How Can We Assess the Achievement of The Sustainable Development Goals? – A Review of Indicators and Their Application at the City Level

Roland ZINKERNAGEL[a]

[a] Lund University, Sweden, roland.zinkernagel@iiiee.lu.se

ABSTRACT

This paper focuses on the assessment of the UN Sustainable Development Goals (SDG) and the use of indicators to assess performance at the city level. Although indicators need to reflect the particular local conditions and requirements, the SDGs can provide guidance to local governments on how to assess progress towards sustainable development, both at global and local level. A challenge is that there is no common definition of sustainable cities and often indicators are failing to include the entire spectrum of sustainability, in effect they tend to be dominated by assessing the environmental/ ecological performance.

In this paper the use of indicators to evaluate the progress of sustainability in cities will be reviewed. The results of the review will be used to compare existing indicators used to assess sustainable development in cities to the indicators suggested by the UN SDGs.

Keywords: *sustainable neighbourhood, indicators, sustainable development goals*

1. INTRODUCTION

In the autumn of 2015 the UN introduced the Sustainable Development Goals (SDGs) in order to be able to provide guidance at global, national, regional and local level towards a more sustainable world (UN, 2015). The 17 goals cover all three different aspects of sustainable development as defined by the Brundtland commission. They comprise of 168 targets and 239 different indicators in order to be able to follow up progress towards reaching the Sustainable Development Goals (UN-1, 2016). The indicators are currently still under development, at the moment several of the indicators are still being discussed (UN-2, 2016). The need for indicators has been identified by the United Nations in order to make it possible to measure progress and to make sure that no actor is left behind (UN, 2015).

This paper focuses on the assessment of the SDGs and the use of indicators to assess performance at the city level. Although indicators need to reflect the particular local conditions and requirements, the SDGs can provide guidance to local governments on how to assess progress towards sustainable development, both at global and local level. So far, there has been done very limited research on the application of the Sustainable Development Goals on local level.

In this paper the use of indicators to evaluate the progress of sustainability in cities will be reviewed. The results of the review will be used to compare existing indicators used to assess sustainable development in cities to the indicators suggested by the UN SDGs.

2. INDICATORS FOR THE EVALUATION OF SUSTAINABILITY PERFORMANCE OF CITIES

Indicators are a useful and efficient tool to collect information on performance and can be used as one foundation for local policy making (Miller, 2005). The Programme of Action for sustainable development, which was adopted at the United Nations conference on Environment and Development in Rio de Janeiro in 1992, asked for the development of indicators for sustainable development in order to be able to take grounded decisions that foster a self-regulating, integrated and holistic sustainable development (UN, 2007; UNSD, 1992). Ever since, many sets of indicators have been developed to assess the development of sustainability, including sustainability in cities. The ISO 37 120 standard on global city indicators (International Organisation for Standardization, 2014) and the indicators suggested to assess progress towards the SDG being two recent examples on global level. Both build on experiences made from earlier indicator systems, such as the UN Habitat Urban Indicators (UN Habitat, 2004) and the Millennium Development Goals and their associated indicators (UN, 2008). Many cities and regions have

also been developing own indicators to measure progress towards global as well as local goals and targets (Astleithner et al., 2004; Tanguay et al., 2010; Neumann et al., 2015; Vázquez et al., 2015).

2.1 What are sustainability indicators?

Indicators are a useful tool to assess the current status (Wilson et al., 2007; Kitchin et al., 2015; King, 2016). Giving feedback and performance assessment is the most important role that indicator systems have, the emphasis is on locating the problem (Fitz-Gibbon, 2002; Science for Environment Policy, 2015). An indicator shows that a certain condition exists or certain results have or have not been achieved (OECD, 2008; Astleithner et al., 2004; Horsch, 1997), using the same indicator several times makes it possible to see trends and development directions. This needs to be connected to a realistic target that should be achieved within a defined time (OECD, 2008). Indicators are non-subjective tools and measure variables over time and/ or space and are seen as decision support instruments. They do not need to be quantified, measurement can be on the basis of qualitative scales (Astleithner et al., 2004).

9 Frameworks and criteria for selecting indicators

Research has developed frameworks in order to be able to group indicators and find causal relationships between the indicators or alternatively frameworks that make it possible to structure reality and facilitate the identification of crucial intersections where indicators would be most meaningful. The development and use of a conceptual framework based on causal networks will aid the selection process as it "facilitates the identification of the most relevant indicators for a specific domain, problem and location" (Niemeijer and de Groot, 2008). Similarly Hak (Hák et al., 2016) and Singh (Singh et al., 2009) consider the use of conceptual frameworks advantageous for indicator selection. Alternatively, system dynamics modelling can be used as a framework to reflect the complex nature of sustainable development (Dahl, 2012). Most commonly used examples of frameworks are the Pressure-State-Response model and its derivatives (Niemeijer and de Groot, 2008) or conceptual frameworks such as policy-based or conceptual approaches (Hák et al., 2016).

Furthermore, indicators can be grouped according to the type of development they measure. Costa (Costa, 2015) groups them into reflective (a manifestation of what is being observed), causal (where an action influences the outcome of the indicator) or composite (where the outcome of the indicator is a result of several correlating factors) indicators. Based on an approach focusing on an evaluative scheme, indicators can be grouped according to what they are measuring, i.e. inputs, processes, outputs or outcomes (Luederitz, in press).

There are quite a number of selection criteria that have been identified and certainly there are a lot more that are being used in the field. The criteria that are most commonly found in research are that they should be policy relevant, that they should be reliable and measurable, that indicators should be wide in scope and that they should be simple (Böhringer and Jochem, 2007; Ness et al., 2007; Wilson et al., 2007; Science for Environment Policy, 2015; Niemeijer and de Groot, 2008). There is however a plethora of selection criteria that spans from analytical soundness to process orientation to the ideal number of indicators used.

As Niemeijer points out "there is considerable room for improvement in the indicator selection process" (Niemeijer and de Groot, 2008).Click here to insert your content.

3. RESULTS

3.1 How have cities used sustainability indicators?

A literature search was conducted using search terms such as city development, indicators, sustainability assessment and related words in different combinations in order to get an overview how city development has been assessed and what schools of thought exist to structure indicator development. The literature search revealed that research has focused mostly on selection criteria, i.e. which characteristics the indicators should fulfil in order to provide useful information to the policy maker or whoever might be using the data derived from the indicators (Böhringer and Jochem, 2007; Ness et al., 2007; Wilson et al., 2007). The research that did investigate in cities' selection criteria for choosing indicators did however show that usually indicators are selected by political prioritisation, perceived importance and/ or data availability (Keirstead and Leach, 2008; Shen et al., 2011;

Lehtonen et al., 2016). There is an implementation gap between the scientific discussion on indicator selection criteria and the application of these criteria on practical level in cities.

However, cities have been and are using indicators to a larger or lesser degree. Indicator use for the assessment of economic efficiency, of living standards or pollution are but a few examples. Environmental indicators have been used in cities increasingly in parallel to the increasing environmental degradation that went along with an increasing industrialisation (Munn et al., 1988). Social indicators have been used since the first half of the 18th century although they have been continuously refined and contextualised since then (Cobb and Rixford, 1998). It is worth noting that the use of indicators has been changing over time, in line with an increasing trend to incorporate 'New Public Management' ideals into public administration, i.e. the ideals of cost-efficiency, decentralisation, customer-orientation and empowerment. The desire towards economic efficiency is reflected in the choice and use indicators in the public sector (Astleithner et al., 2004).

With the introduction of the sustainability concept and its application to city development comes the urge to develop sustainability indicators as described above. A challenge is that there is no common definition of sustainability or sustainable cities (Huang et al., 2015). Despite the three decades that have passed after the Brundtland commission's report are indicators failing to include the entire spectrum of sustainability, even though they are meant to assess the sustainability of a city; in effect they tend to be dominated by assessing the environmental/ ecological performance (Tanguay et al., 2010; Böhringer and Jochem, 2007). Luederitz carried out a cluster analysis of scientific literature on the sustainability performance of urban neighbourhood development and came to the conclusion that none of the 21 papers covered all of the three sustainability aspects or at least not to a significant degree (Luederitz et al., 2013).

The literature review has shown that a lot of research in the field of assessing urban sustainable development has been done comparing different indicator systems, i.e. groups of indicators that collectively describe a state or condition. Examples of indicator systems are the Ecological Footprint, Environmental Sustainability Index, Dashboard of Sustainability, Welfare Index, Genuine Progress Indicator, Index of Sustainable Economic Welfare, City Development Index, Emergy/ Exergy, Human Development Index, Environmental Vulnerability Index, Environmental Policy Index, Living Planet Index, Environmentally-adjusted Domestic Product, and Genuine Saving. This list is however not exhaustive and could be extended. Similarly to the use of individual indicators, research has assessed the varying usefulness of indicator systems but not the extent that cities actually have used the different indicator systems.

Shen (Shen et al., 2011) uses the International Urban Sustainability Indicators List (IUSIL), which consists of 115 indicators formed into 37 categories, in order to analyse and compare different sets of sustainability indicators chosen in various cities around the world. Comparability across cities is argued to be important to create a common baseline and be able to apply successful tools and measures. At the same time Shen also realises that "there is no single set of indicators that suits equally to all cities" (Shen et al., 2011). Similarly, a varying understanding of what sustainability is will lead to different indicators being selected, and in turn that means that the selection of indicators will influence the sustainability statues that the indicators give (Wilson et al., 2007).

Mori analyses 14 indicators systems and some applications of composite indices regarding their coverage of the triple bottom line, if they cover a global or local perspective and whether they follow the perspective of weak or strong sustainability and concludes that none of the systems satisfies the requirements necessary to reach sustainability (Mori and Christodoulou, 2012).

For the purpose of this paper global or international indicator systems were analysed and compared to the structure of the UN Sustainable Development Goals. This made it possible to see to what extent indicator systems cover the same or similar aspects as the SDG. The indicator systems that were chosen in this research were selected on the grounds of their coverage, i.e. they need to cover at least the three most common aspects of sustainability (environmental, economic and social aspects), need to be developed for a larger geographical area and have been widely used. The following indicator systems were chosen: SDG indicators, ISO 37 120, UN habitat urban indicator guidelines, European Common Indicators, Better Life index, Sustainable city index UN Commission for Sustainable development's Indicators for sustainable development, Urban Sustainability indicators.

Name of indicator system	SDG indicators	ISO 37 120	Better Life index	CSD indicators of SD	UN Habitat Urban indicator guidelines	European Common Indicators (ECI)	Urban sustain-ability indicators
Year of intro-duction/ most recent version	2015	2014	2011	2007	2004	2004	1998
Number of indicators	239	94	24	49	38	10	15
Actual use in cities	No numbers available yet	30 cities have reported at least some indicators	Reporting mostly on country level	No information on use in cities	Different versions are used by 200+ cities	Tested by 42 cities	No information on use in cities

Table 1: Overview over analysed indicator systems

In lacking input on the factual use of sustainability indicators by cities it was decided to use the application of the above indicator systems as an approximation. Table 1 shows how many cities have been using the indicator systems. The UN Habitat indicator guidelines have been most frequently used. They have been introduced more than ten years ago and while this might be used as an argument for their extensive use it is worth noting that other, older indicators have been less popular up to the degree that there is no information to be found. Many indicators, especially European ones have been developed through different EU financed projects. Even though the intention is to ensure the use of them after the end of these projects it seems that this is not happening. Either new indicators are being developed (building on the experience of the previous ones) or they are being replace by other indicator systems. In the case of the UN Habitat Urban indicator guidelines, they have been incorporated in the Millennium Goal Indicators, which in turn have been incorporated in the Sustainable Development Goal indicators. What becomes obvious is that indicators in the field of sustainable city development (Goal 11 of the SDGs) and water and sanitation (Goal 6 of the SDG) have been equally important already in the UN Habitat indicators.

When analysing the most commonly used indicator sets (UN Habitat urban indicator guidelines, ISO 37120 Smart City Data, European Common Indicators) and the topics that they cover it becomes possible to get an indication which indicators are most commonly used by cities. This analysis reveals that indicators within Goal 11 are most popular (49 indicators). The indicator that can be found in all three indicator sets is the one on air quality, i.e. levels of PM10 and PM2.5. Also aspects of waste management are frequent as are indicators on settlements on hazardous locations. The second most used indicator group is the one represented by Goal 6 (18 indicators) where indicators on access to safe drinking water, wastewater management and availability of sanitary facilities can be found in all three indicator sets. Indicators under Goal 16 (15 indicators) are the third most popular. The indicator on victims of homicide can be found across the indicator sets as well as indicators on the percentage of women in public institutions/ city government and participation rate in municipal elections. Areas that are not at all covered are the ones associated with Goals 2 (zero hunger), 10 (reduced inequalities) and 14 (life below water). The results of this analysis go in line with the findings of the literature review that sustainability indicator sets tend to be dominated by indicators on the environmental performance (Tanguay et al., 2010, Böhringer and Jochem, 2007).

Figure 1 visualises the diversity and to which extent different indicator systems include all aspects of sustainability, following the structure of the SDGs. The extent to which indicator systems has been increasingly covering all aspects of sustainability becomes obvious when considering the time of introduction of the respective indicator set. At the same time it also becomes obvious that some indicator sets, in this case the ISO 31 120 standard on Smart City Data, are specialising on certain aspects in order to attempt to fully cover this topic. Even when disregarding the fact that the SDGs have by far the most number of indicators it becomes obvious that they are the ones that most holistically cover all aspects of sustainable development.

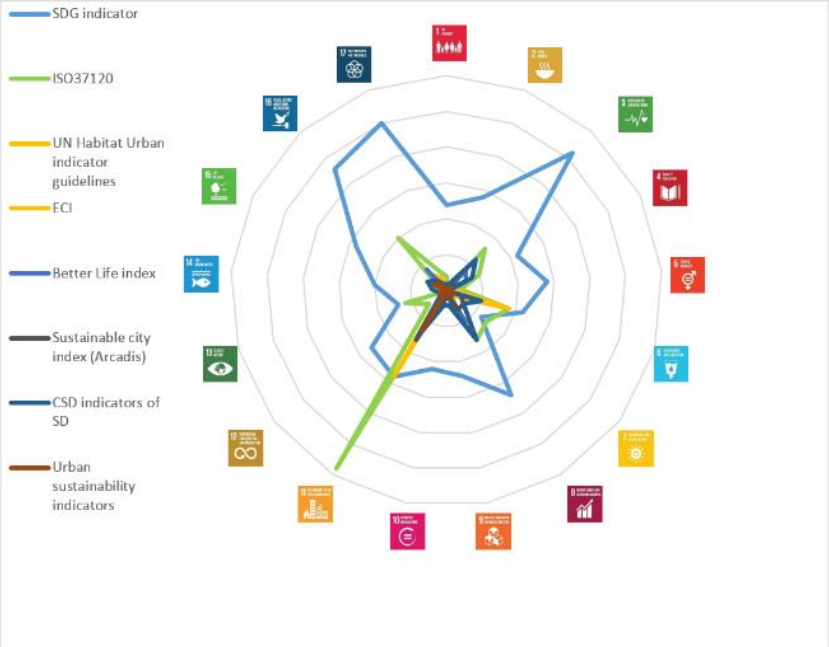

Figure 1: Comparison of indicator sets regarding their coverage of sustainability aspects

3.2 Usefulness of SDGs at local level

One of the SGDs, goal 11, is specifically addressing cities and human settlements, setting the target to make them inclusive, safe, resilient and sustainable. This is the result of experiences with the implementation of the millennium goals as well as the lobbying to recognise cities as an important driver for transformation as well as the importance of a bottom-up approach for global change (UCLG, 2015) ("SDGs: Sustainable Development Knowledge Platform," n.d.). Despite a specific goal focusing on the urban perspective, all goals are relevant for cities, and so are their respective indicators. Of the 239 indicators 215 are considered to be relevant on local level, see Figure 2 below.

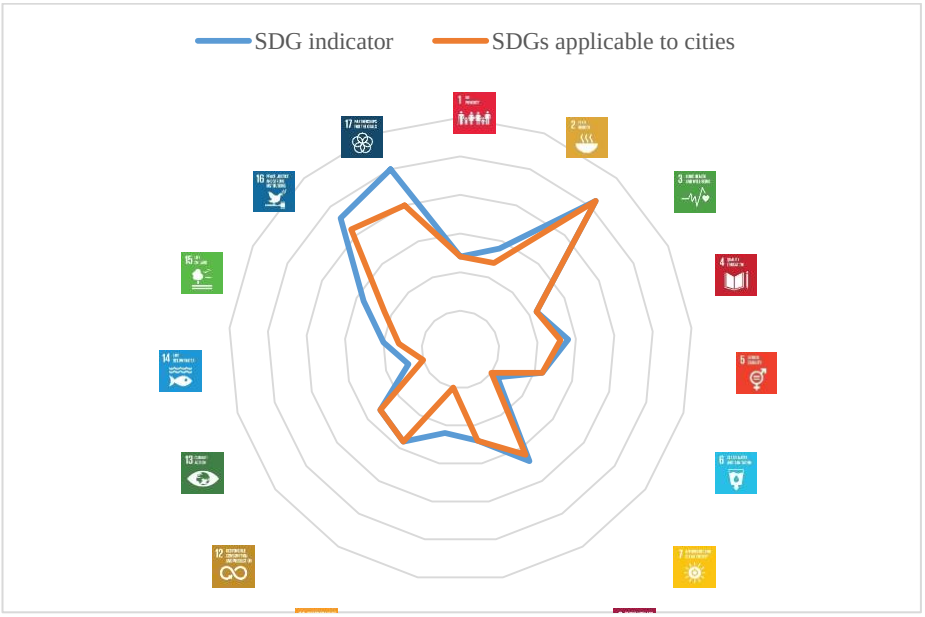

Figure 2: Comparison of SDG indicators and their relevance in a local context

Research regarding the implementation of the SDGs on local level is still limited. One example is the study by Simon (Simon et al., 2016) who tested collecting data on the SDGs for five cities. The focus of that study is on Goal 11, and makes suggestions on how the usefulness of the SDGs can be maximised on the local level. United Cities and Local Governments produced a non-scientific guide for local governments on important aspects to consider when implementing the goals locally (UCLG, 2015).

A comparison between the commonly used indicators and the ones suggested within the SDG framework identifies which topics are most common across the indicator systems. These indicators cover air pollution, waste management, sanitation and drinking water, education and safety and security. This goes in line with findings from the literature review i.e. that environmental aspects de facto dominate 'sustainability assessments'. The types of indicators that are not included in systematic sustainability assessments are opinion-based indicators, alternatives to GDP as a measure of wealth or indicators based on an ecosystem approach, as suggested by Vazques (Vázquez et al., 2015).

4. DISCUSSION

Cities are using indicators to be able to identify changes over time, to assess performance and for decision makers to be able to make the appropriate policy decisions, yet it is not sure if the use of indicators actually benefited the city's development. The literature review revealed that there is a gap between the academic view on which criteria to use when selecting indicators and the practical approach of cities. This is furthermore illustrated by the lack of scientific evaluation of the use of indicators in cities and the impact they might have had on cities developing towards sustainability.

The UN Sustainable Development Goals are an attempt to define a holistic target situation. As the comparison of the SDG indicators with other indicator systems showed, the SDG indicators indeed cover sustainability aspects to the largest extent of all indicator systems. It is clear that this is not least due to the fact that the SDG indicators are by far the largest in number of all the analysed indicator sets, at the same time it becomes also clear that the purpose of the sustainable development goals is to be applicable in a large variety of global contexts.

SGD indicators are to a large extent relevant also on the local level. The apparent exception here are most of the indicators under goal 10, reduced inequalities. These indicators are aimed at the national or international level, such a migration policies or international trade. Locally adapted indicators would need to be developed to sufficiently reflect this goal.

Using the SDG structure for sustainability assessment at local level would make it possible to receive a broad and combined picture of sustainability performance. Cities need to be able to choose and prioritise amongst the indicators according to the local conditions. This is a consequence of the approach that the UN has chosen by developing goals that need to be usable in a global context. Although it is interesting to be able to see how peer cities perform it will however in practice be very difficult to do direct comparisons as different aspects will be more or less important, both from a sustainability perspective but also on a political and managerial position. Tracking changes over time in one city is considered more valuable for cities to progress towards sustainable development.

REFERENCES

[1] Astleithner, F., Hamedinger, A., Holman, N., Rydin, Y., 2004. Institutions and indicators - The discourse about indicators in the context of sustainability. J. Hous. Built Environ. 19, 7–24. doi:10.1023/B:JOHO.0000017704.49593.00

[2] Böhringer, C., Jochem, P.E.P., 2007. Measuring the immeasurable - A survey of sustainability indices. Ecol. Econ. 63, 1–8. doi:10.1016/j.ecolecon.2007.03.008

[3] Cobb, C.W., Rixford, C., 1998. Lessons learned from the history of social indicators. Redefining Progress.

[4] Costa, D.S.J., 2015. Reflective, causal, and composite indicators of quality of life: A conceptual or an empirical distinction? Qual. Life Res. 24, 2057–2065. doi:10.1007/s11136-015-0954-2

[5] Curtis, S., 2016. Cities and Global Governance: State Failure or a New Global Order? Millenn. - J. Int. Stud. 44, 455–477. doi:10.1177/0305829816637233

[6] Dahl, A.L., 2012. Achievements and gaps in indicators for sustainability. Ecol. Indic. 17, 14–19. doi:10.1016/j.ecolind.2011.04.032

[7] Fitz-Gibbon, C.T., 2002. Evaluation in an Age of Indicators: Challenges for Public Sector Management. Evaluation 8, 140–148. doi:10.1177/1358902002008001741

[8] Hák, T., Janoušková, S., Moldan, B., 2016. Sustainable Development Goals: A need for relevant indicators. Ecol. Indic. 60, 565–573. doi:10.1016/j.ecolind.2015.08.003

[9] Horsch, K., 1997. Indicators: Definition and Use in a Results-Based Accountability System [WWW Document]. Harv. Fam. Res. Proj. URL http://www.hfrp.org/publications-resources/publications-series/reaching-results/indicators-definition-and-use-in-a-results-based-accountability-system (accessed 5.27.16).

[10] Huang, L., Wu, J., Yan, L., 2015. Defining and measuring urban sustainability: a review of indicators. Landsc. Ecol. 30, 1175–1193. doi:10.1007/s10980-015-0208-2

[11] International Organisation for Standardization, 2014. Sustainable development of communities — Indicators for city services and quality of life [WWW Document]. URL https://share.ansi.org/ANSI%20Network%20on%20Smart%20and%20Sustainable%20Cities/ISO%2B37120-2014_preview_final_v2.pdf (accessed 12.20.16).

[12] Keirstead, J., Leach, M., 2008. Bridging the gaps between theory and practice: a service niche approach to urban sustainability indicators. Sustain. Dev. 16, 329–340. doi:10.1002/sd.349

[13] King, L.O., 2016. Functional sustainability indicators. Ecol. Indic. 66, 121–131. doi:10.1016/j.ecolind.2016.01.027

[14] Kitchin, R., Lauriault, T.P., McArdle, G., 2015. Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. Reg. Stud. Reg. Sci. 2, 6–28. doi:10.1080/21681376.2014.983149

[15] Lehtonen, M., Sébastien, L., Bauler, T., 2016. The multiple roles of sustainability indicators in informational governance: between intended use and unanticipated influence. Curr. Opin. Environ. Sustain., Sustainability governance and transformation 2016: Informational governance and environmental sustainability 18, 1–9. doi:10.1016/j.cosust.2015.05.009

[16] Luederitz, C., in press. Learning through evaluation - a tentative evaluative scheme for sustainable transition experiments.

[17] Luederitz, C., Lang, D.J., Von, W., 2013. A systematic review of guiding principles for sustainable urban neighborhood development. Landsc. Urban Plan. 118, 40–52. doi:10.1016/j.landurbplan.2013.06.002

[18] Miller, C., 2005. New civic epistemologies of quantification: Making sense of indicators of local and global sustainability. Sci. Technol. Hum. Values 30, 403–432. doi:10.1177/0162243904273448

[19] Mori, K., Christodoulou, A., 2012. Review of sustainability indices and indicators: Towards a new City Sustainability Index (CSI). Environ. Impact Assess. Rev. 32, 94–106. doi:10.1016/j.eiar.2011.06.001

[20] Munn, R., Alcamo, J., Fedorov, V., 1988. Evaluating the Performance of Air-Quality Models in a Policy Framework. Syst. Anal. Model. Simul. 5, 493–510.

[21] Ness, B., Urbel-Piirsalu, E., Anderberg, S., Olsson, L., 2007. Categorising tools for sustainability assessment. Ecol. Econ. 60, 498–508. doi:10.1016/j.ecolecon.2006.07.023

[22] Neumann, H.-M., Jakutyte-Walangitang, D., Vielguth, S., Züger, J., Airaksinen, M., Huovila, A., Bosch, P., Rovers, V., Jongeneel, S., Pangerl, E., 2015. Overview of the Current State of the Art [WWW Document]. URL http://nws.eurocities.eu/MediaShell/media/D1.2%20Overview%20of%20the%20Current%20State%20of%20the%20Art.pdf (accessed 12.20.16).

[23] Niemeijer, D., de Groot, R., 2008. A conceptual framework for selecting environmental indicator sets. Ecol.-Indic. 2008.

[24] OECD, 2008. Handbook on constructing composite indicators. OECD.

[25] Rivera, M., 2013. Political Criteria for Sustainable Development Goal (SDG) Selection and the Role of the Urban Dimension. Sustainability 5, 5034–5051. doi:10.3390/su5125034

[26] Science for Environment Policy, 2015. Indicators for sustainable cities (In-depth report). European Commission DF Environment by the Science Communication Unit.

[27] SDGs: Sustainable Development Knowledge Platform [WWW Document], n.d. URL https://sustainabledevelopment.un.org/sdgs (accessed 9.27.16).

[28] Shen, L.-Y., Jorge, O., Shah, M.N., Zhang, X., 2011. The application of urban sustainability indicators - A comparison between various practices. Habitat Int. 35, 17–29. doi:10.1016/j.habitatint.2010.03.006

[29] Simon, D., Arfvidsson, H., Anand, G., Bazaz, A., Fenna, G., Foster, K., Jain, G., Hansson, S., Evans, L.M., Moodley, N., Nyambuga, C., Oloko, M., Ombara, D.C., Patel, Z., Perry, B., Primo, N., Revi, A., Niekerk, B.V., Wharton, A., Wright, C., 2016. Developing and testing the Urban Sustainable Development Goal's targets and indicators – a five-city study. Environ. Urban. 28, 49–63. doi:10.1177/0956247815619865

[30] Singh, R.K., Murty, H.R., Gupta, S.K., Dikshit, A.K., 2009. An overview of sustainability assessment methodologies. Ecol. Indic. 9, 189–212. doi:10.1016/j.ecolind.2008.05.011

[31] Tanguay, G.A., Rajaonson, J., Lefebvre, J.-F., Lanoie, P., 2010. Measuring the sustainability of cities: An analysis of the use of local indicators. Ecol. Indic. 10, 407–418. doi:10.1016/j.ecolind.2009.07.013
[32] UCLG, 2015. The sustainable development goals - what local governments need to know.
[33] UN Habitat, 2011. The economic role of cities, The Global Urban Economic Dialogue Series.
[34] UN (United Nations), 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Resolution adopted by the General Assembly on 25 September 2015;
[35] UN (United Nations Centre for Human Settlements), 2001. Cities in a Globalizing World: Global Report on Human Settlements 2001. Earthscan.
[36] UN (United Nations, Department of Economic and Social Affairs, Population Division), 2014. World Urbanization Prospects: The 2014 Revision, Highlights.
[37] UN Habitat (United Nations Human Settlement Programme), 2004. Urban Indicators Guidelines – UN-Habitat.
[38] UN-2 (United Nations Inter-Agency Expert Group on Sustainable Development Goal Indicators), 2016. 4th Meeting of the Inter-agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) [WWW Document]. URL http://unstats.un.org/sdgs/files/meetings/iaeg-sdgs-meeting-04/9.%20Refinement%20of%20Indicators%20plenary.pdf (accessed 12.20.16).
[39] UN (United Nations Publications), 2007. Indicators of Sustainable Development: Guidelines and Methodologies. UN Economic and Social Affairs.
[40] UN-1 (United Nations Statistics Division), 2016. SDG Indicators — SDG Indicators [WWW Document]. URL http://unstats.un.org/sdgs/indicators/indicators-list/ (accessed 12.20.16).
[41] UN (United Nations Statistics Division), 2008. Revised MDG monitoring framework including new targets and indicators, as noted by the 62nd General Assembly, and - OfficialList2008 [WWW Document]. URL http://mdgs.un.org/unsd/mdg/Resources/Attach/Indicators/OfficialList2008.pdf (accessed 1.10.17).
[42] UN (United Nations Sustainable Development), 1992. United Nations Conference on Environment and Development, Agenda 21.
[43] Vázquez, P., Río, J.A. del, Cedano, K.G., Martínez, M., Jensen, H.J., 2015. An Entangled Model for Sustainability Indicators. PLOS ONE 10, e0135250. doi:10.1371/journal.pone.0135250
[44] Wilson, J., Tyedmers, P., Pelot, R., 2007. Contrasting and comparing sustainable development indicator metrics. Ecol. Indic. 7, 299–314. doi:10.1016/j.ecolind.2006.02.009