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Research Article

The Criticality of Using Frameworks Designed by Consensus (FDC) to Identify and Select Criteria and Indicators to Assess Sustainability Performance of Cities and Communities

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Abstract: Capturing the various facets of sustainable development is the main objective of sustainability assessment studies. Scientists and practitioners use sustainable development criteria and indicators as instruments to link the theoretical definitions with the evaluation of the effectiveness of management strategies; therefore, identifying and selecting indicators are the most critical processes in evaluating the implementation of sustainable development strategies and progress toward achieving sustainability goals and objectives. The manuscript argues the need for increasing credibility in the identification and selection of criteria and indicators through stakeholder engagement, participation and management. Sustainability aims to primarily address and balance the [social, economic, environmental] needs and expectations of stakeholders; therefore, reaching consensus amongst the various groups of stakeholders became the determining factor in the design, implementation, and assessment of sustainable development strategies. Because a precise definition of sustainability that is universally agreed upon is yet to be introduced, the process of identifying and selecting indicators to assess progress toward achieving sustainable development is embedded in subjectivity and vagueness and can be easily manipulated to meet particular interests. Furthermore, the absence of rigorous and standardized methodological frameworks contributes to continuously proposing set indicators that best capture the notion of sustainable development which creates distrust in the assessment process and directly affects the credibility of the sustainability concept. Departing from acknowledging the relevance of stakeholders groups in decision-making and management processes, the manuscript identifies and discusses three credible and reliable frameworks designed by consensus (FDC) to identify and select criteria and indicators to assess the sustainability performance of cities and communities: (1) ISO 37130:2018 which is complemented by ISO 37122:2019, (2) United Nations Sustainable Development Goals (UN SDGs) with focus on Goal 11, and (3) customized frameworks for sustainable cities (CFSS). To minimize subjectivity and strengthen credibility, the manuscript also makes the case for the need of embedding FDC into sustainability assessment processes to identify and select criteria and indicators. Because of the methodology adopted for their development, FDC provide scientists and practitioners with reliable and credible sources to identify and select criteria and indicators for the assessment of the sustainability performance of cities and communities.

Keywords: decision-making; liveability; quality of living; sustainability assessment; sustainability performance; sustainability criteria; sustainability indicators; sustainable cities

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1. Cities and the Notion of Sustainable Development: Identifying the Challenges in the Terms

Migration trends around the world in the last few decades have resulted in more than half of the world's population living in urbanized areas [1,2]. While current population levels have cities under increasing pressure, additional unprecedented challenges are expected to arise as projections indicate that urban areas will host 68 percent of the world's population by 2050 [3]. Well-managed urbanization brings prosperity and sustainable growth; however, the speed and scale of urbanization have a critical role in developing cities with acceptable liveable environments, adequate standards of quality of living, and satisfactory dimensional balance of social, economic, environmental, and cultural needs and expectations of their inhabitants.

Cities are cultural, human, social, science, and intellectual centers and living epicenters driving critical sectors of commerce and economic productivity and growth. Their progress and development depend upon efficient and coordinated management and effective implementation of evidence-based policymaking. Although urban areas are estimated to contribute more than 80 percent of the world's gross domestic product (GDP) [2] and "urbanization has been an essential part of most nations' development towards a stronger and more stable economy" [4], urban settlements growth presents collateral effects including but not limited to traffic congestion, pressure on services (e.g., health care), informal settlements, urban sprawl, environmental pollution, excessive use and exploitation of resources, significant contribution to climate change, and development or increment of social issues (e.g., homeless) [5–7]. Furthermore, cities are susceptible to internal and external events such as civil wars, social unrest, terrorist attacks, migration, growing political upheaval, and economic instability, among several others. The impact on social, economic, environmental, and other aspects of cities' performance because of unplanned or unwelcomed events affects the living conditions and quality of living of their inhabitants and the networks, interconnections, and flows of the complex set of functional systems of cities. Cities and communities are complex systems of systems. Interconnected and coherently organized systems in urbanized areas meet specific functions within the city's system. Among others, a city system includes transport, sanitation, food, education, waste management, biodiversity, energy, health, and social, cultural, and economic systems. The coordinated and interrelated functionality of the systems aims to provide healthy, liveable environments, good quality of living, and sustainable development for urbanized areas. Therefore, the concepts of liveability, quality of living, and sustainability necessarily become mutually inclusive, complementary, and interrelated; healthy liveable environments indicate sustainable cities with acceptable standards of quality of living.

Their interconnection and the study of liveability, quality of living, and sustainability concepts have been moving targets and continue to evolve. Back in the 1960s, the objective of studying and defining liveability was about making cities more equitable [8]. Years later, scientists understood that cities are not isolated entities, and urban liveability was linked to making cities more competitive. Cities wanted to attract human talent and economic capital, which today are key aspects of successful development in the open market. Nevertheless, economic success (i.e., competitive economy) alone does not sustain the development of a city; a sustainable environment and quality of living are the other two elements contributing to urban liveability. Consequently, the development of a city encompasses different but interrelated dimensions that can be found in the notions of liveability and sustainability.

Furthermore, the concept of a liveable city incorporates the same principles included in the Brundtland Commission's definition of sustainability and "embraces cognate notions such as sustainability, quality of living, the "character" of place, and the health of communities" [9]. Definitions of sustainability in the literature often include wording to emphasize the aim of achieving a quality of living through balancing the relationship between economic development, social well-being, and environmental protection. In contrast, livability is often viewed as "the sum of the factors that add up to a community's quality of living, including, the built and natural environments, economic prosperity, social stability and equity, educational opportunity, and cultural, entertainment and recreation possibilities" [10]. Furthermore, "the concepts of sustainability and livability help us to consider the quality of living for all members of a community or residents of a place, and how the activities and choices of these individuals will impact on the lives of future generations" [9]. Instead of contradictory, liveability and sustainability are intertwined and complementary concepts aiming to provide healthy environments and improve people's quality of living in urbanized areas. Nevertheless, the lack of rigorous theoretical frameworks has led to an abundant number of definitions which in turn has made difficult the assessment and incorporation of the quality of living, liveability, and sustainability concepts into the scientific study and practical application.

Although precise or universally agreed-upon definitions for liveability, quality of living, and sustainability are yet to be introduced, the link between the three concepts appears stronger and clearer. Since sustainability results from the successful implementation of sustainable development strategies, the definitions of liveability and quality of living appear without limit, but the essence of both concepts forms part of the notion of sustainability. The concept of quality of living has been characterized as ambiguous, elusive, obscure, multi-level, amorphous, and even vogue and a cliché [11–13], whereas the term sustainability is being abused and overused to the extent that the vagueness embedded in its definition is lost in the midst of the world of semantics [14,15] and risking the possibility of losing its credibility. As the definitions of quality of living and sustainability, liveability is also a widely known concept, but none of the definitions

is perhaps unanimously accepted. Khorrami et al. [16] state, “livability is an “ensemble concept” with no precise or universally agreed-upon definition.” Even without a unanimous consensus around the definitions of the concepts, it is “widely assumed that consumers should have a right to both “livable” and “sustainable” communities, which raises questions for planners and decision-makers about how to satisfy the needs and desires of current and future residents” [17] and often create opportunities to design definitions of quality of living, liveability, and sustainability using specific stakeholders’ needs or expectations.

The challenges of finding accurate, universally accepted, and enforceable definitions for quality of living, liveability, and sustainability translate into obstacles to effectively embedding the essence of the concepts into the design and implementation processes of any assessment approaches, strategies, models, appraisals, or methodologies. Achieving healthy, liveable, and sustainable communities that improve the quality of living of their inhabitants require the development and implementation of reliable assessment tools to support stakeholders in their decision-making process. Moreover, the current development path has forced residents, legislators, regulatory agencies, and other stakeholders to design and implement programs and plans to capture the essence of sustainable development and achieve acceptable levels of sustainability in cities through quantifiable actions.

2. Research Objectives and Methodology and Manuscript Organization

Frameworks designed by consensus (FDC) effectively engage stakeholders and decision-makers in the identification and selection processes of criteria and indicators to assess the sustainability performance of cities and communities. Departing from recognizing the critical role of stakeholders and decision-makers in sustainability management and assessment, the research methodology was framed around the following objective: (1) demonstrate the importance of engaging groups with different views, perspectives, goals, and perceptions to reach a consensus in the identification and selection of criteria and indicators; (2) identify the role of stakeholder engagement and participation in the design of frameworks to identify and selection of criteria and indicators; (3) highlight the link between stakeholder engagement and the rapid ad global acceptance of frameworks designed by consensus; and (4) identify the need for increasing credibility in the identification and selection of criteria and indicators through stakeholder engagement, participation and management.

Because the aims and objectives of the research are exploratory in nature, qualitative research of content analysis based on three case studies was implemented as a research methodology. The case studies were based on available data and information of (1) ISO 37130:2018 Sustainable development of communities – Indicators for city services and quality of life which is intended to be implemented in conjunction with ISO 37122:2019 Sustainable cities and communities – Indicators for smart cities and ISO 37123:2019 Sustainable cities and communities – Indicators for resilient cities; (2) United Nations Sustainable Development Goals (UN SDGs) with focus on Goal 11, and (3) customized frameworks for sustainable cities (CFSS) which are customized plans developed based on the needs of the specific city or community. The manuscript is structured as follows: (1) the link between the definition of the terms and the selection and identification processes of criteria and indicators is discussed in the introduction section; (2) the role of criteria and indicators in the hierarchical structure organization is highlighted; (3) background and related information of each FDC is presented; (4) the usefulness and credibility of FDC are empathized through the discussion of some benefits and lessons from practice; and (4) the manuscript then present some conclusions and opportunities for future research.

3. Using Composite Indices to Capture the Sustainable Development Notion: A Credible Option with Challenges to Overcome

Processes, approaches, strategies, models, appraisals, and methodologies for the assessment of the quality of living, liveability, and sustainability of cities are continuously evolving along with the definition of the concepts. Current assessment tools, techniques, and methods are diverse, and new emerging ones are constantly designed and introduced by scientists around the world. Therefore, an exhaustive review of all existing tools, techniques, and methods for the assessment of communities and cities’ performance not only presents challenges but is also impractical and outside the scope of this study. With a variable level of complexity, a large number of assessment tools, techniques, and methods have been applied considering the temporal and spatial dimensions of sustainability with the intent of capturing the characteristics of the notion of sustainable development [18]. The classification of the sustainability assessment tools, techniques, and methods is complex, and various intents of categorizing them have been documented. The Sustainability A-Test project applied a consistent and comprehensive evaluation framework to validate a wide range of tools, which were grouped into assessment frameworks, participatory tools, scenario analysis, multi-criteria analysis, cost-benefit analysis and cost-effectiveness analysis, modeling tools, and accounting tools, physical analysis tools and indicator sets [19] whereas Ness et al. [20] developed a sustainability assessment tool framework consisting of three umbrellas or general categorization areas: indicators and indices, product-related assessment tools and integrated assessment. While many other classifications of sustainability assessment tools, techniques, and methods can be cited, Rotmans [21] provides two significant insights regarding overall sustainability assessment studies: the impossibility of capturing the multi-dimensionality of sustainable development in an overall generic tool and

the obstacles for practical application of sustainability assessment in policy-making settings due to the diversity of tools, techniques, and methods.

Although challenges and obstacles can not be dismissed, several reliable tools, techniques, and methods have been developed and implemented to assess the quality of living, liveability, and sustainability of cities with a certain degree of reliability and acceptance. To attain a satisfactory degree of reliability and acceptance, any effort to measure progress towards achieving the goal and objectives of sustainable development must include a number of characteristics which can be grouped in four categories: adopting a holistic perspective, fostering sustainability objectives, incorporating sustainability in the assessment process, and supporting decisions [22]. Common methods to assess urban sustainability include Cost-Benefit Analysis (CBA), Community Impact Evaluation (CIE), Hedonic Pricing Method (HPM), Ecological Footprint (EF), Strategic Environmental Assessment (SEA), Environmental, Social, and Economic Impact Analysis (EIA), Life Cycle Sustainability Dashboard (LCSD), Analytic Network Process (ANP), Life Cycle Assessment (LCA), Sustainability and Environmental Rating Systems (S&ERS), BASF Eco-Efficiency Analysis, and Material Intensity Per Service Unit (MIPS). In the same way, Leadership in Energy & Environmental Design (LEED), Comprehensive Assessment System for Built Environment Efficacy (CASBEE), SBTool, and Green Star is a small selection of assessment tools for urban sustainability. Their popularity, practicality, and wide implementation have made assessment indicators and indices part of a stand-alone category. Urban sustainability indicators (USI) (e.g., The UN/UNCD Indicator, The Organization for Economic Co-operation and Development (OECD) Indicator, The EEA Indicator, The UNCHS & The World Bank Indicator, The WHO Indicator), European Common Indicators (ECI), Environmental Performance Index (EPI), Environmental Sustainability Index (ESI), Indicators of Sustainable Production (ISP), and Cities Environment Reports on the Internet (CEROI) are amongst the most recognizable and widely used indicators. A diverse list of analogous tools, techniques, and methods can be found to assess liveability and quality of living. In a comprehensive review of the methods used to assess urban liveability, Khorrami et al. [16] confirmed the popularity of indicators and indices amongst other tools, techniques, or methods developed and implemented to rank cities for liveability. Some of the most commonly applied indices at national, state, and local levels to compare the liveability of cities and regions are Environmental Friendliness and Sustainability, Socio-Cultural Conditions, and Economic Vibrancy and Competitiveness [16]. The assessment of the quality of living also includes a wide range of tools, techniques, and methods, but “it is becoming increasingly common for researchers to employ a mix of perspectives and methods in assessing the quality of life” [23]. Yet, indicators and indices are also the preferred mechanisms amongst the existing tools, techniques, and methods to capture the various domains of the notion of quality of living. Furthermore, the design and implementation of indicators and composite indices have gained recognition and are considered influential decision-making and reporting tools [24] that measure what is relevant to people while reflecting key trends in social systems, environment, human well-being, economy, and quality of living [25].

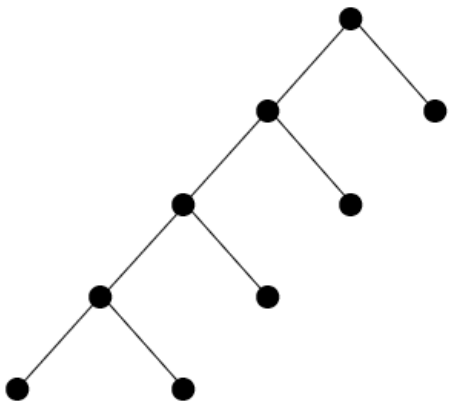
In practice, decision-makers and users, in general, encounter the additional challenge of understanding the terminology implemented by developers or proponents of the tools, techniques, and methods. The words rankings, indices, indicators, ratings, scores, and surveys are often interchangeably used in reference to performance assessment, benchmarking, and categorization (i.e., ranking) of quality of living, liveability, and sustainability of cities and communities. Indices (i.e., composite indices) are meant to be designed following the hierarchical structural organization (HSO) illustrated in Table 1. Composite indices are tools that group together different weighted indicators to produce a combined and stand-alone number. In addition to the composite index (i.e., principle) and indicators, the assessment tool (e.g., ranking, index, rating) often includes various levels of the HSO. At the center of composite indices are the HSO, the identification and selection of indicators, and the weighting and aggregation system (W&AS). The composite index is denominated ‘principle’ in the HSO of assessment tools. The principle is commonly formulated around core concepts such as sustainability, liveability, and quality of living. The sub-principle is the next hierarchical level and can be denominated ‘composite sub-index’, representing a pillar, element, or dimension (e.g., environmental, social, economic). As a second-order principle, a criterion is not a direct measure of performance but adds meaning and operationality to the sub-principle above it. Criteria are often denominated areas of assessment, theme, goal, or category in CDAIs. Below a criterion is an indicator or group of indicators. These measurable or describable variables (i.e., quantitative or qualitative variables) should convey a meaningful message easy to interpret. Subsequently, indicators are supported by verifiers which are at the lowest level of the HSO. “While indicators are seen as variable components used to infer the status of a particular criterion, verifiers contain data or information that enhances the specificity or the ease of assessment of an indicator” [26]. Each level of the HSO is clearly defined and has a specific mission; however, the interchangeable use of terms in the literature –as listed in the right column of Table 1- has contributed to the misunderstanding of the meaning of each hierarchical level in the assessment process of a principle (e.g., quality of living, liveability, sustainability).

Along with identifying and selecting indicators, the W&AS represents a determining factor in the design and implementation of composite indices because of its direct impact on the process and outcome of the assessment. Indicators, criteria, and even sub-principles are not necessarily equally relevant or impactful; therefore, elements within a specific hierarchical level might have different weights. CDAIs assess and compare performance and present the results in the form of composite indices; the assessment processes evaluate the performance of selected parameter(s) (i.e., indicators), which in some instances are used to compare actual performance to pre-established thresholds or baselines [27]. The HSO of

composite indices includes a number of elements grouped in areas of relevance (e.g., criteria grouped under a composite sub-index or indicators grouped under a specific criterion) to facilitate the identification, assessment, and management processes. The lack of a widely accepted methodological framework forces each developer or proponent of CDAIs to create a unique W&AS that assigns each sub-principle, criterion, or indicator a respective weight in relation to others within the same hierarchical level. Cole [28] emphasizes the lack of consensus on theoretical and non-subjective methodology for assigning weights. Because there is no methodological agreed-upon approach for weighting distribution, aggregating the individual performance of indicators, criteria, or sub-principles and converting weights into points or percentages are often some of the most critical issues for debate [29,30]. As a result, some CDAIs adopt the simplistic approach of assigning equal weights to each element (i.e., sub-principle, criterion, indicator), whereas others implement more elaborated methodologies (e.g., multi-criteria decision-making methods). Once the weight of each element has been converted into common units (e.g., points, percentages), the scores of each hierarchical level are given by adding or averaging the points or percentages assigned to each element included in the hierarchical level below. The overall performance (i.e., composite index) is then calculated by rolling up all levels of the HSO to assign value to the principle (i.e., quality of living, liveability, sustainability) under assessment.

Although the HSO and W&AS provide some sense of a methodological approach to develop composite indices, the international scientific community is still working towards a common agreement on the number and characteristics of the indicators that effectively capture the essence of quality of living, liveability, and sustainability notions. Furthermore, these concepts have been embraced by cities but adapting or developing strategic plans to integrate the various aspects of the sustainable development notion remain a major hurdle. For instance, the use of either quantitative or quantitative indicators faces different challenges: identification of relevant data, selection of appropriate indicators, the connection between the academic understanding of sustainability and practice (i.e., municipal planning), limitation of resources, and data availability [15,27,31–34]. Nevertheless, indicators and indices allow to link performance across different sectors and have a decisive factor in integrating the various perspective of policymakers [33,35]. To gain credibility and accountability, performance targets and goals are typically determined by policymakers through consultation. Newman and Jennings [5] point out that the use of indicators creates accountability for government and communities in meeting performance objectives and stakeholders' expectations and needs. Similarly, the use of indicators and indices also allows the assessment of progress made based on those strategies implemented with the objective of improving the quality of living, liveability and sustainability of cities and communities. Munier [36] also found that the effects and challenges of policies and plans on the urban environment can be evaluated through indicators and the outcomes are decidedly credible to decision-makers and stakeholders. Consequently, the assessment and benchmarking of performance through indicators and indices have become not only useful but also powerful and highly trusted tools for cities and communities in guiding policy-making processes based on factual performing data.

Table 1. HSO: Levels and designations found in literature.

Hierarchical Level	Hierarchical Structural Organization (HSO)	Designation(s) in Literature
Principle (Composite Index)		Sustainability, liveability, quality of living
Sub-principle (Composite Sub-index)		Pillar, element, dimension (e.g., planet, economy, social)
Criterion		Area of assessment, theme, goal, category, sector, factor, indicator
Indicator		Indicator, factor, target, sub-category, sub-indicator
Verifier		Performance threshold, baseline, target, goal, means of verification

4. Criticality of FDC in Selecting Criteria and Indicators through Engagement and Participation of Stakeholders and Decision-Makers

The success of composite indices is based on the processes implemented to identify and select the set of indicators and criteria to assess the performance of the sub-principle (e.g., pillar) and principle. In the process of properly capturing the principles embedded in the notion of sustainable development, there are several challenges facing scientists, policy-makers, society, and other stakeholders. To that extent, the identification and selection process of criteria and indicators must guarantee with relative certainty that throughout the performance assessment process, the city or community is moving in the right direction and convey with confidence that the pre-established vision of sustainability, liveability and quality of living is attainable. To achieve the desired performance target, goal or vision, indicators and criteria are selected with the aim of answering questions such as what should be measured and how should it be measured? While the what and how address conceptual areas of sustainability assessment, the same questions emphasize the criticality of engaging the various groups of stakeholders in the identification and selection of indicators and criteria. Indicators and criteria facilitate the communication of setbacks or positive developments made toward the pre-established performance target. Because performance setbacks or advancements have a direct impact on the community, the sustainability, liveability and quality of living performance of cities and communities are policy-driven. Therefore, policymakers, community leaders, and other influential groups of stakeholders often rely on sources of information whose development has been transparent and supported by credible methodologies.

To achieve sustainability, liveability and quality of living in cities and communities, the process of determining what needs to be done and how requires the active engagement and participation of those who are directly impacted by the programs, plans, initiatives, strategies, or policies designed and implemented to address the social, economic, and environmental needs of the community [15,37]. Otherwise, the lack or weak involvement and participation of stakeholders and decision-makers in the initial setting of the areas of performance (i.e., indicators and criteria) results in achieving a vision of sustainability, liveability or quality of living far from the reality of the needs of the city or community, potential rejection of the achieved outcomes, or opening a gap amongst scientists, technically-oriented individuals, decision-makers, and other groups of stakeholders. In addition to engaging the right groups of stakeholders, the identification and selection of indicators and criteria must be a transparent process that departs from a reference starting point.

Although there have been some advances in answering the question “what should we measure?” and the methodologies used to conduct the assessment for certain areas of sustainability performance, the processes of identification and selection of indicators and criteria to assess sustainability, liveability, and quality of living of cities and communities remain under ardent debate. The continuous evolution of sustainability assessment highlights the complexity of balancing the social, economic, and environmental needs of communities and attaining acceptable standards of liveability and quality of living. Nonetheless, stakeholders can find reliable and credible resources offering a pre-selected list of indicators that have proven their usefulness based on proven performance improvement. Poveda [37] identified six resources of sustainable development indicators for the assessment of surface mining operations: governmental regulations, committees and organizations for standardization (e.g., ISO), management and processes best practices, academically and scientifically authored resources, industry standards and programs, and local, regional, national, and international organizations. Some of those resources support stakeholders by providing indicators to assess the performance of other types of projects or industries. For cities and communities, the processes of identification and selection of indicators to assess sustainability, liveability, and quality of living can be supported by a number of FDC. However, policymakers, community leaders, and other groups of stakeholders including everyday citizens must rely on independent, transparent, credible sources of information that have been developed by respected and reliable organizations. Three FDC meet those requirements and provide stakeholders with a set of indicators to assess the sustainability, liveability and quality of living performance of cities and communities: 1) ISO 37120:2018, 2) UN SDGs) with a focus on Goal 11, and 3) CFSS. The development of these FDC included the participation of multi- and inter-disciplinary groups of stakeholders which enhances the credibility of the framework. Similarly, the transparency in the development of the FDC and the organizational reputation of the developer make the three FDC the go-to resource to identify and select indicators and criteria for the assessment of the sustainability, liveability, and quality of living performance of cities and communities.

The consensus reached through the effective engagement of multi-disciplinary stakeholders and decision-makers by these three FDC increase the credibility of assessment frameworks (e.g., composite indices) used to evaluate the sustainability, liveability and quality of life performance of cities and communities. Furthermore, Sustainability processes such as the design of sustainability assessment tools such as composite indices require stakeholder engagement and participation to create accountability on the participants, provide credibility to the process, and facilitate the acceptance of outcomes [31,32,34]. Similarly, multi-disciplinary stakeholder engagement and participation and consensus-building processes are essential during the development phase of sustainability assessment tools to deliver effective decision-making outcomes [27,35]. Consensus through multi- and inter-disciplinary stakeholder engagement is the common factor amongst the three FDC identified to support the identification and selection of crite-

ria and indicators to assess the sustainability, liveability and quality of living of cities and communities.

4.1. Case Study # 1: ISO 37120:2018 Sustainable Development of Communities - Set of Indicators Designed by the Most Respected International Standard-Setting Body

The International Organization for Standardization (ISO), an independent and non-governmental international organization with representatives from 165 national standards bodies, develops voluntary international standards following four key principles: (1) responding to requests from industry or stakeholders, ISO responds to a need in the market; (2) experts from all over the world grouped in technical committees (TCs) guarantee that ISO standards are developed based on global expert opinion; (3) representatives from consumer associations, academia, NGOs (non-governmental organization), and government join the experts as members of the TCs making the development of the standards a multi-stakeholder process; and (4) a consensus-based approach takes into consideration comments and recommendations from all stakeholders [38].

The development process of ISO Standards includes seven main stages: preliminary, proposal, preparatory, committee, enquiry, approval, and publication [39]. The proposal stage has the main objective of confirming the need for a new International Standard. During the preparatory stage, a working group (WG) prepares the working draft (WD), which is circulated amongst experts until an optimal solution has been found. The committee stage is optional under some circumstances; if the committee stage is used, the WD becomes a committee draft (CD) which is circulated until the members agree on the technical content. In the enquiry stage, the Draft International Standard (DIS) is sent to all ISO members who have a 12 weeks period to vote and comment on it. The approval stage can be avoided if the DIS is approved in the previous stage; substantial and significant comments can cause the implementation of the approval stage by the committees. Once the Final Draft International Standard (FDIS) is sent to all ISO members, they have an eight weeks period to vote. Standards are only "approved if a two-thirds majority of the P-members of the TC/SC is in favor and not more than one-quarter of the total number of votes cast are negative" [39]. Only editorial corrections can be made in the final stage before the ISO Central Secretariat publishes the International Standard.

ISO/TC 268 Sustainable cities and communities developed ISO 37120:2018 Sustainable development of communities – Indicators for cities services and quality of life. ISO 37120:2018 "defines and establishes methodologies for a set of indicators to steer and measure the performance of city services and quality of life" [40]. The applicability of ISO 37120:2018 is extended to cities, municipalities, or local governments interested in measuring and benchmarking their performance independently of size and location. Indicators included in ISO 37120:2018 are grouped into 19 themes (i.e., criteria): 45 core indicators are required, while 59 supporting indicators are recommended to those implementing the International Standard. ISO 37120:2018 also includes 24 profile indicators which are designed to help cities in benchmarking performance with other cities of similar characteristics. Profile indicators are based on basic statistics and background information about the cities. Table 1 shows the 19 themes with the core, supporting, and profile indicators included in each of them. Although ISO 37120:2018 does not set a value judgment, numeric threshold, or performance baseline for any of the indicators, cities count with a number of indicators to measure performance aiming for improving quality of living and sustainability globally. Additionally, "existing indicators at the local level are often not standardized, consistent, or comparable over time or across cities" [41]; therefore, the use of an international standard presents three main benefits for cities: assists the performance assessment process, allows performance benchmarking and comparisons, and facilitates sharing best practices.

ISO/TC 268 also developed 37122:2019 Sustainable cities and communities – Indicators for smart cities and ISO 37123:2019 Sustainable cities and communities – Indicators for resilient cities. Because "maintaining, enhancing and accelerating progress towards improved city services and quality of life is also fundamental to the definitions of both smart cities and resilient cities" [40], ISO 37120:2018 is intended to be implemented in conjunction with ISO 37122:2019 and ISO 37123:2019. The development of ISO 37122:2019 and ISO 37123:2019 also follow the strict seven stages process implemented by ISO. Based on the criteria of completeness, technology-neutral, simplicity, validity, verifiability, and availability, ISO 37122:2019 proposes 19 themes grouping 80 indicators "designed to assist cities in steering and assessing the performance management of city services as well as the quality of life" [42]. The third standard, ISO 37123:2019, "contains indicators designed to assist cities in preparing for, recovering from and adapting to shocks and stresses" [43]. ISO 37123:2019 groups 68 indicators in 16 themes and does not include indicators in 3 themes: recreation, sport and culture, and wastewater.

The reasoning behind the conception of new ISO standards and the development methodology implemented by ISO are critical factors in the analysis of the effectiveness of CDAIs in capturing the various facets of the concept of sustainable development applied to cities and communities. The decision-making and other processes adopted in developing ISO standards are contributing factors to the transparency and credibility of the indicators selected and included in ISO 37120:2018, ISO 37122:2019, and ISO 37123:2019. Not only the number of ISO country members but also the inter and multi-disciplinary stakeholder engagement approach and the level of consensus needed for the approval of any ISO standard make them an effective and reliable FDC to examine the various elements of CDAIs and other sustainability assessment methodologies using indicators to assess, compare and rank the performance of cities and communities.

Table 2. Themes and indicators included in ISO 37120:2018, ISO 37122:2019, and ISO 37123:2019.

ISO 37120:2018 Sustainable Development of Communities - Indicators for City Services and Quality of Life				**ISO 37122:2019 Sustainable Cities and Communities – Indicators for Smart Cities**		**ISO 37123:2019 Sustainable Cities and Communities – Indicators for Resilient Cities**	
Themes	**CI**	**SI**	**PI**	**Themes**	**Indicators**	**Themes**	**Indicators**
Economy	1	7	3	Economy	4	Economy	7
Education	4	2	0	Education	3	Education	4
Energy	5	2	2	Energy	10	Energy	3
Environment and Climate Change	3	6	0	Environment and Climate Change	3	Environment and Climate Change	9
Finance	2	2	2	Finance	2	Finance	7
Governance	1	3	0	Governance	4	Governance	6
Health	4	2	0	Health	3	Health	4
Housing	2	2	6	Housing	2	Housing	6
Population and Social Conditions	1	2	6	Population and Social Conditions	4	Population and Social Conditions	5
Recreation	0	2	0	Recreation	1	Recreation	0
Safety	5	5	0	Safety	1	Safety	4
Solid Waste	5	5	0	Solid Waste	6	Solid Waste	1
Sport and Culture	1	2	0	Sport and Culture	4	Sport and Culture	0
Telecommunications	0	2	0	Telecommunications	3	Telecommunications	1
Transportation	2	5	2	Transportation	14	Transportation	1
Urban/Local Agriculture and Food Security	1	3	0	Urban/Local Agriculture and Food Security	3	Urban/Local Agriculture and Food Security	2
Urban Planning	1	3	3	Urban Planning	4	Urban Planning	6
Wastewater	3	1	0	Wastewater	5	Wastewater	0
Water	4	3	0	Water	4	Water	2
Total	**45**	**59**	**24**	**Total**	**80**	**Total**	**68**

CI: core indicator, SI: supporting indicator, PI: profile indicator

4.2. Case Study # 2: SDGs: Goal 11 - Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable

The SDGs succeeded the Millennium Development Goals, which ended in 2015. The SDGs - also known as Global Goals - are 17 interlinked global goals part of the 2030 Agenda for Sustainable Development which was adopted in September 2015 by the UN General Assembly. The agenda entitled "Transforming Our World: The 2030 Agenda for Sustainable Development" was agreed upon by the 193 participant Member States. Ban Ki-moon, UN Secretary-General, highlighted that Agenda 2030 "is a roadmap to ending global poverty, building a life of dignity for all and leaving no one behind. It is also a clarion call to work in partnership and intensify efforts to share prosperity, empower people's livelihoods, ensure peace and heal our planet for the benefit of this and future generations" [44]. Between 2015 and 2030, a people-centered, universal, transformative, and integrated agenda addresses five areas of critical importance: people, planet, prosperity, peace, and partnership.

The participatory process to develop the SDGs proved to be based on consensus. "The SDGs, proposed by the Open Working Group, are the result of a three-year-long transparent, participatory process inclusive of all stakeholders and people's voices. Many stakeholders, especially youth, were also involved from the beginning on social media and other platforms, including the UN's global My World survey that received more than 8 million votes from around the world, with approximately 75% of participants under 30 years of age" [44]. Furthermore, a global indicator framework was designed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs), integrated by the Member States and including regional and international agencies as observers, to monitor and review the 17 SDGs and their corresponding targets. Nevertheless, governments were expected to develop national indicators to support and monitor progress toward the goals and targets included in the 17 SDGs.

Although the latest refinement indicates that 231 unique indicators (247 indicators are part of the global indicator framework but 12 indicators repeat under two or three different targets) are included in the global indicator framework, those under Goal 11 – Make cities and human settlements inclusive, safe, resilient and sustainable – are directly related to the purpose of the analysis conducted in this study. In describing Goal 11's objective, Global Goals for Sustainable Develop-

ment [45] states, “to accommodate everyone, we need to build modern, sustainable cities. For all of us to survive and prosper, we need new, intelligent urban planning that creates safe, affordable, and resilient cities with green and culturally inspiring living conditions.” Goal 11 includes ten targets and 15 indicators. Table 3 lists the targets and corresponding indicators included in SDG 11. The latest refinement of the global indicator framework includes a clarification on target 11.c that states “no suitable replacement indicator was proposed. The global statistical community is encouraged to work to develop an indicator that could be proposed for the 2025 comprehensive review” [46]. However, an indicator for target 11.c was included in previous versions of the global indicator framework, which has been listed in Table 3 and was used for the purpose of this study.

4.3. Case Study # 3: Cities Efforts to Develop and Implement Sustainable Development Strategies

Because CFSS are customized plans developed based on the needs of the specific city or community, their effectiveness for the identification and selection of criteria and indicators was demonstrated by discussing in detail the cases of the Cities of Vancouver and Montréal. Four Canadian cities are often included in CDAIs (i.e., rankings, scores, indices, surveys): Toronto, Vancouver, Calgary, and Montréal. It is not unusual to find Canadian cities well-positioned and comparatively ranking better than other North American cities. Multi-culturalism, diversity, size (i.e., population), and influence on the economy are some of the common characteristics of the Canadian cities often selected to be included in CDAIs using composite indices to assess, compare and rank the sustainability, liveability, and quality of living performance of cities and communities. Vancouver and Montréal were selected for the analysis of the effectiveness of CDAIs in capturing the various facets of the sustainable development notion. Vancouver and Montréal are the largest cities in the Provinces of British Columbia and Quebec, respectively, and demonstrated their commitment to becoming more sustainable, improving the quality of living, and creating more liveable environments for their inhabitants through the implementation of diverse, sustainable development strategies.

Table 3. UN SDG 11 – Targets and Indicators.

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	
TARGETS	**INDICATORS**
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate 11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world’s cultural and natural heritage	11.4.1 Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional, and local/municipal)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g., PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities. 11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	11.a.1 Number of countries that have national urban policies or regional development plans that (a) respond to population dynamics; (b) ensure balanced territorial development; and (c) increase local fiscal space
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	11.b.1 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	11.c.1 Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials

Both cities illustrate the uniqueness of the set of criteria and indicators used by cities and communities around the world. Because each sustainability, green, resilience, and climate change plan must be designed with local needs in mind, engagement, participation and management of stakeholders becomes a critical factor for the proper identification and selection of performance indicators. Vancouver and Montreal developed their own CFSS (e.g., sustainability management plans) with the collaboration and participation of multi- and inter-disciplinary groups of stakeholders. In both cases, local experts from diverse backgrounds led the work to design and develop the diverse plan implemented by the Cities of Vancouver and Montreal. Furthermore, workshops, advisory groups, committee discussions, and community engagement were some of the activities part of the process. "The Sustainable Montreal plan 2016-2020 was realized by a collaborative working process involving more than two hundred partner organizations and representatives from central and local municipal administrations" [47] whereas "more than 35,000 people from around the world participated in the development of the resulting GCAP through social media, online, and in face-to-face workshops or events" [48].

4.3.1. City of Vancouver

While multi-culturalism, diversity, enjoyable weather, liveability, and quality of living, among others characteristics, make the City of Vancouver an attractive place to live, maintaining and improving sustainability present real challenges for city planners and authorities. Becoming a sustainable city and the greenest city in the world has been embedded in the City of Vancouver's development plans. The latest available plan related to Vancouver's urban sustainability is the Greenest City Action Plan (GCAP). The City of Vancouver [49] describes the GCAP as a "strategy for staying on the leading edge of urban sustainability." The GCAP was developed in collaboration with over 60 City staff, more than 120 organizations, and thousands of individuals. Currently, the City of Vancouver is developing the Vancouver (City-wide) Plan that aims to guide the city to 2050 and beyond. The GCAP includes 10 goals with their respective indicators and targets plus an additional goal related to greening the city's operations [50]. Since some discrepancies in the indicators used can be found between documents describing the GCAP and implementation updates, Table 4 present a comprehensive list of goals, targets, and indicators. For example, the GCAP includes one indicator designed to measure progress towards the two targets under Goal 2 - Green Buildings [48], whereas the 2016-2017 implementation update presents a dashboard that includes one indicator for each target [50]. Following the HSO, criteria in the GCAP are designated as 'Goals', and a set of indicators falls under each goal. Similarly, the GCAP includes at least one measurable 2020 target for each goal area. Although the GCAP is a City of Vancouver initiative targeting urban sustainability, there are other frameworks aiming to support the city's sustainable development and sustainability performance: Climate Emergency Action Plan, Zero Emissions Buildings Plan, Zero Waste 2040, Climate Change Adaptation Strategy, Neighborhood Energy Strategy, Renewable City Strategy.

4.3.2. City of Montréal

The planning and development of the City of Montréal -which attractiveness can be measured from several standpoints- is carefully crafted by city officials and other multi-disciplinary decision-makers. A shared commitment of the city and parent organizations to achieving practical and measurable initiatives is the foundation of the City of Montréal's approach to sustainable development. A wide range of organizations was committed to implementing the Sustainable Montréal 2016-2020 Plan in conjunction with the city. The Sustainable Montréal 2016-2020 Plan was an extension of two previous plans: Montréal's First Strategic Plan for Sustainable Development 2005-2009 and Montréal's Corporate Sustainable Development Plan 2010-2015. The efforts described in the Sustainable Montréal 2016-2020 Plan will continue with the Montréal Climate Plan: Objective Carbon-neutral by 2050, starting in 2021. As a result, the Climate Plan 2020-2030 will assist the City of Montréal to achieve carbon neutrality by 2050. Sustainable Montréal 2016-2020 Plan included three sustainable development challenges, four priorities for intervention, and ten measurable collective targets (i.e., indicators). Sustainable Montréal 2016-2020 proposed "20 actions to be completed by 2020 by partner organizations and 20 actions to be completed by 2020 by the municipal administration" [51]. On the other hand, the Climate Plan 2020-2030 includes 46 actions grouped into 5 sectors. The success of the plan will be measured by a limited number of indicators; however, there is not a specific indicator for every target. 4 indicators assess performance in the area of reduction of GHG emissions, whereas another four indicators measure resilience and adaptation [52]. Table 5 lists the challenges, priorities, and collective targets included in the Sustainable Montréal 2016-2020 Plan and the eight indicators to monitor the evolution of the Climate Plan 2020-2030. As the city is transitioning to a new sustainability plan, the benchmarking analysis performed in this study included both the Sustainable Montréal 2016-2020 Plan and Climate Plan 2020-2030. Although the actions of the Sustainable Montréal 2016-2020 Plan are to continue with the Climate Plan 2020-2030, the Citywide Strategic Plan known as Montréal 2030 has also set twenty 20 priorities that are linked to the SDGs and grouped in 7 areas: ecological transition, solidarity, equity, and inclusion, democracy and participation, innovation and creativity, human, neighborhoods, and metropolis [52].

Table 4. Areas of Performance and Indicators Included in Sustainability Plans: City of Vancouver.

Areas/categories of Performance with corresponding indicators	Vancouver			
	Greenest City 2020 Action Plan (GCAP)			
	GOAL 1: CLIMATE AND RENEWABLES Eliminate dependence on fossil fuels **2020 Target:** Reduce community-based greenhouse gas emissions by 33% from 2007 levels **2050 Targets:** Derive 100% of the energy used in Vancouver from renewable sources. Reduce greenhouse gas emissions by 80% below 2007 levels. **Indicator:** Total tonnes of CO_2e emissions in Vancouver	**GOAL 4: ZERO WASTE** Create zero waste **2020 Target:** Reduce solid waste going to landfill and incinerator by 50% from 2008 levels **Indicator:** Annual solid waste disposed to landfill and incinerator by 50% from 2008 levels.	**GOAL 7: LOCAL FOOD** Vancouver will become a global leader in urban food systems **2020 Target:** Increase city-wide and neighborhood food assets by a minimum of 50% over 2010 levels **Indicator:** Total number of neighborhood food assets in Vancouver.	**GOAL 10: LIGHTER FOOTPRINT** Achieve a one-planet ecological footprint **2020 Target:** Reduce Vancouver's ecological footprint by 33% over 2006 levels **Indicators:** Total global hectares per capita. Number of people empowered by a City-led or City-supported project to take personal action in support of a Greenest City goal and/or to reduce levels of consumption (cumulative).
	GOAL 2: GREEN BUILDINGS Lead the world in green building design and construction **2020 Targets:** Reduce energy use and GHG emissions in existing buildings by 20% over 2007 levels. Require all buildings constructed from 2020 onward to be carbon neutral in operations. **Indicator:** Total tonnes of CO_2e from residential, commercial, and industrial buildings. Kilograms of CO_2e per square metre of newly built floor area.	**GOAL 5: ACCESS TO NATURE** Vancouver residents enjoy incomparable access to green spaces, including the world's most spectacular urban forest **2020 Targets:** All Vancouver residents live within a five-minutes walk of a park, greenway or other green space. Plant 150,000 new trees. Restore or enhance 25 hectares of natural areas between 2010 and 2020. **2050 Target:** Increase canopy cover by 22% **Indicators:** Percent of city's land base within a five-minute walk. Total number of additional trees planted. Total hectares of natural areas restored or enhanced. Per centage of city's land area covered by tree-leaf canopies.	**GOAL 8: CLEAN AIR** Breathe the cleanest air of any major city in the world **2020 Target:** Always meet or beat the most stringent air quality guidelines from Metro Vancouver, British Columbia, Canada, and the World Health Organization. **Indicator:** Total number of instances of not meeting air quality standards for ozone, particulate matter (PM2.5), nitrogen dioxide, and sulfur dioxide from both the Kitsilano and Downtown air quality monitoring stations combined.	**WALKING THE TALK: GREENING OUR OPERATIONS** **2020 Targets:** 50% reduction in GHGs from City operations from 2007 levels. 70% waste diversion in public-facing City facilities, and 90% waste diversion in all other. City-owned facilities: Reduce water use in City operations by 33% from 2006 levels. **Indicators:** Total tonnes of CO_2e from City operations. Total diversion rate (public). Total diversion (other). Total water use by City facilities (m^3)
	GOAL 3: GREEN TRANSPORTATION Make walking, cycling and public transit preferred transportation options **2020 Targets:** Make the majority of trips (over 50%) by foot, bike, and public transit. Reduce distance driven per resident by 2% from 2007 levels **2040 Target:** Percent mode share by walk, bike or public transit. Total vehicle km driven per person.	**GOAL 6: CLEAN WATER** Vancouver will have the best drinking water of any city in the world **2020 Targets:** Meet or beat the strongest of British Columbian, Canadian or appropriate international drinking water quality standards and guidelines. Reduce per capita water consumption by 33% from 2006 levels. **Indicators:** Total number of instances of not meeting drinking water quality standards. Total water consumption per capita.	**GOAL 9: GREEN ECONOMY** Secure Vancouver's international reputation as a mecca of green enterprise **2020 Targets:** Double the number of green jobs over 2010 levels. Double the number of companies that are actively engaged in greening their operations over 2011 levels. **Indicators:** Total number of green jobs. Percent of businesses engaged in greening their operations.	**Other Plans or Strategies:** Climate Emergency Action Plan. Zero Emissions Buildings Plan. Zero Waste 2040 . Climate Change Adaptation Strategy, Neighborhood Energy Strategy Renewable City Strategy

Table 5. Areas of Performance and Indicators Included in Sustainability Plans: City of Montréal.

	City of Montréal			
	Sustainable Montréal 2016-2020 Plan		Climate Plan 2020-2030	
Areas/categories of Performance with corresponding indicators	**3 SUSTAINABLE DEVELOPMENT CHALLENGES** Low -carbon Montréal: Reduce GHG by 80% by 2050 Equitable Montréal: Improve access to services and facilities Exemplary Montréal: Adopt exemplary sustainable development practices **4 PRIORITIES FOR INTERVENTION** Reduce GHG emissions and dependence on fossil fuels Add vegetation, increase biodiversity and ensure the continuity of resources Ensure access to sustainable, human-scale and healthy neighborhoods Make the transition toward a green, circular and responsible economy	**10 COLLECTIVE TARGETS** Reduce Montréal's GHG emissions by 30% by 2020, compared to 1990, and 80% by 2050 Reach the Canadian Ambient Air Quality Standards (CAAQS) regarding ambient air fine particulate matter concentration (8.8 µg/m^3) by 2020 – Three-year average of the annual average concentrations Reach a 55% modal share for morning rush-hour travel on foot, bicycle and transit by 2021 Re-establish energy consumption (GJ/m^2) equal to or lower than that of 1990 in commercial and institutional buildings Increase the number of environmental certifications or participation in voluntary environmental programs in Montréal by 30% by 2020, compare to 2010 Increase the canopy cover from 20 to 25% by 2025 In the medium term, increase land protected areas to 10% of the territory Meet governmental recovery objectives for recyclable material (70%) and organic materials (60%) by 2020 Reduce the amount of drinking water produced by Montréal treatment plants by 20% between 2011 and 2020 Reduce sedentarism of the island of Montréal population by 10% by 2025	**SECTOR 1**: MOBILIZATION OF THE MONTREAL COMMUNITY (10 Actions) **SECTOR 2**: MOBILITY, URBAN PLANNING AND URBAN DEVELOPMENT (13 Actions) **SECTOR 3**: BUILDINGS (6 Actions) **SECTOR 4**: EXEMPLARITY OF THE CITY (13 Actions) **SECTOR 5**: GOVERNANCE (4 Actions)	REDUCTION OF GHG EMISSIONS GHG emissions produced by the community and by municipal activities Consumption of fossil fuels by the Montréal community (fuel, diesel, natural gas, oil and propane) Use of different travel models, including the model share of automobiles Percentage of electric vehicles registered in the agglomeration of Montréal RESILIENCE / ADAPTATION Number of trees planted by the city and its partners (with vulnerable areas prioritized) Area of protected zones Status of various climate hazard shown on vulnerability maps Area of heat islands

5. Validating the Usefulness and Credibility of FDC: Benefits and Lessons from Practice

The usefulness and credibility of FDC can be proven through their adoption for the certification of sustainability, liveability, and quality of living performance of cities and communities or their acceptance in the identification and selection of criteria and indicators which are incorporated into their programs, plans, strategies, policies, or initiatives addressing the [social, economic, and environmental] needs and move the city or community towards a more sustainable and liveable future with a higher quality of living standards.

ISO 37120:2018 and its set of indicators "have quickly become the international reference point for sustainable city" [42]. Furthermore, cities and communities around the world are rapidly implementing ISO 37120:2018, ISO 37122:2019 and/or ISO 37123:2018 to assess and report performance compliance in a simple and inexpensive manner. The rapid acceptance of this specific ISO family is supported by the World Council on City Data (WCCD) which " was founded in Canada in 2014 and exists to help cities and communities of all sizes globally embrace ISO standardized, independently verified, and globally comparable city data to make data-driven decisions on management, planning and investment, monitor progress and results, and overall become more sustainable, safe and resilient, prosperous, inclusive and smart" [53]. The WCCD offers 5 certification levels for ISO 37120:2018: aspirational, bronze, silver, gold, and platinum. Similarly, cities and communities can achieve the early adopter certification level for ISO 37122:2019 and ISO 37123:2019. Although the adoption of an ISO standard and pursuing a certification carry a proven set of benefits, the indicators included in the three ISOs can be used by cities and communities to design their own programs, plans, strategies, policies, or initiatives. Nevertheless, WCCD has been assisting more than 100 cities in 35 countries worldwide to implement ISO 37120 [54]. From the performance assessment and reporting management standpoint, the ISO 37120 series -that includes ISO 37120:2018, ISO 37122:2019, and ISO 37123:2019- supports decision-makers and stakeholders in the identification and selection process of criteria and indicators to track and monitor progress towards their sustainability, liveability, and quality of living goals and achieve the vision of the notion of sustainable development tailored to the needs of a particular city or community. Additionally, these indicators can help cities in several areas including but not limited to (1) measuring and managing performance; (2) learning from one another (i.e., benchmark performance

across a wide range of performance measures); (3) supporting policy development, (4) responding to sustainability and associated challenges; and (5) improving and achieving higher standards of services, quality of living, resilience preparedness, and liveability. To that extent, the set of indicators in the ISO 37120 series has then become a driver of change and a critical tool to set priorities at the city and community levels. Policymakers, community leaders, and other groups of stakeholders can use quality data collected by cities and communities around the world and design programs, plans, strategies, policies, or initiatives guided by evidence-based decision-making.

Cities and communities can not pursue or be granted certification for implementing the UN SDGs but a good sense of their acceptance and usefulness can be demonstrated by the percentage of data reported by countries around the world. While the UN SDGs are a non-legally binding international commitment acquired in 2015 by the UN General Assembly (UN-GA), countries are expected to design and implement a national framework for achieving the 17 goals [55]. With the collaboration of governments, civil society, the private sector, and other groups of stakeholders, each country is responsible for the implementation and success of its own sustainable development policies, plans, and programmes. The Inter-Agency and Expert Group on SDG Indicators (IAEA-SDGs) developed the indicator framework to closely monitor the 17 SDGs and 169 targets. Furthermore, the Sustainable Development Goal indicators website provides access to the Global SDG Indicators Data Platform. Table 6 includes the latest data available in the SDG analytics section of the SDG Indicators Database [56]. The percentages illustrated in Table 5 indicate the need for accelerating the development and implementation of policies, plans and programmes to achieve the objective of Goal 11. In regards to its implementation, the latest progress report indicates that as of March 2021, "156 countries and territories have developed national urban policies, almost half of which are already at the implementation stage. Of these countries and territories, 38 percent are in the early stages of plan development, while 13 percent are monitoring and evaluating the performance of their plans" [57].

Out of the three proposed FDC to assist in the identification and selection of criteria and indicators to assess the sustainability, liveability, and quality of living of cities and communities, the CFSS are the most easily recognized, widely implemented and usually developed with a wider representation of participants in each group of stakeholders involved in the process. The development of CFSS involved multi- and inter-disciplinary groups of stakeholders with the aim of capturing a more holistic perspective of the notion of sustainable development, the vision that inhabitants of cities and communities have about the future, and the needs of those directly or indirectly impacted by any social, economic, and environmental activity. The development and implementation of CFSS have become a mandatory planning and policy-making tool for cities and communities around the world independently of their size, geographical location or [social, economic or environmental] notoriety on the world stage. Efforts made by cities and communities towards better performance are reflected in CDAIs using composite indices to assess, compare and rank the sustainability, liveability, and quality of living performance of cities and communities. In their annual publication, CDAIs (i.e., rankings, scores, indices, surveys) award higher scores to cities and communities that have proven higher sustainability, liveability, or quality of living performance. Similarly, the efforts of cities and communities are also recognized with awards for their leadership, innovation, or commitment to sustainability, resilience, environmental, and other related areas of performance. The ultimate sign of approval for CFSS is the acceptance and subsequent support of the community which includes policymakers, the private sector, civil society, and many other groups of stakeholders. Moreover, the acceptance and support of stakeholders are an indication of the city or community moving in the right direction toward achieving its sustainability, liveability, and quality of living goals, and the notion of sustainable development is how that specific city or community vision has been rightfully captured.

Table 6. Percentage of countries reporting on each indicator included in the UN SDGs - Goal 11.

Compare Indicators across all goals for All Countries														
Countries with data for at least one year since 2015, by goal and indicator (average across countries in percent)														
Indicators	11.1.1	11.2.1	11.3.1	11.3.2	11.4.1	11.5.1	11.5.2	11.6.1	11.6.2	11.7.1	11.7.2	11.a.1	11.b.1	11.b.2
%	63.21	0	0	0	5.60	55.13	31.16	22.28	99.48	0	0	100	67.88	55.27
Countries with data for at least two years since 2015, by goal and indicator (average across countries in percent)														
Indicators	11.1.1	11.2.1	11.3.1	11.3.2	11.4.1	11.5.1	11.5.2	11.6.1	11.6.2	11.7.1	11.7.2	11.a.1	11.b.1	11.b.2
%	60.62	0	0	0	0	42.33	21.97	1.04	99.48	0	0	0	53.37	43.70
Countries with data for at least two years since 2015 and at least two years before 2015, by goal and indicator (average across countries in percent)														
Indicators	11.1.1	11.2.1	11.3.1	11.3.2	11.4.1	11.5.1	11.5.2	11.6.1	11.6.2	11.7.1	11.7.2	11.a.1	11.b.1	11.b.2
%	40.93	0	0	0	0	32.75	13.30	0.52	99.48	0	0	0	10.36	9.84

6. Conclusions and Recommendations for Future Research

The success of sustainability assessment methodologies in particular CDAIs using composite indices to assess, compare and rank the sustainability, liveability, and quality of living performance of cities and communities depends on effectively capturing the various facets of the sustainable development notion. The identification and selection of criteria and indicators is the most critical process to convey the stakeholders' vision and achieve progress toward the pre-established sustainability, liveability, and quality of living goals. The ISO 37120 series, the UNSDG – Goal 11, and the CFSS provide practitioners and scientists with credible and reliable sets of criteria and indicators that have been selected with the participation of multi- and inter-disciplinary groups of stakeholders. Moreover, stakeholder engagement and participation not only characterize the identification and selection of criteria and indicators processes in each of the three FDC but also become a critical element in the success of achieving the intended sustainability, liveability, and quality of living goals.

The set of recommended criteria and indicators to assess the sustainability, liveability and quality of living of cities and communities varies amongst the three recommended FDC. The lack of standardization in the set of criteria and indicators emphasizes the need for the identification of transparent, reliable, and credible frameworks to support sustainability assessment methodologies. The ISO 37120 series, the UN SDG – Goal 11 and CFSS are reference points for the identification and selection of criteria and indicators to evaluate the progress towards improving the standard of living and achieving pre-established sustainability goals and objectives. Because multi- and inter-disciplinary groups of stakeholders accompanied the development of each of the three FDC, the sets of criteria and indicators possess the intrinsic credibility, reliability, and transparency values needed in unstructured processes surrounded by subjectivity.

The set of criteria and indicators to assess sustainability, liveability and quality of living is constantly evolving and highly debatable amongst scientists and practitioners. While the latest developments in research and lessons for practice allow redefining the set of criteria and indicators needed to better capture the notion of sustainable development, policymakers, community leaders, the private sector, civil society, and many other groups of stakeholders must be supported with transparent, reliable and credible frameworks to assess the progress of cities and communities towards a more sustainable future. Similarly, scientists can utilize the set of criteria and indicators included in each of the three FDC as a starting point to either evaluate the appropriateness of the criteria and indicators or embed them into other sustainability assessment methodologies.

Conclusively, the identification and selection of criteria, indicators, and verifiers to properly capture the different facets of sustainable development are among of the areas in sustainability assessment studies where constant efforts are made and require future research. Similarly, because the relevance or importance (i.e., weight) of each indicator, criterion, and sub-principles within the same level of the HSO has a critical role in evaluating the successful implementation of the pre-established sustainable development goals, objectives and strategies, research on the application of multi-criteria decision-making (MCDM) and multi-criteria decision-analysis (MCDA) methodologies provides another area of research for future development. In the area of management, future research can focus on the identification, selection and engagement of stakeholders and decision-making groups and their role in identifying and selecting the set of sub-principles, criteria, indicators, and verifiers to better capture the various facets of sustainable development.

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