

SUSTAINABLE URBAN LANDSCAPE: AN APPROACH FOR ASSESSING AND APPROPRIATING INDICATORS

Ahmed Mohamed Amin

Abstract

The impact of development on its context is considered a key issue that governs the discussion and understanding of sustainability. For the reason, that ethics of sustainability are based on developing with no or less negative impacts on the contextual environment despite its urban scale whether limited or extended. This describes types of development that increase the good impacts on the tangible and intangible aspects of the built environment. Thus, achieving sustainability is no more a choice but it is a must especially, in an environment suffering from a lot of threats and stresses that affect all aspects of life; socially, economically, environmentally and also affect the beauty and aesthetics of urban fabrics. Assessing sustainability, the applied indicators and ways of assessment are all-important concerns for urban sustainability discourses. Especially in such sensitive interacting domains as landscape, that links nature with the built environment. Approaching these concerns has a great deal when enhancing our environment aiming at better urban life containers. This paper aims at investigating the issue of sustainable urban landscape assessment through discussing the hue of indicators, their ways of classification, the criteria of selection and stating the variety of methods in which they can be assessed. Finally, it appropriates an approach for stating and assessing urban landscape sustainability indicators, which evaluates their both qualitative and quantitative value upon performance scale.

Keywords

Sustainable urban landscape, sustainability assessment, sustainability indicators.

Introduction

Recently, sustainability has occupied a prominent but contested place on the public agenda. While few question the fundamental idea that human life on Earth must ultimately be sustainable, the precise definition of this term – especially in urban landscape - remains subject to deep disagreement. Therefore, there is a great need for more specific frameworks for interpreting and implementing urban landscape sustainability. Thus, sustainability in urban landscape has become an important topic because of perceptions of environmental degradation. However, it has also become salient because people have with the quality of life in their communities (Miller, 2007), (Soures & Quentella, 2008). Faced with diverse and sometimes contradictory goals, many communities have turned to indicators of urban landscape sustainability as an approach to establishing a more specific definition and implementation that are of importance in their

context. A key question arises: "How does one define the set of indicators? And also what are the measures to be used?"

Objective

The objective of this paper is to appropriate an approach for investigating and quantifying assessment of sustainability indicators in site landscaping processes. The problem concerning this discourse is the complexity and variety of the criteria that can act as a set of indicators and the qualitative aspects that are related to the majority of these criteria. Another important concern is the nature of measurements and how to fit them empirically with landscape designers. These attitudes that often prefer to deal with simple figures and/or charts rather than complex calculations.

This objective is achieved by discussing major discourses as sustainability definition, approaches and the nature of this term in urban context. This led to highlight sustainable landscape as system and subsystem, figure out the set of criteria ruling such a system and clarify the nature of relevant indicators. This is finally concluded by an approach for adapting and combining measurements for these indicators in the form of an index for quantifying sustainable landscape system.

Sustainability in the Context of Urban Landscape

The revolution of environmental awareness makes sustainability the theme of our times (IUCN, 1997). Hence, the environmental problems such as biodiversity loss, ecosystem degradation, landscape fragmentation, climate change

and urban heat islands are already exist and have a great stress upon the natural and built environment. Urbanization is often considered the cause for all these problems. The relation between urbanization and sustainability is still contradicting throughout the recent discussions of interest in sustainability. There are different thoughts trying to configure this relation, some consider urbanization is vital to regional and global sustainability, whereas others regard urban and sustainability as an oxymoron (Wu, 2010), (Thompson & Sorvig, 2008).

Logically speaking, if our cities are unsustainable, urban landscape should be part of the solution to regional and global sustainability problems (Benson & Roe, 2007). The concept of sustainability in association with urbanization and landscape includes both technical aspects such as energy saving, reusing material, environmental management or ecology and non-technical aspects like social behavior and spatial organization. This is to insure that urban sustainability encompasses more than ecologic technology and other quantifiable aspects. From design point of view landscape sustainability has to be approached holistically. This insures that the technological side of sustainability should be considered as an accepted standard and a self-evident part of the project requirements rather than a desired ideal (Christianease & Salweski, 2009).

Urban landscape planning and design should be understood as a multidimensional and multipurpose managed change of the natural and built environment, also, as a corner stone for sustainable cities. Thus, it influences the production of quality spaces, urban patterns, support of environmentally sensitive

development and promotion of participatory processes to allow citizens awareness and involvement (Rosales, 2010). It can be stated that, urban sustainability is fundamentally the sustainability of the urban landscape as a whole (Claudia & Kristin, 2009), so Indicators must highlight the following concerns:

- The process to measure urban landscape sustainability.
- The type of metrics that can be used as urban sustainability indicators.
- The landscape models that capture and project sustainability trajectories in response to environmental, economic, social changes? (Wu, 2010).

Landscape Sustainability: Discourses and Dimensions

'Sustainable landscapes' commonly describes landscapes that support environmental quality and conservation of natural resources. A well-designed sustainable landscape reflects a high

level of self-sufficiency. Once established, it should grow and mature virtually on its own as if nature had planted it (Benson & Roe, 2007). Sustainable landscape should emphasize critical issues and concerns such as:

• Aesthetic:

Although sustainable landscapes may appear more "natural" and less manicured, they still rely on basic principles to create a visually appealing combination of plants and materials. Aesthetic principles including accent, contrast, harmony, repetition and unity ensure the design is attractive, visually compatible and has a "sense of fit" with the context (see Figure 1).

• Functional:

This dictates whether the design will be usable and will meet certain health and safety criteria, Figure 2. In addition, Sustainable landscape has to elaborate other important factors such as cost effectiveness and maintainability. These are strongly connected with functional aspect and depends on the appropriate plants and raw



Figure 1: Combination of plants and materials to support the aesthetic dimension of sustainable landscape (Source: Author).



Figure 2: The compatibility of hard and soft areas as a function dimension of sustainable landscape (Source: Author).

materials selection, the compatibility between use and maintaining process, the location and also the ratio between soft and hard elements (Calkins, 2009; Vanderzen & Rodie, 2008).

• Environmental:

This focuses on several concerns such as enhancing landscape microclimate, increase biodiversity and maximizes reuse of resources. One of the major environmental concerns is that of using plants that provide habitat as well as aesthetic value. Moreover, resources can be reduced and waste can be minimized by choosing the correct plants and their locations (Smith, Clayden & Dunnett, 2008). Maximizing and reusing resources have recently received notable attention in the form of recycling. Effective sustainable design not only incorporates recycled materials, but also addresses how communities can recycle for the good of their landscapes (Rodie, 2010). Sustainable urban landscape should also address the concerns of sociability with its variant qualities such as diversity, cooperation, intimacy and sense of friendly spaces (Claudia & Kristin, 2009). However, even if the mentioned discourses are identified as urban landscape sustainability indicators or qualities, their use has been limited to their specific areas (Rosales, 2010).

A self-organized landscape as a conceptual frame for creating indicators

This can be defined by a setting that consists of a finitude of systems that expand and transform according to the objective of its site conditions. The concept of self-organization when is referred to urban landscape is inundated with diversity and temporality, The indeterminate, though site-specific condition, offers a shift from a modality to a notion of an urban landscape that is dynamic (Monacella,2004).

The definition of the landscape as morphogenesis enables a landscape to be reconsidered as continually shifting and emerging phenomena. Understanding urban landscape settings within these conceptual approaches is of great importance when aiming to crystallize a set of indicators. This should clarify the recognition of flexibility and multidisciplinary for every landscape setting and reflecting this dynamism as a frame for creating indicators.

Landscape setting as a merge of different system qualities

Understanding the landscape setting as a system is very important for identifying relations and aspects of sustainability, therefore deducing indicators for assessing it. The site landscaping patches do contain one of the

following systems:

- Static systems that do not interact with their environment and do not change such as rocks.
- Metabolic systems that require a throughput of energy, matter such as waterfalls.
- Self-supporting systems that have the ability to secure necessary resources such as simple organisms.
- Selective systems that respond selectively to environmental challenges such as plants.
- Protective systems that can protect themselves from adverse influences.
- Self-organizing systems that can change their structure to adapt to changes in their environment such as plants or human activities.
- None isolated systems that modify their behavior in response to the presence and activities of other systems.
- Self-reproducing systems that can reproduce systems of their own kind such as culture patterns and systems.
- Sentient systems that can experience pain, stress, emotions and so on such as humans.
- Conscious systems that can reflect their actions and subsequent impacts (Bossel, 1999).

These systems can be classified whether they are surface systems that can be sensed visually or core systems, which need a specific type of deep investigation to cover their property (see Figure 3).

Accordingly, each site is dependent on its landscape systems and defines a certain situation. The capacity of typical situations to hold together heterogeneous elements in a specific site and also the capacity to give them a primary common meaning is an important criterion of the basic humanity of urban space. (Thompson & Sorvig , 2008) Situation, despite its openness, is a useful term to describe urban landscape setting because the landscape domain does not consist of isolated categories, but rather of a mixture of themes, programs, typologies, contexts and methods (kavaliauska,2007).

Sustainable urban landscape design requires concerning about and designing landscape situations in a thorough and precise, yet creative and daring way. It is necessary that the urban landscape designer concentrate not



Figure 3: landscape settings as core and surface system (Source: Author).

only on the spatial and programmatic design, but also on the process of implementation. The process according to which a design vision is implemented also needs to be designed and this is all should be reflected when considering the discourse of assessment and deducting relevant indicators (Christianease & Salweski, 2009).

The Purpose of Landscape Sustainability Assessment

Assessing sustainability becomes more important when striving for enhanced urban landscape environments. One way of evaluating the outcome of action is using sustainability indicators (Hales, 2009). Indicators arise from values as one measures what he cares about and also create values as one cares about what he measures. The main feature of indicators is their ability to summarize, focus and condense the complexity of dynamic landscape environment to a manageable amount of meaningful information. By visualizing phenomena and highlighting trends (Rosales, 2010).

Indicators of urban landscape sustainability: What are they and why create them?

An indicator is anything that gives an indication to its reader of a key feature or state of a human or environmental system (Miller, 2007), (Bossel, 1999). Most frequently, indicators of sustainability take the form of quantitative measures of key features of human or environmental systems that relate to the long-term viability of human communities to better inform citizens, public, officials, scientists, or others who make decisions about aspects of sustainability, so as to improve the choices they make.

However, indicators are not merely technical

measurements; they are hybrids that meld technical considerations with human values (Miller 2007). Making use of sustainability indicators requires investing those indicators with meaning to the people who will have to use them, and that means adopting a different approach to creating them in the first place. Recently, many indices and rating checklist have been activated to ensure the efficiency and performance such as LEED, BREEAM, SBTOOL, and CASBEE ...etc. A November 2009 SITES report notes that landscape must improve the inherent benefits and services provided by ecosystems regardless of the type of site use, this is to be done through design, construction, operations and maintenance practices that follows the essence of sustainability ethics (Sustainable site initiative[SITE], 2009). This type of good practice represents a source for stating indicators that reflects critical issues concerning landscape.

For this, a rating system Credits are rewarded for areas that include initial site selection, pre-design assessment and planning, water, vegetation, materials, human health and well-being, construction, operations and maintenance and finally, monitoring an innovation. Seeking indicators for sustainable landscape is a complex issue and it falls into the responsibility of several parties such as the decision makers, designers, authorities and communal organization. The interest of each category affects the set of indicators represented by them and this may have negative impact upon the holistic concept of the sustainable urban landscape patch. This holistic approach can be articulated through basic principles discussing the degree of change for a certain site, the cautiousness in making decisions that could be risky, the responsibility to economic, environmental and

cultural conditions with respect to the local, regional, and global context, the use mimic patterns of the ecosystem benefits, the use regenerative technology and approaches, the use of system thinking approach, understand and value the relationships in an ecosystem, reflecting and sustaining ecosystem services; re-establishing integral and essential relationship between natural processes and human activity, linking long-term sustainability with ethical responsibility and Maintaining integrity in leadership and research Implement transparent and participatory leadership.

What makes for a good sustainable landscape indicator?

There are problems that could appear while choosing and using landscape indicators. Subjectivity represents one major problem, either on the selection of the representative indicators according to certain background weather scientific or social background (Bossel, 1999; Hasna, 2008), or on the evaluation of the indicators results according to lack of appropriate data which may result on missing vital information. In sustainable landscape, this could further lead to measuring what is measurable rather what is important. Other problem is over aggregation of too many things resulting in an unclear meaning and therefore bad communication and analysis capability.

The quality of sustainable landscape indicator can be assessed according to:

- Policy relevance or guiding visions and goals that describes the ability of the indicator to be associated with one or several issues, such as environmental, economic, visual and social. This linkage helps the indicator to motivate actions.

- Simplicity which present the information in an easily, understandable and appealing way.

- Validity questioning is the indicator has true reflection of the facts and if the data collected using accepted measurement techniques.

- Time-series data, describes the availability, reflecting the trend of the indicator over time.

- Availability of affordable data determines whether good quality data is available at a reasonable cost or it is feasible to initiate a monitoring process that will make it available in the future.

- Ability to aggregate information describes whether the indicator is about a very narrow or broader sustainability issue. For practical reasons, indicators that aggregate information on broader issues should be preferred. For example, in sustainable landscape setting some indicators could determine the status of certain concern and is preferable to measuring many other landscape potentials .

- Sensitivity so the indicator must detect a small change in the system.

- Reliability is achieved when the indicators arrives at the same result if you make several measurements of the same indicator.

- Another important concern is meaning discussing whether the indicator has meaning for people. Does it motivate them to want to change the way things are currently done? Does the indicator communicate more than just its factual content?

- It is important for the urban landscape

sustainability indicators to have good governance. Thus, indicators emerge from a process that engages people in defining and implementing sustainability in their own lives.

- Indicators have to ensure adaptability and flexibility, communities may acquire new values, learn new things or find better measures. The system of indicators has to be flexible and adaptable enough to change (Hardi and Zdan, 1997; Bossel, 1999; Miller, 2007).

The classification of urban landscape indicators varies and can be based on what aspect of the sustainability is assessed, what techniques/methods are used for appropriating index like quantitative/qualitative, subjective/objective, cardinal/ordinal, one-dimensional/multidimensional, and whether the indicator compares the sustainability measure for urban landscape across space or time or in terms of input or output (Singh, Murty, Gupta, and Dikshit, 2009).

Indicators, orientors and sustainable urban landscape

Urban landscape sustainability can be understood as the capacity of a landscape system to generate and maintain environmental conditions for an adequate, safe, harmonious and healthy habitat with a high environment quality that respects natural eco-systems that support it (Mackendrick & Parkins, 2004). This can define a set of sustainability indicator modules for urban landscape such as:

- The Safety Indicator Module which includes a variety of issues going from the satisfaction of primary needs such as health, learning to the protection against crime as well as the impact of natural and technological disasters.

- The Healthy Indicator Module that refers to a landscape within the city that has a healthy environment and that takes into consideration the environmental impacts of urbanization and urban landscape development patterns. This module incorporates indicators related to quality of the urban environment, urban form, urban metabolism, and sustainability of the urban local system (Kural, 2007).

- The Visually and Cultural Appealing Indicator Module which refers to the spatial quality because an appealing quality built environment contributes to collective interaction and favors the social cohesion in cities, quality of public space, the vitality of the city and urban landscape.

- The Efficiency Indicator Module that is another approach towards sustainable cities includes an urban development that guarantees the protection of natural, historic, architectural, cultural and artistic heritage (Hales & Prescott-Allen, 2002). These modules represent the most frequent demands for users in their landscape settings (see Figure 4).

- Another important thing is that understanding landscape as a system and subsystems has to elaborate the determination of the constraints and forces formulating them, thus understanding these forces is of great importance especially when figuring the hue of relevant indicators, as:

- Constraints of physical conditions and laws of nature that state that not everything is possible. This implies restrictions on landscape patches that cannot be circumvented. Such as, Physical environment and its constrained development by the existing conditions of the context and global environment.



Figure 4: Differentiated issues and orientors for landscape indicators (Source: Author).

- a) Al-Azhar park (Cairo)
- b) Children Park (Cairo)
- c) Setting in Saqara (Cairo)
- d) Smart village (Cairo)
- e) Setting in Dubai (Emirates).

- Constraints of human nature and human goals that state that not everything is desirable. This means that users for certain site are not restricted to act in narrowly confined ways.

- Constraints of time that are clarified in the role of time that determines the ratio of rates of threat to rates of response. If responses cannot keep up with threats, viability and sustainability

of urban landscape are at risk.

The understanding of these constraints should determine the limits and the prospected performance from landscape system. In addition, it ensures the applicability of the proposed landscape indicators and their proposed range of acceptance. Bossel (1999) introduced the term orientors to represent interests, values, criteria or objectives. Orientors in urban landscape are labels for certain categories of concerns. They are mostly general terms like health, existence, freedom, security and so on that represent important interests of people or systems in general, but which cannot usually be measured directly. Inferring their state of fulfillment could only be achieved from observing appropriate indicators, like temperature, leaf color, vegetation density, fluctuation of use and other indicators that reflect the nature of urban landscape patch and the pattern of use in it.

Developing indicator systems without explicit reference to the orientors about which they are to provide information does not make sense. If indicators for landscape sustainability are needed, the parties concerned in the design and development of urban landscape settings should be clear about what orientors would have to be satisfied to ensure a path of sustainability. These orientors have to reflect the relation between the environmental property and system category as a base for their emergence (Bossel, 1999) different environments (sea, land, desert, arctic) enforce attention to an orientation towards existence, causing plants and other organisms to avoid environments with which they are not compatible. Resource scarcity (water, land and energy) imposes an

orientation towards effectiveness, causing humans to develop effective and efficient means of using scarce resources.

The diversity and variety of environments cause an orientation of freedom of action, allowing humans as users and human organizations to respond selectively and appropriately to a multitude of environmental challenges. In some landscapes, the unpredictable variability of the weather imposes an orientation of security on humans and animals, causing search for shelter and food storage.

Eventual change in the environment causes an orientation of adaptability, enabling organisms, ecosystems and human organizations to cope with changing environment by changing their own structure and processes. The presence and behavior of other systems in the same landscape environment causes an orientation of coexistence (Bossel, 1999).

Quantifying/qualifying value control: Combining indicators with a performance scale.

Indicators measure completely different things. A common unit is needed that does not distort what we value about every single item. (Prescott, 1997) The most widely used common unit is money. The performance scale is presented by Prescott Allen in the field of sustainable development as an alternative to money, to allow the use of measurement that is most appropriate to the issue concerned. Cost and added value are measured in money. But other concerns related to landscape such as health, comfort, livability is measured in rates, numbers and percentages, and so on. Then, it is needed to define what are accepted and not

accepted concerning landscape indicators which helps to improve understanding of the nature of sustainability in such a domain, the result is a set of performance measurement, all using the same scale and therefore able to be used together and combined. Discussing key issues for sustainable landscape setting and stating the desirable and unacceptable performance range are critical to build consensus awareness on the relationship of human and environmental wellbeing that can be supported by designing landscape. Other concern is the compatibility between the surface and core system for the landscape patch which ensure the site wellbeing.

Implications of a Performance Scale for the Choice of Indicators

A performance scale can combine only those landscape indicators to which one can attach a performance value. Indicators are chosen if it is possible to define values for them that would be desirable, acceptable or unacceptable with respect to human or ecosystem wellbeing or with respect to the surface and core systems wellbeing that define them. For example, the quantity of a nutrient (such as nitrogen or phosphorus) in volume unit of soil is a valid performance indicator because it is possible to define acceptable (unpolluted) and unacceptable (polluted) levels.

Organization of indicators

The indicators are organized and combined up hierarchically from the lowest to the highest level. Let the levels be: System, Subsystem, Dimension, Issue and Indicator. Combining indicators up to the subsystem level yields two results (for two main subsystems affect the

performance of a whole landscape system such as an index of surface system and an index of core system). These are combined and projected upon performance scale into an index of sustainability or overall wellbeing by reading the intersecting points on the barometer. Combining scores of indicators also should take into consideration if the indicators are equally important or they should be weighted and averaged. Similarly, if a dimension is represented by one issue, that issue's score is the dimension's score. If the dimension is represented by two or more issues, the issues have to be aggregated following the same procedure. This process is introduced by Prescott Allen in the field of measuring sustainable development indicators. This paper is adapting the process for assessing sustainable urban landscape. It is also important to be aware that some Composite indicators are based on sub-indicators that have no common meaningful unit of measurement and there is no obvious way of weighting these sub-indicators. So, a clear idea is needed of which sub-indicators are relevant to the phenomenon to be measured (Urbel, 2003).

Sustainable urban landscape indicators: appropriating a frame for assessing indicators

The process of creating and assessing indicators of urban landscape sustainability is important, therefore, it helps the decision maker (the designer) to operationalize his ideas about urban landscape sustainability (Winograd and Farrow, 2011; Reed, Fraser, Dougill, 2005). The proposed framework for assessing sustainability indicators for urban landscape is configured through sequence of steps illustrated in Figure (5). First of all, the definition of the landscape system is needed to be clear and leads to a clear determination to the relevant two subsystems

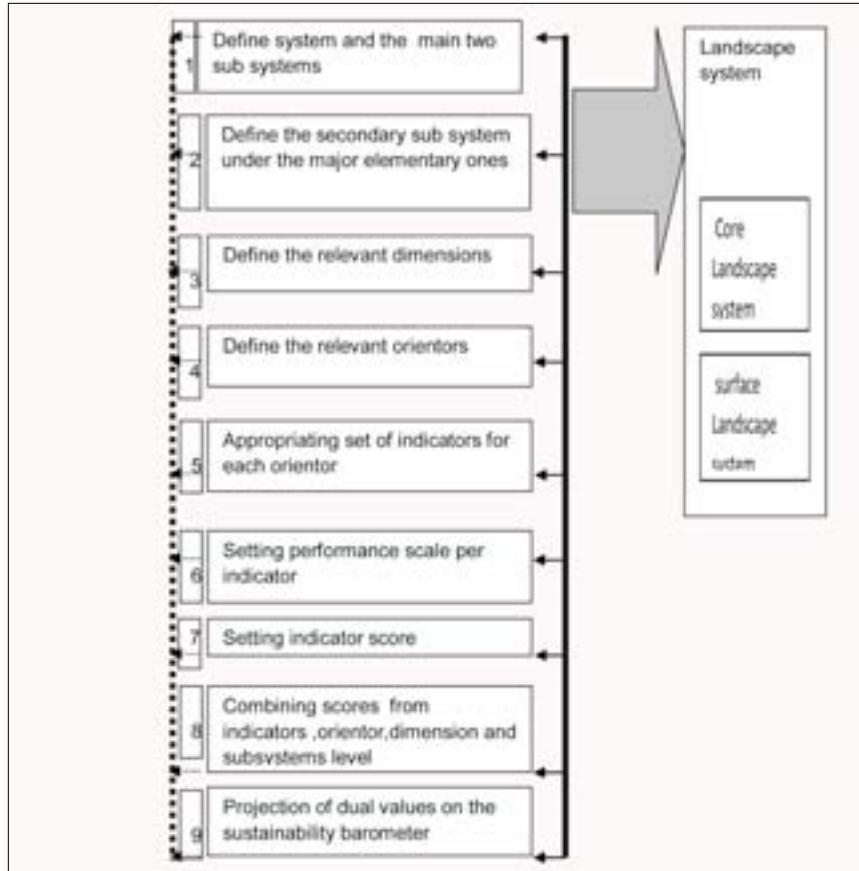


Figure 5: Framework for gathering and assessing landscape sustainability indicators (Source: Author).

that are affecting its performance. This will elaborate accurate configuration considering the other subsystems that are relevant to the major ones. Once, this level is clarified, it is needed to define the relevant dimensions and their relation to each subsystem. In addition, the set of orientors under every single dimension is need to be configured, this will lead to

determine the number and nature of relevant sustainable indicator under each orientor Then, appropriating a performance scale for each indicator and also to determine the score of each indicator upon the performance scale. Finally, combining scores from the level of indicators up to the level of subsystems and projecting the dual value for the landscape

system as a container of both surface and core system is projected upon the combined performance scale for each system. This loop is cyclic and has to end by reviewing results and assess implications.

This framework could be applied upon landscape systems for assessing and combining the sustainability indicators relating surface and

core systems (also, can be applied relating other landscape duals) according to the following hierarchy of levels and their relevant components, as shown in table 1 for site landscaping system:

- Subsystems (level 1) as, surface system and core system. The combined scores for these systems are projected upon scale divided to five

scale	0-20	20-40	40-60	60-80	80-100			
80-100	bad	poor	medium	good	very good			
60-80								
40-60								
20-40								
0-20								
system	Site landscaping							
Subsystem(s)	Core system		Surface system					
Sub-subsystem(s)	soft	hard	water	furniture	irigation	drainage	infra	horti
Dimension(s)	function	environment	aesthetic	economy	social	maintaining	other	
Oriantor(s)	Vital	Safe	Charming	Cost	Diverse	Curing		
	Special	Green	Pleasure	efficient	Steward-	Recycling		
	Flexible	Clean	Attraction	Cost	Ship	Durability		
	useful	Curing	Readable	reduce	Cooperati	Sustained		
		recycling	Convenient	Life	ve	Reuse		
			preference	cycle	Friend			

Table 1: Assessing landscape sustainability indicators (Source: Author).

The number and nature of indicators are based on several backgrounds such as theory, empirical analysis. They also cover the variety of orientors and dimensions. Selection requires a balance between simplification and complication. Based on the goal, the components will have to be selected whether it is of universal significance or for local conditions, as shown in table 2. Approaching the proposed framework for assessing urban landscape sustainability has to be combined by an appropriated tools for analysis and combining indicators.

Indicator(s)	Function
	Number of activity- balance between benefits/adequacy of standards- compatibility (use v.s setting)
Environ.	Rate of natural/ natural materials soil deterioration- rates of forest/ water- nutrients- energy/ pollutants prevention- quality of deposits- soil both embedded and operational- energy both embedded and operational- rate
	Of runoff/ dissolved energy consumption soil enhancement
aesthetic	Number of compositions- balance between benefits/number of selected elements-number of accent / complement/integrated patterns- users preference
economy	Initial cost- running cost- life cycle costing- monetary flow
sociability	Numbers of users- group- time of use- number of behavioral units, ...
Maintainability	Number of repaired items-complexity of process-quality of labor - bility
	Substitution of process

Table 2: Indicators and their relation to sustainable landscape dimensions (Source: Author).

margins (each one is 20 points) as bad (0-20), poor (20-40), medium (40-60), good (60-80) and very good (80-100), so the good performance must achieve the highest score for the two subsystems involved in the assessment.

- Subsystems (level 2) as soft, hard, water, furniture, irrigation, drainage, infrastructure and horticulture. (The score of systems is deducted by averaging total sum of values for each subsystem divided by the number of proposed subsystems).
- Dimensions as, functional, environmental, aesthetic, economy, sociability and maintainability. (The score of subsystem is deducted by averaging total sum of values for each dimension divided by the number of proposed dimensions).
- Orientors as, vital, special, flexible, useful, safe ,green clean, curing, recycling, charming , pleasure, etc. (The score of dimensions is

deducted by averaging total sum of values for each orientor divided by the number of proposed orientors).

The use of tree diagram for breaking down the landscape system and distributing the involved indicators acts as on-hand appraisal tool. This helps to organize sustainable landscape indicators and enables the landscaper to configure the possible relation between landscape settings as a system and its relevant subsystems, dimension and smaller classifications. This gives an elaborated and holistic view for the landscape settings. In addition, this tools helps to determine the cross relations between the dimensions and orientors and their common indicators. The flow up of combining indicators from the level of dimension to the level of subsystems and system using the tree diagram is illustrated in figure 6. For example if the scores of water quality and water supply on the performance scale are 40 and 70 respectively, so the score of the water as dimension - in the case of the same relevant indicator importance- will be 55 on the performance scale.

Conclusion

The landscape settings do have a great deal towards enhancing sustainability in the urban fabric due to its hue, which combines natural and manmade components. Sustainable urban landscape encompasses more than ecological concerns. Although ecological concerns and adapted technologies are mostly connected to sustainability, sustainable urban landscape has to appropriate other intangible dimensions. Thus, there are several aspects considering

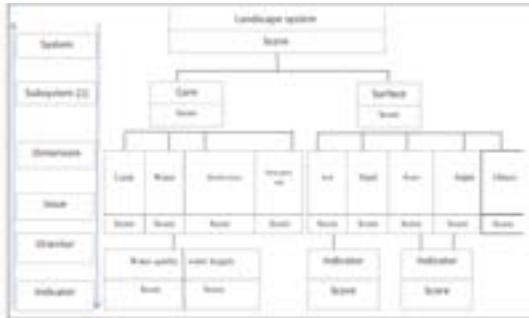


Figure 6: The tree diagram as an on-hand appraisal tool (Source: Author).

the sustainability of urban landscape. These aspects are differentiated between aesthetics, functionality, environmental awareness, cost effectiveness and maintainability. These aspects are also associated by other concerns such social and communal interactions. Sustainable urban landscape is a state of balance and complementation between these aspects all-together in order to enhance the contextual environment and to raise the quality of life. One of the pillars in sustainable landscape approaches is to believe on the aesthetics, visual interests and perceptual preference of functional, ecological and workable landscape patterns rather than the artificial, vague ones.

Although rating checklists as "Leed and Site" give a qualitative value control/analysis, it is still needed to work on quantifying qualitative attributes for sustainable urban landscape by clarifying indicators statements and its initiator orientor as a keystone in assessing sound figured values for sustainable site landscaping conditions. Thus, some of the indicators have a defined and direct scaled value but there are many which are hybrid and have embedded

indirect values. The landscape is not simply an ecosystem versus human wellbeing system. Other systems such as surface system and core system might be involved according to the level of influences that is analyzed.

It is of great importance to define landscape settings as a series of correlated operational systems. This will appropriate a better understanding concerning contextual and in core impacts. Thus, the quality of sustainability index of any system depends on the accuracy and comprehensiveness in stating relevant indicators and figures the scaled value for them. Also, this quality is affected by the multidisciplinary, indeterminacy, dynamism and morphogenesis aspects in site landscaping patches, which increase the level of difficulty and complexity in assessing sustainability indicators.

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Ahmed Mohamed Amin

Ahmed Amin is an associated professor in the department of Architecture, Faculty of Engineering - Cairo University. He received his Bachelor of Architecture with highest honors followed by Masters in Urban landscape and Ph.D. in landscape architecture from Cairo University. He is currently on leave of absence and lecturing at the Department of Architecture and Environmental Design at the Arab Academy for Science and Technology in Cairo. His research interests includes urban landscape assessment and metrics, aesthetics preference in urban landscape environment, appropriated and regenerative approaches in sustainable sites landscaping and value engineering applications in the field of landscape. He can be contacted at amin_ahmedamin@yahoo.com