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## **A Comprehensive Strategy to Identify Indicators of Sustainable Heritage Conservation**

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# A Comprehensive Strategy to Identify Indicators of Sustainable Heritage Conservation

Georges A. Tanguay<sup>1</sup>, Etienne Berthold<sup>2</sup>, Juste Rajaonson<sup>3</sup>

## Résumé

La recherche actuelle sur la conservation du patrimoine urbain est caractérisée par un nombre croissant de travaux qui visent à décrire et évaluer la durabilité des pratiques existantes. Nous analysons 25 études qui discutent et proposent des indicateurs permettant d'évaluer le patrimoine urbain sous l'angle du développement durable. L'analyse révèle une absence de consensus sur la quantité, la fréquence d'utilisation et le type d'indicateurs utilisés. Elle implique le développement d'une grille commune d'indicateurs. Nous proposons une stratégie permettant de sélectionner des indicateurs-clés qui couvrent largement les dimensions environnementales, économiques et sociales du développement durable ainsi que les principaux enjeux relatifs à la conservation du patrimoine urbain. La pertinence de ces indicateurs ainsi identifiés est reconnue par les experts et appuyée par les études de cas examinées.

**Mots clés :** Indicateurs, développement durable urbain, patrimoine

## Abstract

*Current research on the conservation of urban heritage is characterized by a growing number of studies that aim to describe and assess the sustainability of existing practices. We analyze 25 case studies that specifically discuss and propose sustainability indicators to assess urban heritage conservation. The analysis reveals a lack of consensus regarding the quantity, frequency of use, and type of the indicators, which calls for the development of common key indicators. We propose a strategy to select key indicators, which broadly cover the environmental, economic, and social aspects of sustainable development, as well as the basic dimension of heritage conservation. The selected indicators are those that are recognized by experts and legitimated by analyses and case studies.*

**Keywords:** Indicators, urban sustainable development, heritage

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## **1. Introduction**

Current research on the conservation of urban heritage is characterized by a growing number of studies that aim to provide an overview of how to describe and assess the sustainability of existing practices. This dominant focus of the research has contributed to the development of indicators and approaches to sustainable development (SD) in this field. In addition, it has assisted with the implementation of policies and development strategies based on the assessment of the indicators.

In the present paper, we present an overview of the literature, which reveals a lack of consensus regarding the appropriate indicators and approaches to use in assessing the sustainability of urban heritage conservation. For each case study, it seems that the researchers have adopted customized indicators based on their own conceptualization of SD. Such individualization of practice is often justified by the fact that each building, site, and urban area has its own characteristics, requiring the use of customized indicators. But, when indicators become too specific, issues of credibility may arise, as the indicators could serve a political purpose. For instance, one can assess the sustainability using only indicators according to which they have good performance. In addition, issues of comparability become problematic, as the indicators that are used do not allow for comparison across size or site. Such issues are challenging for governments, as it becomes difficult to establish a systematical diagnosis of local problems and needs.

We analyze 25 case studies that specifically discuss and propose indicators in sustainable urban heritage conservation. We acknowledge that each site of urban heritage is unique and possesses its own characteristics. As such, specific indicators are relevant with respect to the assessment of their sustainability. Nonetheless, we demonstrate that it is possible to reach a minimum number of indicators that are common across the case studies. In this context, we propose a strategy to identify these key indicators, which broadly cover the environmental, economic, and social aspects of sustainable development, as well as the basic dimension of heritage conservation.

Before presenting the analysis of the case studies, we address the general conceptions of urban heritage and sustainability in sections 2 and 3 respectively. In section 4, we discuss

the emerging links of the two concepts that serve as the underpinnings of sustainable conservation heritage. We present the methodology and the results in sections 5 and 6. The conclusion follows.

## **2. Urban Heritage Conservation**

Since the beginning of the 20th century, various conceptions of urban heritage and its conservation have succeeded one another (Giovannoni, 1998; Riegl, 1984; Choay, 1992). Overall, urban heritage conservation is defined as the conservation and development of public spaces and the monumental heritage of the public domain. In addition, it likely encompasses private property, if the latter is the subject of a heritage conservation process. For example, Chapuis et al. (2012) underlined that a neighborhood in the Marais (Paris) has experienced a vast urban renewal process through which heritage has been conserved based largely on the restoration of private housing by individuals. Berthold and Mercier (2013) have conducted a similar study for the Old Town district in the city of Quebec. They show how real estate speculation can become the subject of discursive construction through which the conservation of the heritage successfully occurs via the conservation of private property within a historic district.

Researches have also demonstrated that the heritage conservation process (HCP) is carried out based on several factors. Among these are the economy and tourist activity (Rocher, 2003). Ideologies also play a role in the sense that the heritage is inserted into a system of values that underlies the language of political action. It must also be added that the HCP can be fed by knowledge and disciplinary specializations that are manipulated for political purposes (Davallon, 2006; Berthold and Miglioli, 2011, Berthold, 2012). For instance, Berthold (2012) has recently analyzed the process by which the Royal Square of Quebec has taken the form of the 'Birthplace of the French America' by demonstrating that this public square, which was anonymous until the middle of the 20th century, has become the subject of interests for architects, historians, and archaeologists, as well as public authorities. This can be seen as a concrete embodiment of the foundations of modern Quebec nationalism.

Research in this field has also shown that several levels of actors are likely to be involved in a HCP, including public authorities, interests groups, and citizens (Drouin, 2005). Existing case studies have also emphasized that, as a heterogeneous social phenomenon, the HCP involves social tensions and conflicts. As a result, HCP is likely to favor certain groups and to exclude others, based on power interaction between the stakeholders (Graham, Ashworth, and Tunbridge, 2000).

Finally, to maintain harmony with the prevailing paradigms of research, a study of the sustainable conservation of urban heritage today must rely on an approach to heritage as a social construction. This approach must take into account the economic, ideological, and normative factors that structure the HCP. In addition, in the era of sustainability, environmental and social dimensions are becoming central in HCP. This creates more challenges for researchers, for instance when the goal is to develop indicators of sustainable urban heritage conservation. As we show in the next section, part of the challenge comes from the measurement of SD using indicators.

### **3. Indicators of Sustainable Development**

The concept of sustainable development took root in the 1970s with the growth of the environmentalist movement. However, it is mainly because of the Brundtland report, which was published by the World Commission on Environment and Development (WCED), that the concept has found itself at the heart of international political agendas (Rametsteiner, 2009). In this report, sustainable development is defined as "development that meets the need of the present generation without compromising the ability of the future generations to meet their own needs" (WCED, 1990: 43). Its implementation is reflected by harmonious development, with respect to environmental, economic, and social dimensions, over time (WCED, 1990; Zilahy et al., 2009). However, in 30 years of research and application, its interpretations have multiplied due to its broad and ambitious definition. Two years after the publication of the Brundtland report, there were more than 60 definitions (World Bank, 1989). In 1996, more than 300 definitions were identified by Dobson (1996). Today, according to Boutaud (2004), nothing is being done

in the area of policy without the label of sustainable development. Thus, it is no wonder that the concept has been repeatedly questioned (Rotillon, 2005).

Graphical representations using Venn diagrams (Figure 1) are widely used to represent and introduce the concept of sustainable development (Connelly, 2007). The latter is schematized as an overlap of three circles representing, economic, social, and environmental concerns, respectively (Beauregard, 2003). Compared to other approaches (e.g. in terms of resources and capital), this representation has the advantage of expressing the concept as a form of balance between the developments of each dimension. It also reflects the interdisciplinarity required in its implementation (Boulanger, 2004).

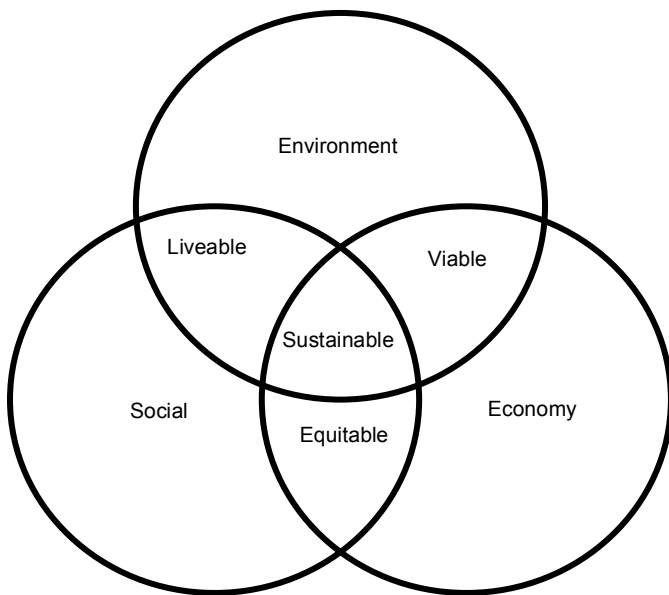


Figure 1. Conceptualization of Sustainable Development

Each dimension is generally divided into several areas, and each area, in turn, is divided into several sub-domains. The more complex the issue is to apprehend, the more indicators are recommended (Boulanger, 2004). For example, to provide information about the quality of surface water, a variety of indicators are used, such as the concentration of chemical pollutants, the limpidity, the health of aquatic fauna and flora, and the safety of the riverbanks.

The passage from dimensions to indicators raises several issues, one of which is the question of usefulness. The choice of one or several indicators to inform on a theme or a given sub-domain must take into account their usefulness. As informational tools, the indicators are used to quantify and synthesize complex phenomena falling under the constitutive dimension of sustainable development and to organize the information in order to give it a political meaning (e.g. benchmarking) (Bouni, 1998). The indicators must allow for the installation of an environmental and socio-economic diagnosis in order to support the sustainable development strategies projected. Therefore, key indicators appear to be essentially a system of information that has a political character. The information vehicle must be organized in such a way that it crosses the "world of research and science to be integrated with that of the policy" (Bouni, 1998: 21). Therefore, much subjectivity is inevitably introduced in view of the fact that the indicators chosen depend on, despite the use of relevant selection criteria, the targeted users, and objectives related to the analysis process. As a result, the procedure for the production of indicators is closely linked to the requested information.

Indicators, however, are not the only tools used to assess sustainability (see Ness et al., 2007 for a discussion and a comparison between the different families of tools to assess sustainability). Also, like any tools, indicators have limitations and advantages. For instance, they do not allow to account for the impact of a change in policy or the impact of the implementation of a specific project unless they are designed to assess actions and government programs (Ness et al., 2007). Additionally, they do not allow for greater evaluation of the flow of materials or energy than tools such as life cycle analysis (Harger and Meyer, 1996). In addition, they may not replace essential tools such as cost-benefit analysis, risk and vulnerability assessment, or dynamic analysis of a system (Ness et al., 2007), which are all essential and complementary to one another from a sustainable development assessment point of view. However, indicators are generally recognized for their simple character and their analytical effectiveness in that quantitative data generally fall within the three pillars of sustainable development (Ness et al., 2007). A grid of common indicators can play an important role in information systems in ensuring that the assessment truly reflects the values and concerns identified at a local level or municipal level, as well as at a higher level (Mascarenhas et al., 2010). Unlike statistics held by the



public administration (i.e. local or municipal), the indicators are an instrument of democratic evaluation rather than a management tool in the hands of only the authorities (Baker, 2004). In this regard, they generally perform two functions. They constitute a basis of information for political decision-making (internal use for municipalities), as well as contribute to the development of a common language covering the concept of sustainable development and of its constituent dimensions (external use for all categories of potential users). In some themes reflected by the indicators, the authorities may have the power to perform changes, while in others it does not.

In addition to the challenges of usefulness, the development of sustainability indicators also depends on the constraints of observations and measurements. In fact, several inevitable compromises limit the effectiveness of the indicators and lead to changes in objectivity. For example, we must take into account the request for concise information by users while simultaneously using a consistent methodological approach and considering the supply of data. From a scientific viewpoint, this compromise is often reflected by the use of fewer indicators that are less explicit; the data is then used to calculate information for the scale of the desired analysis (Singh et al., 2009). Let us take the example of poverty. It is commonly measured with the aid of one or several indicators relating to income, expenses, and the housing of individuals or households, since the statistical data referring to these indicators are easily accessible. Yet, poverty is also characterized by social and cultural dimensions in addition to its economic aspect (e.g. income, housing), (e.g. related to issues of exclusion and education). For these dimensions, there are several other indicators that are just as relevant whose measures, if they are available, sometimes require calculations or more complex adjustments (Boulanger, 2004). As we will see in the next section, such adjustments are often necessary when bridging the concepts of urban heritage conservation and sustainability measurement.

#### **4. Bridging Urban Heritage Conservation and Sustainability Indicators**

The literature on sustainable conservation of urban heritage often focus on one or two dimensions of sustainable development , rather than proposing a holistic approach

covering the three pillars (i.e. environment, sociocultural, economic). For instance, focusing on the environmental dimension, Liao and Jones (2010) have stressed the need to situate the problem of sustainable conservation in the context of climate change. Judson et al. (2010) have compiled a review of writings that have tried to measure the environmental performance of ancient buildings from a qualitative perspective (based upon established certifications, such as LEED) and a quantitative perspective (e.g. Life Cycle Assessment or LCA). From the LCA perspective, Wong et al. (2010) proposed a typology to measure the energy value of heritage buildings based on materials of construction, age, operational energy (Mj/M<sup>2</sup>), embodied energy (Mj/M<sup>2</sup>), and CO<sub>2</sub> emissions. They observed the importance of heritage buildings having adequate insulation to reduce their energy consumption. From another perspective, focusing on the built environment, Faddy recalled the central problem posed by urban housing density to the sustainable conservation of urban heritage: "Conventional wisdom is that sustainability equals an acronym densities (...) some historic suburbs are under threat from a push to accommodate dramatically an acronym densities" (Faddy, 2010: 402). He particularly highlighted the environmental costs (e.g. CO<sub>2</sub> emission impacts) that resulted in the demolition of buildings for the rejuvenation of park real estate from a perspective of densification of central neighborhoods. Su (2010) has proposed a few indicators to measure residential density. Some directly relate to buildings (number of floors, height, number of residents per building), and others relate to the surrounding environment (number of outdoor public areas, amount of interior and exterior parking). Many other examples exist that focus on other dimensions of sustainable development, such as the economic dimension (see Greffe, 2003) and the sociocultural dimension (see Volpiano, 2011), which are not relevant to further detailed for the purpose of this paper.

In sum, consideration of the three fundamental dimensions of sustainability for a holistic approach has yet to be achieved, as the environmental, economic and sociocultural aspects of sustainability are often analyzed separately. The use of indicators of sustainability is a good starting point to achieve this, considering their flexibility and their ability to translate such complex concepts into measurable information. Before identifying which indicators are to be used, several questions arise, including how to select these indicators and how to obtain key indicators that are able to encompass the

broad dimensions of sustainability efficiently. We address these issues in the next section and present the methodology used to select indicators measuring sustainable conservation of heritage.

## 5. Methodology

We conducted a four-step analysis. First, using computer based research engines, we identified 25 scholarly papers that focused on the use of indicators to bridge sustainability and urban heritage conservation. The selected papers propose indicators or criteria for assessing the sustainability of urban heritage conservation. The 25 studies are presented in Table 1.

Table 1. List of the 25 Studies

References	# of indicators	References	# of indicators
Rosado Correla et Walliman (2012)	29	Bullen et Love (2009)	16
Farhanah et al. (2012)	8	Lorenz et Lützkendorf (2008)	7
Yung et Chan (2012)	24	De Silva et Henderson (2011)	9
Suntikul et Jachna (2013)	6	Judson et Iywe-Raniga (2010)	5
Pendlebury et al. (2009)	4	Liao et Jones (2010)	1
Tweed et Sutherland (2007)	9	Wong et al. (2010)	5
Wang and Zeng (2010)	13	Zancheti et Hidaka (2011)	2
Volpiano (2011)	1	Zancheti et Hidaka (2012)	3
Peano et al. (2011)	6	Faddy (2010)	1
Phillips et Stein (2013)	8	WTO (2004)	24
Bullen et Love (2011)	24	Su (2010)	1
Pons et Roders (2011)	6	Landorf (2010)	5
Agyekum-Mensah et al. (2012)	6		

Second, we extracted the indicators used in these studies. We analyzed their characteristics, including their number, frequency of use, and nature. Such analysis is relevant to identify the common characteristics of the proposed indicators, especially if one is to select core key indicators.

Third, the key indicators were identified by applying two selection criteria to the indicators obtained from step two. These two selection criteria were frequency of use and systematic coverage of the main rationales of sustainable heritage conservation.

The first criterion involved selecting the indicators that were most frequently used among those that were present in the 25 studies. This was done to identify those that were most often mentioned and for which relevance and reliability are recognized within the scientific literature. Additionally, we wanted to include only those that were most frequently used, as those mentioned only by one study were considered specific to a particular context. Since our paper focuses on core indicators, such context specificity was beyond the scope of the present study.

The second criterion was applied to the most frequently used indicators. It involved ensuring that the selected indicators covered five aspects of urban heritage conservation, which emerged from the interpretation of two frameworks of indicators developed by Phillips and Stein (2013) and Volpiano (2011): i) characteristics, ii) protection motives, iii) enhancement opportunities, iv) use and impacts, and v) policy and regulations. To ensure such consistency, we organized the indicators into a framework with these five categories. In this step, we aimed for an equal number of indicators in each category to prevent weighting issues when the indicators will be measured. Such concern is also thought to contribute to the comprehensiveness of the indicators and to appeal to a broader range of involved stakeholders. Consequently, in order to reach an equal number of indicators in each of the five categories, the identified key indicators are likely to be further shortened by applying two sub-selection criteria. First, we retained the most frequently used indicators of each category. Second, to discriminate indicators with the same frequency of use, we chose one that was able to cover at least two of the environmental, social, and economic dimensions of sustainability. This was to account for the main characteristics of the indicators in the 25 studies, as it was found that most of the indicators covered at least two of the three pillars of sustainability. As advocated by Tanguay et al. (2013), subjectivity is inevitable in the development of such a set of indicators. We discuss some of the limits of this approach in the concluding section.

## **6. Results**

In this section, we first present the main observations revealed by our analysis concerning the lack of consensus in the number, choice, frequency of use, and the nature of

indicators. We then present the key indicators that are chosen to measure sustainable conservation heritage.

*Lack of Consensus in the Number, Choice, Frequency of Use, and the Nature of Sustainability Indicators*

First, a lack of consensus emerged concerning the number of the indicators used. In total, 117 indicators were identified, and each study used between 3 and 29 indicators at a time. Generally, cases that involved various stakeholders used a limited number of indicators. For example, the study of Farhanah and Mohamed (2012), which surveyed various actors, used only eight indicators to identify key characteristics associated with the sustainable conservation of heritage assets. Conversely, studies that were theoretically or conceptually more oriented toward a specific goal tended to use a larger number of indicators due to their concern with accuracy (e.g., Yung and Chan, 2012). As underlined in Tanguay et al. (2013), a trade-off between scientific consistency and the practical purpose of the indicators implies that a parsimonious number of indicators has been reached. Thus, a minimum number of indicators is desirable, but it is also important to maximize the coverage of the different dimensions of sustainable heritage conservation as well as the environmental, social, and economic concerns of sustainability.

Second, our analysis revealed a lack of consensus in which indicators to use. As illustrated in Figure 2, 70% of the indicators only appeared in one study, 21% were suggested in two and 10% were used in three. As a result, many indicators were not commonly used because they were very specific to a given building, site, or urban area. In fact, the number of indicators commonly used in more than four studies was quite low (7.6%). Such observations enabled us to identify the frequently used indicators, whose pertinence and value have been recognized and explained in the case studies.

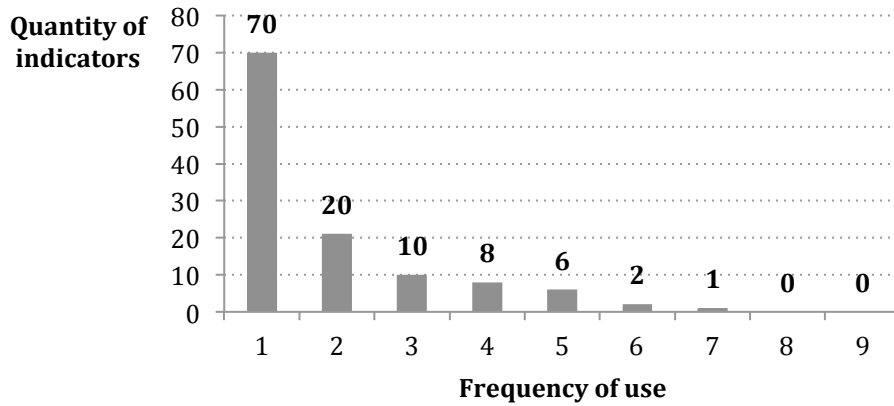


Figure 2. Frequency of Use of the 117 Indicators

Third, we consensually classified the indicators across the three integrated dimensions of sustainable development. Although we recognize the subjective nature of such process, it provides a good idea of the nature and type of indicators that are generally used to assess sustainability in urban heritage conservation. As illustrated in Figure 3, most of the indicators overlapped the environmental, social, and economic dimensions of sustainable development.

The results show that 34.74% of the indicators cover the overlapping of three dimensions, 28.81% cover the overlapping of the social and the economic dimensions, and 8.47% cover the overlapping of the economic and the environmental dimensions. Such results show that multi-dimensional indicators, which can encompass two to three aspects of sustainability at once, must also be complemented with one-dimensional indicators (e.g., CO<sub>2</sub> emission, sensitivity of the locals to changes). Consequently, the key indicators should replicate the distribution of the initial indicators, as show by the Venn diagram in Figure 3.

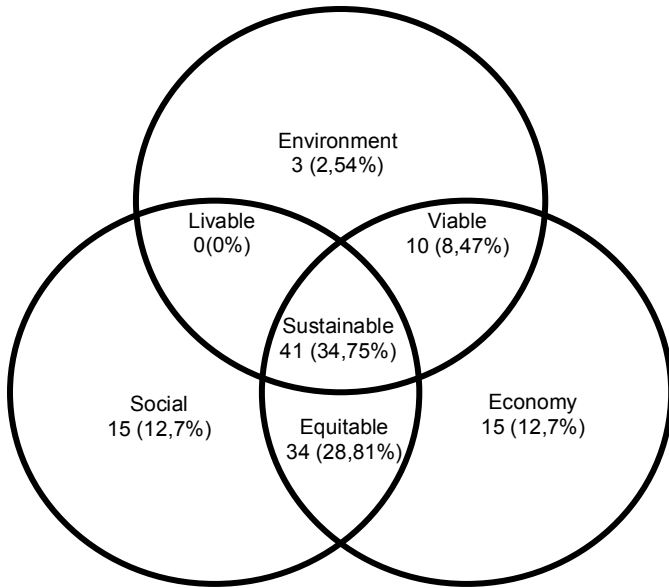


Figure 3. Distribution of the 117 indicators surveyed in the 25 studies

#### *Key Indicators*

The above discussion relating to the lack of consensus reiterates the relevance of establishing core key indicators. Such indicators are identified using the selection strategy described in the previous section. The first criterion applied to the indicators is the frequency of use. Amongst the 117 indicators, 48 are common to at least two studies. Hence, these have the most recognized and demonstrated pertinence and value. In addition, they are able to closely replicate the distribution of the initial indicators (Figure 3), as shown by the Venn diagram in Figure 4.

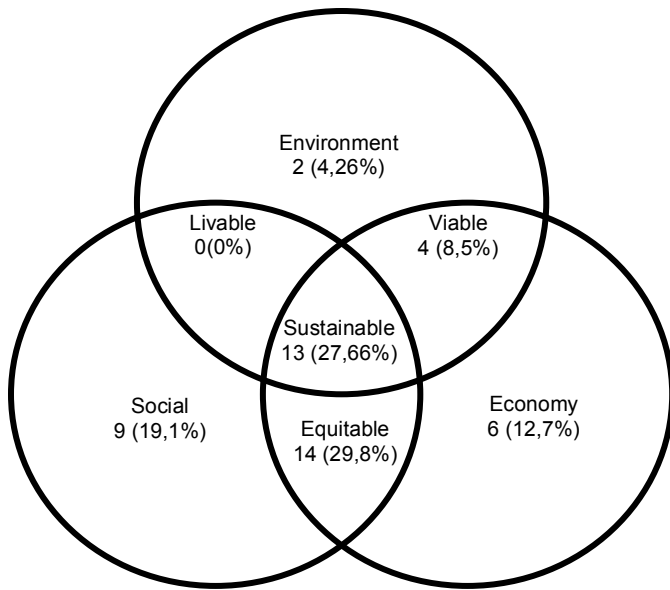


Figure 4. Distribution of the 48 indicators common to at least two studies

The application of the next criterion to the 48 indicators requires their organization into the five aspects of sustainable urban heritage conservation: i) characteristics, ii) protection drives, iii) enhancement opportunities, iv) use and impacts, and v) policy, incentives, and regulations. As shown in Table 2, 17 indicators relate to the characteristics of heritage buildings and sites, nine indicators cover the protection aspect, eight indicators address the enhancement aspect, six indicators relate to the use and impacts of the heritage buildings and sites, and five cover the policy and regulations matters.

Table 2. The Most Frequently Used Indicators Organized into Five Categories

Indicators	Covered Dimension(s)
<b>Characterisation (17 indicators)</b>	
Cultural context	Social
Sense of place and identity	Social
Sensitivity to change	Social
Attachement to place	Social
CO2 emission	Environment
Educational value or perceived	Soc-Econ
Historical value or perceived	Soc-Econ
Traditional value or perceived	Soc-Econ
Artistic, aesthetical and harmonious value or perceived	Soc-Econ
Symbolic value	Soc-Econ



Sense of ease and happiness	Soc-Econ
Risks situation	Soc-Econ-Env
Life safety	Soc-Econ-Env
Fragility	Soc-Econ-Env
Accessibility and location	Soc-Econ-Env
Building age	Soc-Econ-Env
Building fabrics, insulation and ability to adapt	Soc-Econ-Env
<b>Protection (9 indicators)</b>	
Public's sensitivity to change	Social
Cost-efficiency	Economic
Viability of recycling existing materials	Econ-Env
Resources and materials consumption reduction	Econ-Env
Authenticity	Soc-Econ
Integrity	Soc-Econ
Uniqueness	Soc-Econ
Spatial compatibility	Soc-Econ
Life span of existing building extension	Soc-Econ-Env
<b>Enhancement (8 indicators)</b>	
Maintenance capabilities	Economic
Opportunity for technical innovation	Economic
Environmental and ecological awareness	Environment
Opportunity for low pollution, emission and energy consumption infrastructure implementation	Econ-Env
Buildings and sites conditions awareness	Soc-Econ
Promotion of actions for further knowledge of historical-cultural heritage	Soc-Econ
Improvement of living conditions and quality of life	Soc-Econ-Env
Benefit of reuse versus redevelopment	Soc-Econ-Env
<b>Use and Impacts (6 indicators)</b>	
Locals and visitors interests and involvement to conservation	Social
Enhancing the role of communities	Social
Business and functional use	Economic
Investments and tourists drawing	Economic
Potential environmental quality of the surroundings	Econ-Env
Increase urban density	Soc-Econ-Env
<b>Policy and regulations (5 indicators)</b>	
Social cohesion and inclusiveness	Social
Public perceived consideration of their opinion	Social
Adequate protection and management system	Soc-Econ
Compliance with regulations and building codes	Soc-Econ
Stakeholders inclusiveness and partnership	Soc-Econ-Env

As discussed in the previous section, a balanced number of indicators across the five aspects of urban heritage conservation is aimed for methodological purpose. Two sub-selection criteria are applied to the indicators in each of the five categories to reach an equal number. First, we retain the five most frequently used indicators of each dimension. Five were picked because it is the maximum number of indicators that we could retain, as the policy and regulation dimension only has five indicators. Second, to choose between

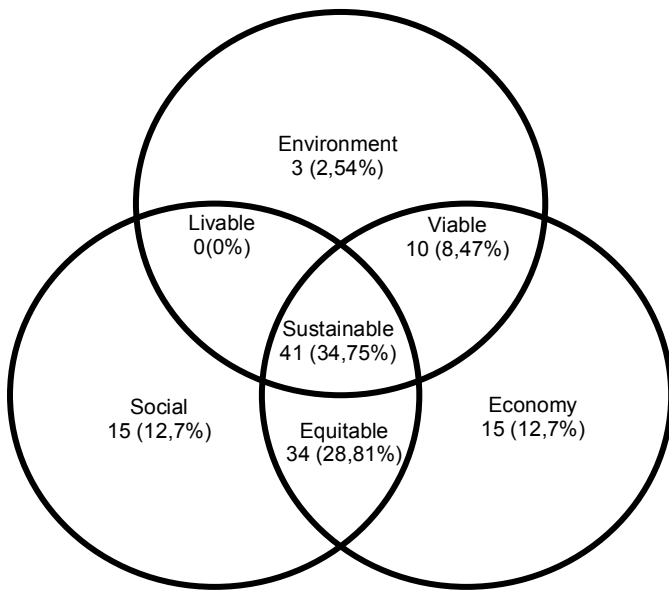
indicators that have the same frequency of use, we chose the ones that are able to cover at least two of the environmental, social, and economic dimensions of sustainability. This was to respect the main characteristics of the indicators in the studies, which are mostly covering at least two of the three dimensions of sustainability. At the end of this step, 20 indicators were retained (see Table 3).

Table 3. Key Indicators of Sustainable Urban Heritage Conservation

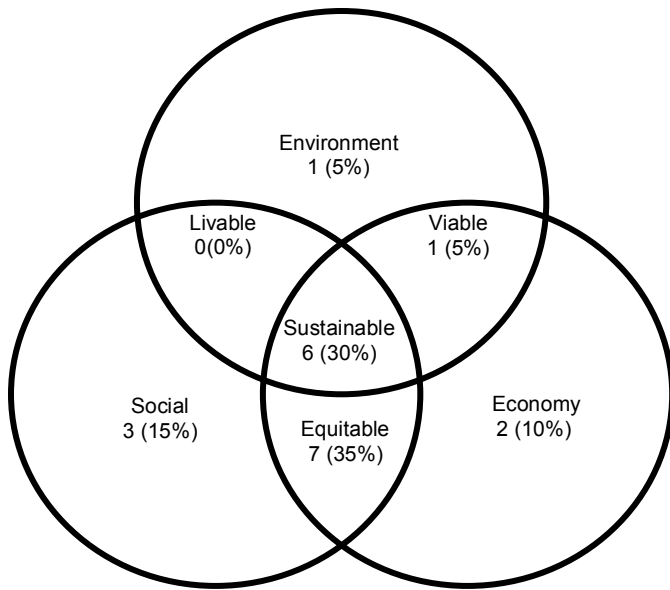
Indicators	Covered Dimension	Threshold
<b>Characterisation</b>		
Attachement to place	Social	5
Traditional value or perceived	Social-Econ.	5
Artistic, aesthetical and harmonious value or perceived	Social-Econ.	6
Building fabrics, insulation and ability to adapt	Soc-Econ-Env.	5
<b>Protection</b>		
Viability of recycling existing materials	Econ.-Env.	4
Authenticity	Social-Econ.	7
Integrity	Social-Econ.	6
Spatial compatibility	Social-Econ.-Env.	5
<b>Enhancement</b>		
Environmental and ecological awareness	Env.	5
Promotion of actions for further knowledge of historical-cultural heritage	Social-Econ.	2
Improvement of living conditions and quality of life	Soc-Econ.-Env.	5
Benefit of reuse versus redevelopment	Soc-Econ.-Env.	3
<b>Use and Impacts</b>		
Locals and visitors interests and involvement to conservation	Social	4
Business and functional use	Econ.	3
Investments and tourists drawing	Econ.	2
Increase urban density	Soc-Econ.-Env.	2
<b>Policy and regulations</b>		
Public perceived consideration of their opinion	Social	3
Adequate protection and management system	Social-Econ.	4
Compliance with regulations and building codes	Social-Econ.	4
Stakeholders inclusiveness and partnership	Soc-Econ.-Env.	2

In sum, the resulting indicators have four main characteristics. First, they represent the commonly used indicators and whose relevance is recognized throughout the literature. Accordingly, they were chosen from a first indicators identified through a review of specific literature on sustainable development indicators associated with the field of

heritage conservation. Second, they are able to reproduce how the first list of indicators is covering the dimensions of sustainable development. Thus, the 20 indicators coverage is closely comparable to that of the first list (see Figure 5a and 5b for comparison). Third, they address the major rationale behind the heritage conservation. In fact, they relate to: i) the characteristics of the buildings; ii) their protection; iii) their improvement, iv) their usage and impacts and v) the corresponding policies and regulations, with four indicators each. Finally, the indicators used include seven quantitative indicators and thirteen qualitative ones. These two types of indicators necessary in the assessment of sustainable heritage conservation are well represented in our approach. Our approach is thus distinguishable by its ability to not discriminate the types of indicators.



a) 117 Initial Indicators



b) 20 Final Indicators

Figure 5. Indicators Across the Dimensions of Sustainable Development

## 7. Conclusion and Perspectives

This paper builds upon the existing literature on sustainability indicators to propose a set of 20 key indicators that i) covers the dimensions of sustainable development, ii) are reliable and recognized among academics and professionals, and iii) are consistent with the diverse aspects of heritage conservation. In order to provide a good assessment of sustainable heritage conservation, the presented approach is distinguishable by its ability to not discriminate the types of indicators used. For instance, given the nature of urban heritage, seven indicators are quantitative while thirteen are qualitative.

The development of such indicators presents some advantages. First, it allows minimizing the risk of using indicators that are too exclusive, which is often viewed as hiding political intentions (Rametseteiner, 2010). In addition, local authorities tend to use indicators for which statistics are already available; The adoption of key indicators will encourage them to put effort into developing data collection methods to provide information that is of higher quality, more current, and that allows comparison amongst existing practices and experiences. Such comparison will help support local authorities in

sharing experience and learning from others. It will also make them less reticent to change by creating an environment that is more open to new ideas. Third, for provincial and national governments, such comparison allows for a more systematic diagnosis of urban heritages issues that affect local areas. As a result, it will become easier to develop general policy strategies.

Nonetheless, such an approach to sustainability indicators has its limits, especially because subjectivity is unavoidable in the choice of indicators, frameworks, and the methods of data analysis (Tanguay et al., 2013). First, the selection of key indicators is based on a non-exhaustive list of indicators that we have identified through a limited number of case studies. The indicators may not be exhaustive, but they are those whose relevance has been recognized and advocated for in relevant case studies. Second, different frameworks (e.g., goal-oriented, resources-oriented, capital-oriented) exist through which to organize the indicators (McLaren, 1991). In this study, the choice of the framework was guided by the intention to ensure that the indicators were consistent with the main aspects to be covered when addressing urban heritage conservation (Volpiano, 2011). Third, many data analysis methods exist. As a result, it is important to ensure that the selection of a method is justified and transparent. This study did not include an empirical section where choosing a method appeared to be problematic. In fact, this study was only conceptual and sought to identify key indicators that could serve as an assessment tool for the sustainable development of urban heritage conservation. Nonetheless, it provides a starting point for further research with an empirical basis through which indicators are computed and their usefulness and limits are further discussed.

Therefore, the development of empirical analysis and the use of indicators appear to be relevant, as the integration of sustainable development principles within urban heritage conservation has only recently emerged. In fact, municipal authorities and their partners have only begun to integrate the principles of sustainable development in their practices and in their policies of territorial development in the last two decades. This trend is reflected by the development of planning documents and policy strategies where these principles are applied to transport, land-use planning, public services, and (more recently)

to the development of the heritage. Today, much information has been gathered, policies have been implemented and realized, and planning has led to action. Thus, it is time to assess and evaluate the effectiveness of these policies and initiatives that are aimed at sustainable development and heritage conservation.

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