Plan Name**	**Release Date**	**End Date**	**Author/Organization**	**Indicators**
						sweeping
						# of visitors to the aquarium
						# of public beach and waterway access points
						# of Ocean Assessment Programs
						Number of person hours spent of ocean assessment
						Annual Aquifer Withdrawl
						kWh used by the City and VBCPS
						Miles driven by City vehicles
						# of City owned LEED or Energy STAR buildings
						# of properties qualified of the Energy Efficient Building tax incentive
						% of energy supply from renewable sources
						# of green industry jobs
						Acres of open space per 1000 pop.
						Acres in the agriculture reserve program
						% of waste stream recycled
						Tons of recycled materials collected by curbside recycling

Table 9 Comprehensive List of Indicators.

Rank	MSA Code	Plan Name	Release Date	End Date	Author/Organization	Indicators
						program
						% of structures inareas vulnerable to reccurent flooding
						# of colleges and unviersities that are nationally ranked
						# of properties o the Historic Register
						Acreas of land protected per person
						Stormwater treatment cost per person
						Dollars spent per person on services

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