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Missing Goals Yet Tangible Indicators within Sustainability Assessment Literature: The Need to Align Planning and Monitoring in Urban Sustainability

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Missing Goals Yet Tangible Indicators within Sustainability Assessment Literature: The Need to Align Planning and Monitoring in Urban Sustainability

Sustainability assessment literature is often based on large indicator sets, frequently lacking organizational framing. Previous research calls for stronger theoretical groundings and for urban sustainability assessments specifically to be goal-oriented, meaning that assessments should articulate goals for sustainable cities and select the indicators most appropriate for tracking progress. Here we analyzed the content of 69 papers from sustainability assessment literature. We asked: What common sustainability goals guide indicator selection? What is the distribution of natural, proxy, and constructed indicators across the literature? And what is the distribution of indicators within and across capital types? We found that less than half of the papers define clear goals. Still, the majority of indicators used were natural indicators as opposed to proxies or constructed indicators. Most indicators are linked to the natural sciences, suggesting a need to expand and diversify indicators across additional capital assets, broadening the disciplinary foci of such assessments and better tying into the holistic and systems nature of sustainability. We conclude that urban sustainability assessment should be framed around sustainability goals, and that such a framing would facilitate the selection of indicators, which yield more accurate evaluative results. This is significant in that the relationship between sustainability assessment goals and indicators is mutually reinforcing.

Keywords

natural capital, USA, cities, urban, sustainability science, sustainability science, planning, monitoring

INTRODUCTION

Across sustainability domains, including global biodiversity (Butchart et al. 2010), managed forests (Lindenmayer et al. 2000), agriculture (Quinn et al. 2013), sustainable development (United Nations 2007), and product life cycle assessment (Hermann et al. 2007), among others, assessment research has created and leveraged large indicator sets (Moldan and Dahl 2007). Likewise, in the applied research of cities, urban sustainability assessment (reviewed in Cohen et al. 2017) follows this norm (e.g., Xing et al. 2009; Boyko et al. 2012; Zhou et al. 2012; Ameen et al. 2015, Sharifi 2019). For example, Cohen (2017) found 29 different urban sustainability indicator categories with frequencies of these categories in the literature ranging from 124 for governance down to six for manufacturing. Other frequent categories included climate change, housing, transportation, water, and natural environment.

Though this approach is built upon rich data sets needed to plan for resilient cities, such indicator-based work can suffer from weak theoretical grounding (Davidson 2011; Chesson 2013), with indicators potentially being selected out of convenience and availability versus the robustness of data (Quinn et al. 2011), yielding cherry-picked analyses or assessments that don’t align with stated goals (Sala et al. 2015). Additionally, this proliferation can then become challenging to compare across sectors and domains, or in the case of sustainable urban development, it can be difficult to compare across cities (Keirstead and Leach 2008; Cohen 2017) or when downscaling (Ameen and Mourshed 2019). Ultimately, this proliferation may create more confusion than clarity for planners, decision makers, and researchers alike (e.g., Hély and Antoni 2019; Lou et al. 2019) in scoping and defining sustainability practice, scholarship, and outcomes.

Organizing sustainability assessment and multi-criteria decision-making tools around goal-based frameworks has been proposed broadly in the literature (e.g., Pope et al. 2004; Dezelan et al. 2014; Elgert et al. 2016; Cohen 2017, Dawodu et al. 2018) to improve the grounding of indicators and limit the likelihood of convenience sampling. If such a structure were followed, much like the structure of adaptive management (Allen and Garmestani 2015) clear goals for sustainability outcomes would inform indicator selection, as indicators would be sought to track progress on the stated goals (Figure 1). With an assessment appropriately framed around a city’s sustainability goals, the best indicators for tracking progress towards these stated sustainability outcomes are selected. However, in a recent review of urban sustainability assessment literature (Cohen 2017), there was no quantitative assessment or rigorous review of goal statements and alignment in the literature to detect how frequently assessments are aligned with goals and the subsequent success of these assessment programs.

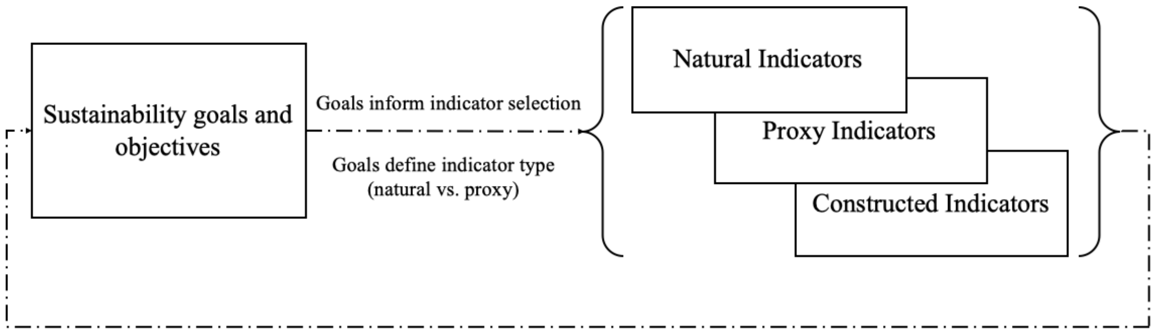

Figure 1. Conceptual framework of the relationship between sustainability goals and indicators for sustainability assessment.

We see this as a fundamental question in urban sustainability assessment and indeed in sustainability assessment more broadly, as there is a clear feedback loop between goals and indicators. For example, if an indicator is not tracking a goal, a manager will not be able to observe progress. If not selected properly, indicators may also misguide a goal, creating unnecessary data collection and results that are unclear or not helpful (Groves and Game 2016). Additionally, resources may be wasted when an indicator is collected but not used (Field et al. 2005). As such, there may be room to improve sustainability assessments by taking the time to align goals and indicators.

A clear goal supported by the best indicators can engender support for a plan or present opportunities to improve implementation. For example, in the United Kingdom, farmland birds are a government identified indicator that has allowed conservation groups like The Royal Society for the Protection of Birds to rally support broadly from the public. In contrast, the lack of specificity in indicators resulted in a discrepancy between stated goals of land trusts and the private land owners they were working with (Dayer et al. 2016) while rich indicators associated with agriculture were used to demonstrate that the EU Common Agricultural Policy needed further reform to meets its goals (Pe'er et al. 2014).

Adding to the above challenge, indicators can vary in how precisely they report on a stated goal. Indicators as defined by Groves and Game (2016) and Mischen et al. (2019) include natural, composite and proxy indicators (defined in Table 1). Natural indicators are likely to be more precisely aligned with a goal, or at a minimum, easier to document the connection between a goal and a natural indicator. However, it can be difficult or time consuming to collect these types of data. In addition, some sustainability assessment goals and objectives may have associated indicators that cannot be measured using a natural scale, for instance the need to aggregate environmental and demographic data at community scales to describe human wellbeing. In these cases, a proxy or constructed indicator can be more suitable or practical. For example, *percent green space* is often used as a proxy for both access to recreation and environmental conservation goals. However, as a proxy indicator it can mask outcomes moderated by other confounding factors. Constructed indicators may reflect multiple desired goals but can at times feel subjective or be less tangible or actionable because of the nature of their units (i.e., a number representing a composite score for an index). These weaknesses maybe mitigated with clear goals. It could even be that a more complex goal requires a quality constructed indicator that links to correlating values by aggregating datasets (Groves and Game 2016).

Table 1. Indicator types (adapted from Groves and Game 2016).

Indicator type	Description
Natural	Measures an objective directly with empirical data
Proxy	Measures another objective that is likely to reflect changes in the objective of interest
Constructed	Measures an objective with scaled numerical representations or with composite scores that combine multiple indicators

Despite stated values for assessment goals and clear alignment with indicators, in urban sustainability assessment, it is also unknown how frequently or infrequently urban sustainability assessments use different types of indicators (natural, proxy, constructed). Moreover, given the lack of data on the application of goals and connections between goals and indicators in urban sustainability assessment literature, it is difficult to enter an evidence-based discussion about these challenges and opportunities. As such, in this research, we are expressly interested in the frequency of use of direct or natural indicators that measure progress towards explicitly stated sustainability goals for cities, which we see as a novel contribution to the literature.

To provide further context for sustainability goals, sustainability assessment literature often organizes assessment indicators thematically (Chao et al. 2020; Merino-Saum et al. 2020; Michalina et al. 2021; Sharifi 2021). In this paper we uniquely categorize our indicators as expressions of capital assets. Capital assets have been explored as a framing in sustainability science literature (for example: Reed et al. 2006; Roseland 2012; Costanza et al. 2016; Matson et al. 2016). As such they present a more comprehensive lens than other frameworks in sustainability science literature (e.g. the triple bottom line). For instance, when assessing the sustainability of a city, it might be fruitful to consider urban development's impact on such elements as natural capital, physical capital, cultural and social capital, among others as compared to just environmental and social. Here, we defer to Roseland's (2012) framework of seven capital assets. Table 2 provides an overview of these capital assets and defines each.

Table 2. Capital assets for sustainable urban development (adapted from Roseland 2012).

Capital asset	Definition
Natural	Properties and conditions of the urban ecosystem
Physical	Built infrastructure
Economic	Labor and financial resources
Human	Community demographics
Social	Cohesion, shared values, rules, and norms
Cultural	Heritage, identity, and diversity

Thus, in this paper, to better understand the role of goal-oriented urban sustainability assessment framings and the use of direct indicators applied in urban sustainability assessment literature, we quantitatively and qualitatively analyze a body of literature rigorously identified and validated through a previous systematic review of urban sustainability assessment literature (Cohen, 2017). To our knowledge, such an analysis has not been done on any comprehensive indicator set, urban or otherwise. Specifically, we ask the following novel research questions:

- *Research Question 1*: What sustainability goals for cities guide indicator selection, as articulated within the body of urban sustainability assessment literature?
- *Research Question 2*: What is the distribution of natural, proxy, and constructed indicators across the body of urban sustainability assessment literature?
- *Research Question 3*: What is the distribution of indicators within and across capital types and how has this varied over the last 10 years of urban sustainability assessment research?

METHODS

A previous systematic review of urban sustainability assessment literature identified 69 peer-reviewed articles which we applied to this study. Following PRISMA guidelines for systematic literature reviews, Cohen (2017) followed rigorous methods, applying consistent search terms, carefully selecting databases, and applying strict selection criteria for including papers in the study. The initial search yielded 3,152 potential peer-reviewed journal articles and 11 gray literature resources. The vast majority of these initial results were not from relevant disciplines or focused on issues beyond the scope of the study. After removing duplicate records and screening the initial set, the author performed a full-text assessment of 108 full-text articles, excluding 39 for not meeting inclusion criteria. This process yielded 69 articles, which were analyzed to identify the most common urban sustainability assessment methods and frameworks and to identify common categories for organizing urban sustainability indicators.

In this study, we document the number of articles included by Cohen (2017) that use their own unique indicator sets to assess urban sustainability. We excluded articles that do not use any measurable indicators and articles that assess or use indicator sets that are not their own (e.g. a scholar applying the LEED cities framework). This selection process identified 29 of the 69 original articles to be appropriate for this study. The 29 articles were reviewed to identify and document the indicators within each article. While 29 articles is certainly a small sample, we view our initial dataset as a sample of 69, and we discuss below in the results that excluding more than half of the initial 69 articles is itself a relevant research finding.

We define an indicator of urban sustainability assessment as something that can generate a measurable number and unit. This included obvious examples like population density, but also constructed indexes, such as the Human Development Index, Gini coefficient, and Local Watershed Vulnerability Index, as indicators (Groves and Game, 2016).

Each document was coded using the MAXQDA qualitative content analysis software program. Working from a heuristic to conceptualize urban sustainability assessment and indicators (see Table 1, Table 2, Figure 1) we predefined qualitative codes to apply to the literature, thus following a deductive coding approach to categorize the indicators for tracking progress on urban sustainability goals. As such, before analyzing the included literature, we created a codebook (Table 3) to apply to the texts.

Table 3. Deductive codes applied to the literature.

Capital Asset Category	Indicator Type
Natural capital	Natural
Physical or Manufactured capital	Proxy
Economic or Financial capital	Constructed
Human capital	Uncertain to coder
Social capital	
Cultural capital	
Political or Institutional capital	

We classified each indicator into one of three indicator types, or scales: natural, proxy, and constructed, following Groves and Game (2016), with natural indicators being more objective and constructed indicators being more subjective. Natural indicators are the most obvious and pre-existing units of measurement. We applied one predefined code as *not explicit* for instances in which the indicators were organized by categories or ambiguous goal areas without clear definitions or objectives. To test if different sectors or disciplines use natural, proxy, or constructed indicators more or less frequency, we also coded each indicator as a measure of a type of capital asset, based on Roseland's Community Capital Tool (2012). Following the explicit definitions of each indicator type (Groves and Game 2016) and capital asset (Roseland 2012), we tested for intercoder reliability with a small sample of articles. Once we established coding consistency across the sample, one researcher coded the content of all 29 sources.

Our initial intention was to identify indicator types (natural vs. proxy vs. constructed) by identifying the authors' stated sustainability goals and then judging each indicator type as it relates to the goal. In the absence of consistent and clear goals, we used expressed assessment categories to identify whether an indicator was natural, proxy, or constructed. In cases that we were not comfortable inferring a clear goal through our own judgment, we coded indicators as *uncertain*. We coded 810 indicators across the 29 articles.

We quantitatively analyzed the frequency of each indicator type sorted by the capital asset category under which each indicator was most closely related. We then assessed the capital asset and indicator distribution and diversity across the articles.

RESULTS

After an initial review of the 69 articles included in the Cohen (2017) study, we identified 29 that clearly articulated indicators for measuring sustainability outcomes in cities (Table 4).

Table 4. Articles from the original data set included in this study (n=29).

Abudllahi et al., 2015	Lin et al., 2010
Atkisson and Hatcher, 2001	Mitropoulos and Prevedouros, 2016
Blackwood et al., 2014	Munier, 2011
Bourdic et al., 2012	Murakami et al., 2013
Boyko et al., 2012	Schetke et al., 2011
Braulio-Gonzalo et al., 2015	STAR Community Rating System, 2016
Cavalcantia et al., 2016	Sun et al., 2015
Cruz and Marques, 2014	Tran, 2015
Egilmez et al., 2015	U.S. Green Building Council, 2016
Estoque and Muyayama, 2014	van Dijk and Mingshun, 2005
Fitzgerald et al., 2012	Wei et al., 2015
Gonzalez et al., 2011	Yigitcanlar et al., 2015
Gutowska et al., 2012	Yin et al., 2014
Huang et al., 2009	Zanella et al., 2015
Huang et al., 2015	

Research Questions 1

Twelve papers, approximately 17% of the initial 69 papers and 41% of the subset with stated indicators, presented clear sustainability goals as a part of their sustainability assessments or frameworks. Most papers included a broad definition of sustainability or used undefined categories to select indicators, but they failed to provide any clear sustainability goals by which indicators should be guided. For example, Murakami et al. (2013), uses a triple-bottom-line approach of ‘environment,’ ‘society,’ and ‘economy.’ The indicators reflect these categories, yet we are not given specific sustainability goals that the indicators are intended to measure. On the other hand, papers such as Fitzgerald et al. (2012) provide goals that allow them to select more appropriate indicators: “... sustainable development of an urban area entails minimizing vulnerability, maximizing resilience and maintaining or enhancing ecosystem functions” (pp. 371-72).

The general lack of goals articulated in the literature provided us with an insufficient base from which to report a credible list of common sustainability goals for cities. Therefore, it is not possible to answer our first research question (*What common sustainability goals for cities guide indicator selection, as articulated within the body of urban sustainability assessment literature?*). We view this as a significant finding in its own right and pick this thread up below in the Discussion.

Research Questions 2 and 3

Natural indicators far outweighed the other indicator types across capital types (Table 5). We identified 468 natural indicators, 277 proxy indicators, and 40 constructed indicators. Given the ambiguity of creating the indicator typology through a data set of papers that did not share a methodological grounding, we were unable to interpret 25 indicators and therefore coded them as “uncertain” (the full list of coded indicators is published in Harvard Dataverse: Cohen 2020). The magnitude of these differences and few uncertain indicators suggest that the lack of clear goals does not limit the accuracy of this inference. Natural capital indicators were the most frequent across all types of capital (Figure 2), though human and physical capital frequently had a high percent of proxy indicators.

Table 5. Distribution of qualitative codes for capital assets and indicator types.

Capital Asset	Indicator Type	Total	Example
Natural capital	Natural	198	Daily concentration of SO2 (van Dijk and Mingshun, 2005)
	Proxy	64	Recycling rate of general waste (Murakami et al., 2013)
	Constructed	15	Human-to-ecosystem service value ratio (Estoque and Muyayama, 2014)
	Uncertain	8	Per capita public green area (Wei et al., 2015)
Total		285	
Economic capital	Natural	58	GDP per capita (Blackwood et al., 2014)
	Proxy	36	Number of small businesses per 1,000 residents (STAR Community Rating System, 2016)
	Constructed	4	Human development index- Income index (Estoque and Muyayama, 2014)
	Uncertain	3	Social impact associated with one unit in changing the GDP (Munier, 2011)
Total		101	
Physical capital	Natural	110	Area of impervious surface (Tran, 2015)
	Proxy	103	Number of LEED certified buildings (Egilmez et al., 2015)
	Constructed	3	Land use diversity (0 to 1) (Abudllahi et al., 2015)
	Uncertain	11	Real travel time minus the travel time of a vehicle when it travels at 30 minutes per hour (Mitropoulos and Prevedouros, 2016).
Total		227	
Cultural capital	Natural	7	Number of cultural and sports events per year (Gutowska et al., 2012)
	Proxy	6	Annual cinema attendance per resident (Zanella et al., 2015)
	Constructed	2	Ratio of creative industries to the share of all business in the county, according to the Local Arts Index (STAR Community Rating System, 2016)
	Uncertain	0	
Total		15	
Political capital	Natural	17	% voter turnout rate in local elections (STAR Community Rating System, 2016)
	Proxy	11	Expenditure on public facility (Huang et al., 2009)
	Constructed	1	Strength of policy used in planning (Boyko et al., 2011)
	Uncertain	1	Survey data on satisfaction with government performance (Atkisson and Hatcher, 2001)
Total		30	

(Table 5, continued)

Capital Asset	**Indicator Type**	**Total**	**Example**
Human capital	Natural	52	% People with university degree (Braulio-Gonzalo et al., 2015)
	Proxy	50	Teacher to student ratio (measure of institutional health) (Atkisson and Hatcher, 2001)
	Constructed	15	Human Development Index (Lin et al., 2010)
	Uncertain	2	Intensity of learning activities (Bourdic et al., 2012)
Total		119	
Social capital	Natural	26	Crime rate (Estoque and Muyayama, 2014)
	Proxy	7	Pass rate of drug spot check (Wei et al., 2015)
	Constructed	0	
	Uncertain	0	
Total		33	

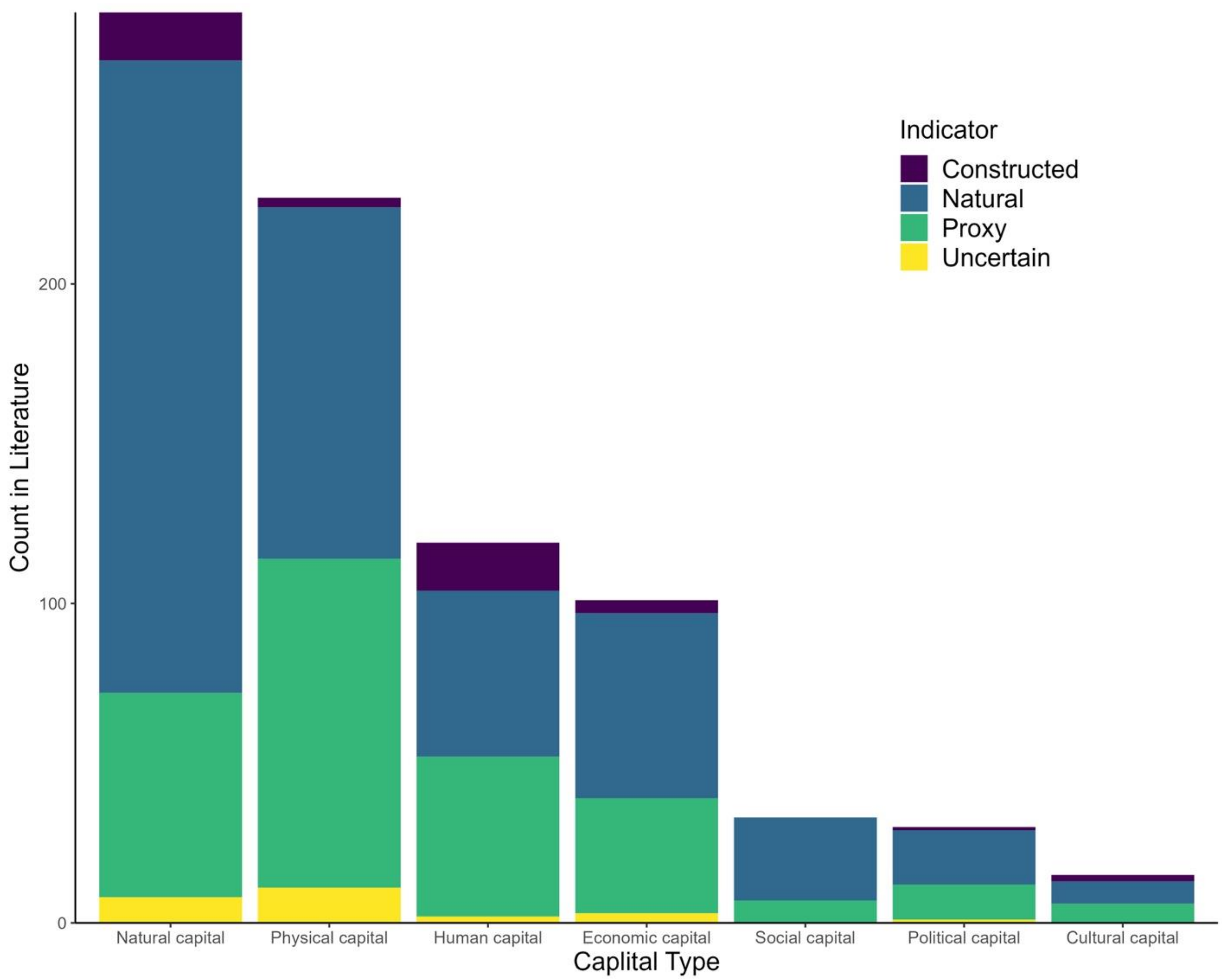

Figure 2. Frequency of capital types (vertical bars) and frequency of indicator types within each type of capital (colors within each bar).

As noted above, the natural type and natural capital indicators were the most frequent. Exploring the diversity patterns of indicators with other measures drawn from the ecology literature (see descriptions in footer for Table 6), natural and proxy indicators are more diverse across types of capital, with proxy indicators slightly greater on all measures except richness (Table 6). Within the capital assets categories, we can see that natural and social capital have the lowest diversity, while social and cultural have the greatest evenness.

Table 6. Diversity measures of indicators sorted by indicator type and capital type.

	Abundance*	Richness*	Evenness*	Shannon Index*	Simpson Index*
By Indicator Type					
All Types	810	7	0.59	1.59	4.12
Constructed	40	6	0.56	1.40	3.33
Natural	468	7	0.54	1.55	3.75
Proxy	277	7	0.59	1.58	4.10
By Capital Categories					
All Types	810	4	0.55	0.94	2.20
Cultural	15	3	0.84	0.99	2.53
Economic	101	4	0.54	0.92	2.18
Human	119	4	0.65	1.06	2.61
Natural	285	4	0.47	0.84	1.86
Physical	227	4	0.56	0.91	2.26
Political	30	4	0.55	0.92	2.18
Social	33	2	0.75	0.52	1.50

**Abundance* is defined here as a count or frequency of the number of times an indicator is mentioned. *Richness* is the count of the number of times an indicator type or capital type was counted within an indicator or capital type. *Evenness* is a measure of relative abundance across types; as the value is closer to one (1.00), relative abundance or frequency within a grouping (Indicator or Capital) are more similar. The *Shannon* and *Simpson* indexes incorporate both richness and evenness. The Shannon index assumes all species are represented in a random sample. The Simson index gives more weight in the calculate to dominant indicators.

DISCUSSION

Research Question 1

Given the dearth of sustainability goals identified in the literature, we were not able to code, analyze, and present a coherent set of sustainability goals for cities. This is not to say that research on sustainable urban development and assessment does not define urban sustainability goals and outcomes. Rather, the literature on urban sustainability assessment is not presently the place to turn for this information or there remains a disconnect between goals and assessment. Given the weak theoretical framing of urban sustainability assessments, past calls for goal-oriented urban sustainability assessments (Davidson 2011; Chesson 2013; Cohen 2017), and the potential for urban sustainability assessment to drive visioning and planning research for sustainable cities (Cohen et al. 2019), we contend that our inability to code common sustainability goals from the literature included in this study identifies a serious research gap for scholarship on urban sustainability assessment.

Research Question 2

We hypothesized *a priori* that there would be more proxy and constructed indicators than natural indicators given critiques in the literature around the proliferation of indicator sets and the lack of theoretical framing for many urban sustainability assessment studies (Davidson 2011; Chesson 2013; Cohen 2017). However, we instead found that natural indicators constituted most indicators used in the urban sustainability assessment literature in our sampling window and that there are few constructed indicators. This finding grants credibility and adds value to the data reported in empirical urban sustainability assessment studies and an opportunity to better leverage this data. We take this position because the transparent use of natural indicators to directly measure sustainability goals allows reviewers to concretely verify progress and draw evidence-based conclusions. But still, there is space in the literature to further drive natural indicators and prioritize this indicator type over proxy and constructed indicators whenever possible.

Research Question 3

Natural capital in cities has clearly been measured more frequently than other capital types when assessing urban sustainability, despite suggestions that social and cultural dimensions are as important (Ameen and Mourshed 2019). The sustainability of physical capital has also received much study, which is not surprising, given the role of the built environment in defining urban space. On the other end of the spectrum, social, political, and cultural capital have received far less attention in urban sustainability assessment studies over the past 10 years. Through future research, it may be worth asking why this is the case, as civil society, governance, and culture have all been presented as meaningful to sustainability (Hawkes 2001; Nurse 2006; Perra and Moulaert 2010; Duxburry 2014). The diversity patterns also suggest that there is variation within the types and categories that could be explored further in combination with progress towards meeting goals. For example, are goals more frequently met with projects that have multiple indicator types within each capital asset category? Regardless of how measured, given sustainability science's framing as integrative (Gibson 2006) and transdisciplinary (Lang et al. 2012; Brandt et al. 2013; Miller 2014), we would agree with Ameen and Mourshed (2019) that when assessing the sustainability of cities (or any other sector for that matter), studies should set sustainability goals and outcomes that span across domains and disciplinary considerations, thus guiding the selection of indicators that provide a wider and more holistic perspective.

Lastly, the literature included in the study represents a 15-year sample that has been shaped by the development of sustainability science as an evolving discipline. Thus this paper serves as an important benchmark for future research to document any shifts towards more balanced distribution across capital assets and indicator types. As a next step, we will be conducting a similar analysis on the recent literature to see if these patterns hold over the last five years as discussions have become more holistic.

General Takeaways

We show in our conceptual framework (Figure 1) the potential for sustainability goals and natural indicators to create positive feedbacks, where clear goals guide the selection of salient natural indicators, which in turn refine goals through an adaptive management process that can be applied to strengthening planning for sustainable urban development. The absence of clear sustainability goals in urban sustainability assessment literature then poses a challenge for identifying the strongest natural indicators and setting a course for sustainable urban futures. This result should be seen as an opportunity for the field. Researchers and practitioners have an abundance of data sources available, but thoughtful conversation a priori will improve the impact of scholarship and practice.

Despite this shortcoming, the body of urban sustainability assessment literature uses more natural indicators than we would have assumed given the inconsistent (and oftentimes lacking) framings across the studies. This application of natural indicators might imply more reliable data and research results in the assessment of urban sustainability, though there is room to grow the use of natural indicators in relation to proxy and constructed indicators. Also, with few clearly articulated sustainability goals within the included assessment studies, there is also space in the literature to identify natural indicators that best measure strong sustainability outcomes for cities.

Because there is an obvious lack of goal framing for sustainability outcomes in cities, we wonder if in most cases, sustainability assessment, as applied to cities, is being used to measure after the fact whether urban development initiatives are achieving sustainability ambitions. We contend that orienting future urban sustainability assessment studies around clear sustainability goals, assessment research can instead play a leading role in visioning research and help set the agenda for urban futures and sustainable urban development, rather than reacting to development outcomes planned by other stakeholders.

The imbalance in the use of various capital types and other organizational mechanisms (Merino-Saum et al. 2020; Michalina et al. 2021; Sharifi 2021) across urban sustainability assessment indicators shows the difficulty that frameworks have in representing sustainability as an integrative concept (Gibson, 2006). It is imperative that indicator selection not only becomes more goal-oriented but also more socially, culturally, and politically oriented to better represent the facets of sustainability that too often go unnoticed in the assessment of urban sustainability challenges and opportunities. Indeed, we would hypothesize that the use of our proposed framework, where goals inform indicator selection, would result in more diversity and evenness throughout the capital types.

CONCLUSION

Following the trite adage, *you can't manage what you don't measure*, sustainability assessment as an evaluative practice can and should drive sustainability outcomes in cities, but the current state of the literature falls short of this ideal. We found that less than half of reviewed papers oriented sustainability assessments around explicit goals, though just over half of reported indicators were natural indicators. Further, the included literature lacked disciplinary balance, focusing on natural and physical capital, while less frequently tracking progress on social, political, and cultural capital.

As such, sustainable urban development practice and research may benefit from balanced input from natural scientists, social scientists, humanists, and artists to determine the best ways to explicitly track sustainability outcomes in our cities. To better insert sustainability assessment as a visioning and planning tool for sustainable urban development, the method should be framed around clear, specific sustainability goals and objectives. Under this framing, scholars and practitioners can more mindfully select natural indicators that track progress towards achieving diverse goals spanning disciplinary concerns that drive development towards a sustainable city.

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