

SUSTAINABILITY INDICATORS: MEASURING THE UNMEASURABLE

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Summary

Key Performance Indicators for buildings have been applied in a production oriented way emphasizing construction time, costs and quality. User driven indicators focusing on perceived performance (e.g. usability, adaptability and comfort) are not so widely known. Moreover, many of those related in particular to usability and adaptability fall into the domain of the so called perception indicators, whose definition becomes fundamental to understand the complex relationship between certain objective conditions and their assessment by the user.

This paper shows an approach towards value metrics from the point of view of end users of facilities (owners, users and the society). The starting point is achieved by measuring life cycle performance against related costs and carbon footprint. The next step is to bridge these indicators with owner's sustainable businesses, happiness of changing users of the facility and quality of life of citizens. This, in turn, presents an interesting topic for reflection in terms of

- harmonizing the different, and sometimes opposed, interests of parties involved
- addressing the complex nature of the concept of well-being, either taken at an individual level: happiness of users, or at a social/urban level: quality of life of citizens
- realizing once more that sustainability cannot be achieved as an addition of a series of 'sustainable moves', but as the result of a holistic approach

Keywords: performance indicators, well-being, social sustainability, value metrics, carbon footprint

1 Context

At present, more than half of the world's population is living in towns and cities [1], fact that supports in itself the idea of Maurice Strong, General Secretary of the Stockholm 72 and Rio 92 summits, for whom *'the battle for sustainability will be won or lost in the cities'*. What lies behind this statement is the realization of the key role of the city, not only in terms of its environmental impacts and its contribution to the global warming associated to climate change of anthropogenic origin, but also as the main centre of production of all types of 'goods': information, values, culture, services, education, innovation, leisure, etc. The city is also the place where new social movements appear and spread, and influences heavily the surrounding territory in numerous ways. Finally, as many suggest, the role of

cities should be understood in the context of what has been called Global Change, which poses important challenges but also a lot of opportunities [2].

Following this train of thought, buildings and their contribution to sustainability, as important as it may be, must be inserted in a wider strategy operating at city and even regional level. A collection of ‘sustainable buildings’ doesn’t necessarily produce a ‘sustainable city’. However, this must not lead to neglect the importance of buildings’ performance, on the contrary, it should be considered instead with a bigger scope, shifting from urban scale to building scale and viceversa in order to achieve integrated and lasting solutions. As a consequence, assessment tools and methods, like the performance indicators discussed here, should be also subjected to the same consideration.

On the other hand, despite that to date more than 2.500 local governments around Europe have signed the Aalborg Charter, thus joining the Sustainable Cities and Towns Campaign, the results achieved until now are far from being satisfactory, as proven by the increasing environmental impacts of urban systems. This shows that, in practice, this commitment does not translate into a real change of paradigm when planning the future of our cities and towns. So, there is a clear need for setting goals whose level of accomplishment must be checked at the end of the period established for their completion, which implies there is a need for reliable metrics. Finding adequate indicators for the building sector can have an enormous influence on the final outcome.

Finally, this paper is the result of a joint reflection on perceived performance indicators, focusing on the user’s experience, very often not properly addressed, particularly when referring to housing. The fact that Finland and Spain represent different realities regarding economy, population, climate, etc. demands a previous harmonization if any general conclusions are to be drawn, and also allows both parties to benefit from a sometimes entirely diverse perspective.

2 Key Performance Indicators for buildings

ISO/TS 21929-1:2006 defines that sustainable building achieves the required performance with the minimum of environmental impact. In parallel, sustainable building encourages economic, social and cultural improvement at a local, regional and global level [3]. But in practice, there’s been a clear focus on environmental and economic aspects of sustainability – at all levels, while somewhat neglecting social and cultural ones. However, it has been claimed that well-being should be the main target for all economic, health and social policies undertaken. Therefore, having a set of national indicators of well-being is important, not only in terms of its intrinsic benefits, but also because of the positive outcomes it can produce, such as worker productivity and rewarding relationships [4].

At present, some governments around the EU have started to follow this recommendation, thus recognizing well-being as an essential part of sustainable development [5]. This principle bears such importance that should become transversal to all decision-making processes and productive sectors, and that includes sustainable building.

Traditionally, construction related Key Performance Indicator (KPI) systems focus on the delivery process [Fig. 1]. These production oriented KPIs (construction time, costs and defects) may also cover aspects related to the performance of the supply chain. Measuring sustainability of buildings or built environment should emphasize issues like

health and comfort of users and usability, carbon footprint and life cycle economy, that are not necessarily connected with the traditional KPIs.

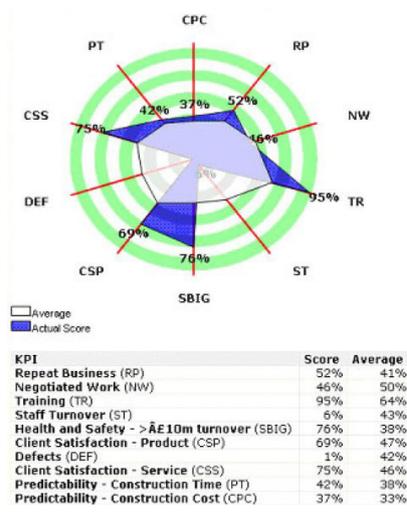


Fig. 1 An example of process and company KPIs [6]

CREDIT (Construction and Real Estate – Development of Indicators for Transparency) project [7] developed an indicator framework focusing on issues that are relevant for the users in the operation phase of buildings (location, performance, life cycle costs, environmental and social impacts) trying to link that with metrics that can be used in real estate business by owners and linking that with the user experience [Fig. 2].

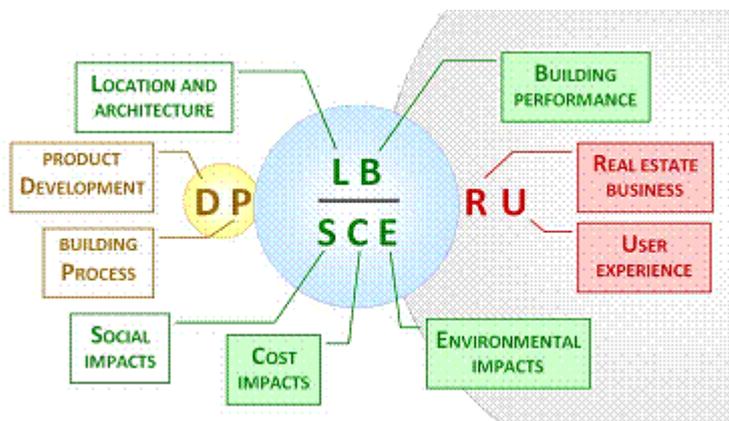


Fig. 2 The performance indicator framework in CREDIT project

Perfection (Performance Indicators for Health, Comfort and Safety of the Indoor Environment) project [8] aims at developing a framework for indoor performance indicators and mapping them to sustainability [Fig. 3].

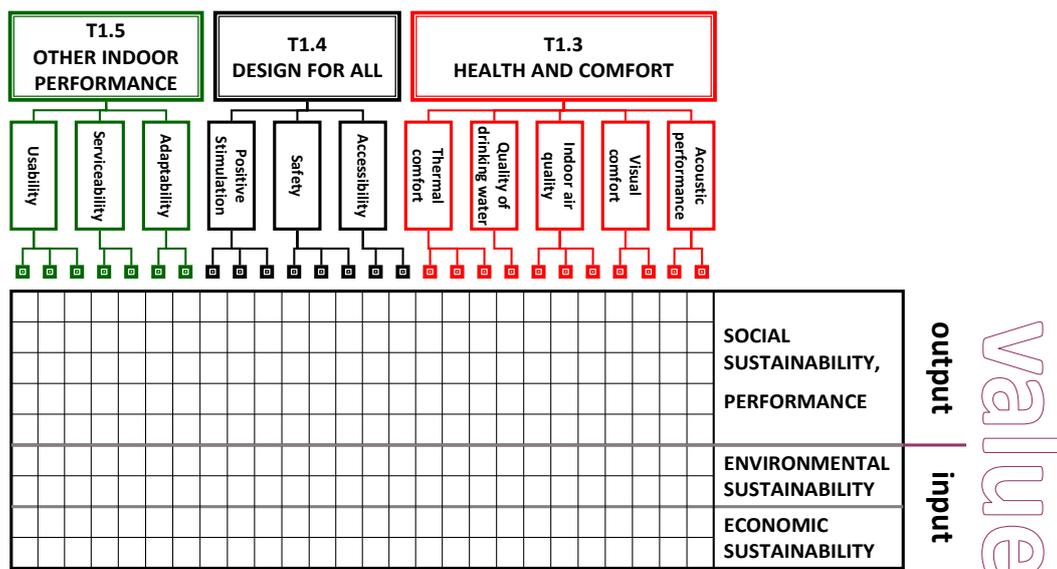


Fig. 3 The indoor performance indicator framework in Perfection project

These are all examples of attempts trying to link provided sustainability metrics for buildings focusing on the performance in use with their impacts on nature and economy. In addition to that, they are both international joint projects oriented to develop a shared base of knowledge regarding performance indicators that is flexible enough to allow adaptation to national or regional particular circumstances, while having a common assessment ground necessary for comparison, which is very much the objective of the research promoted within the EU.

3 Focusing on the users' experience: indicators of perceived performance

All variables should not be called indicators. Good indicators need to provide a clear link to the performance goal. They must be based on reliable information and appropriate data must exist and should be obtained. Good indicators must be understandable for the community. They must be measurable and reliable in use.

In Finland, many owners of companies collect and benchmark systematically economic performance indicators of the built assets. Also some environmental impacts like energy consumption and performance indicators, such as indoor conditions are monitored, especially in office buildings. The frontrunner owners also have their systems for collecting information about the user satisfaction, especially after a refurbishment process.

The challenges in comparing these results often contain the following aspects

- how should the changes in electricity consumption be measured (energy efficient refurbishment with improved indoor climate)
- how can the aspects of building performance be differentiated from other changes (renovation often contains adjustments in the work processes, like moving from a cell office to an open office)

- how can aspects related to location - or general sentiment be differentiated from aspects the respondents are judging (room temperature before or after holidays, conflicts with the boss, etc.)

Spain has suffered a spectacular development of the building sector during the past 15 years, which in turn has produced an unprecedented increase in the environmental impacts traditionally associated to this activity – energy, water, materials, land and waste, as well as important social and economic consequences [9]. Energy consumption within the sector has increased by 53% since 1991, while country emissions of GGs are over 55% with respect to 1990 when, according to the Kyoto Protocol, they shouldn't be above 15%.

Regarding the sustainability of the building sector, the roles played the public administration on the one hand, and private companies on the other, should be clearly distinguished. The public administration, committed to the fulfillment of the targets set by Kyoto, and the translation into the Spanish legislation of the Directive 2002/91/CE on the energy performance of the buildings, approved in 2006 a new Technical Code for Building [10], that has become the main benchmark for building design and performance particularly in relation to safety and indoor environment. In addition to this, the different administrations of the autonomous regions have developed assessment tools generally based on the application of a series of recommendations or good practices [Fig. 4].

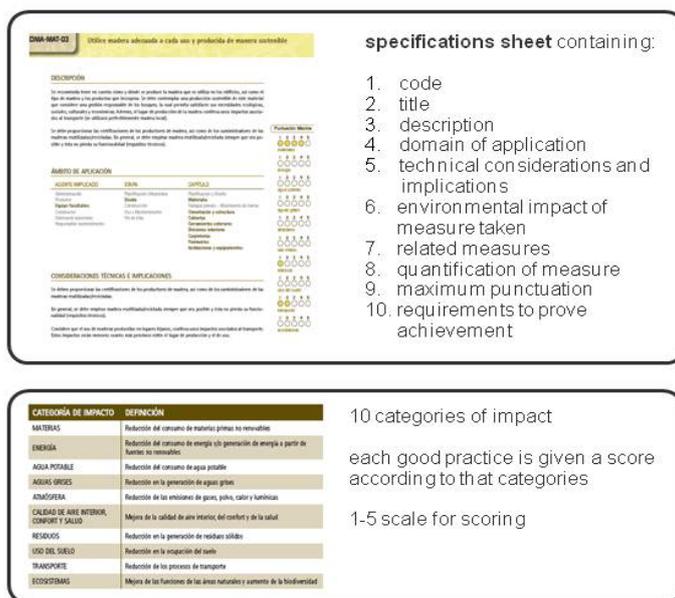


Fig. 4 Guide to Sustainable Building for Housing in the Basque Country [11]

In the private sector, construction companies have focused on the assessment of the environmental impacts caused by their activity, not only because these can be easily linked with physical parameters to be measured on site during construction works, but also because the outcome in this area can have a great influence on the company's risk management strategy [Fig. 5] and [Fig. 6].

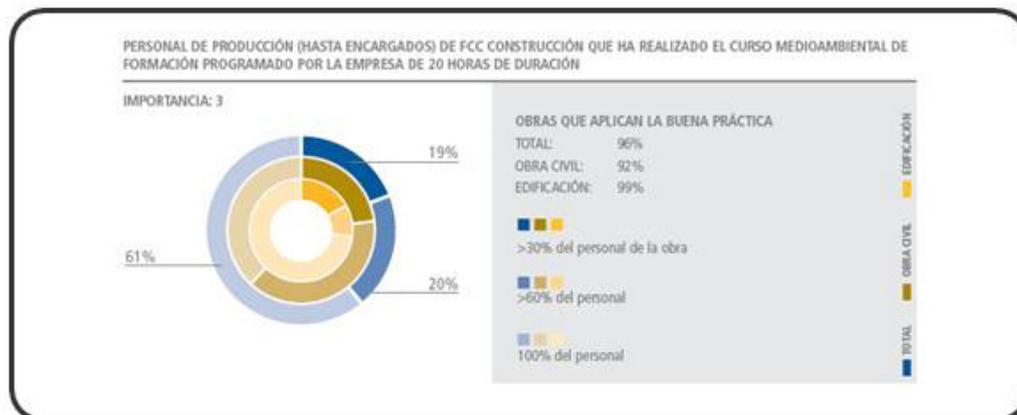


Fig. 5 FCC's Good Environmental Practices [12]

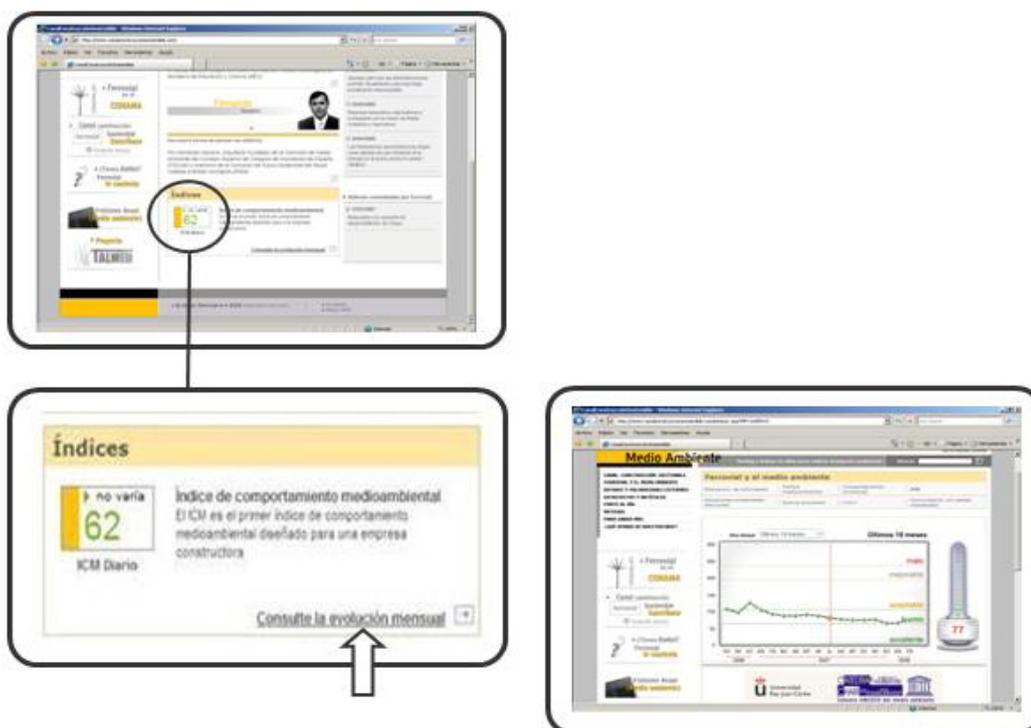


Fig. 6 Ferrovial's Environmental Performance Index [13]

Both the public administration and real state companies, which are in many cases a division of construction companies, normally use surveys to assess user's satisfaction after the hand over. And again in both cases, the information gathered relates to construction defects, energy performance and indoor environment.

So basically, the data collected relate to measurable concepts for which there are value metrics, whereas those concepts somewhat 'unmeasurable', like for example adaptability or usability, don't have clear value metrics, even if there is a consensus regarding their definition. Not to mention spatial qualities and their perception by the

users, an even more challenging domain. But the fact is that, without sound indicators for both groups, it is very difficult to assess how they interact with each other modifying the final users' perception, even though there is certain evidence of this happening. For example, location can change the user's perception regarding confort parameters or value.

4 Relating these indicators to sustainable cities, businesses and lifestyles

The ISCE (Índice de Sostenibilidad de la Construcción para España) project [14], aimed at developing a Sustainable Index for Construction Works in Spain, divides the phases included in the building process –considered from the complete life cycle perspective, both in terms of materials and processes- into two groups: the ideological model and the operational/functional model [Fig. 7].

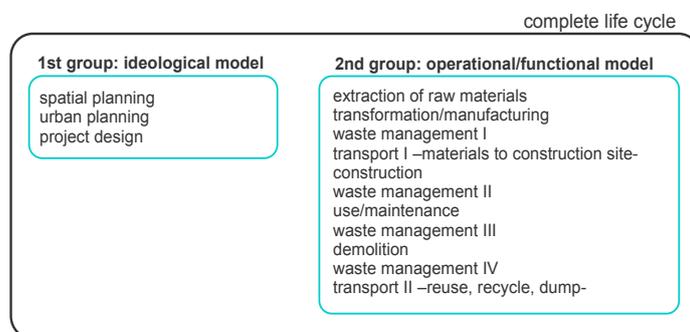


Fig. 7 Phases considered by the research team in the ISCE Project

The phases associated to the 1st group are considered of key importance, since the indicators selected in relation to them will be the result of the application of an ideological model or, if preferred, a proposal on how we want to live. Thus, Spatial Planning is a powerful tool capable of fostering the economic activity while improving productivity and energy efficiency at the same time. Different models of occupation produce different synergies on the territory, different patterns of mobility and accesibility, etc., which in turn has a strong potential influence on social well-being and user's satisfaction. In a similar way, Urban Planning has a definite impact on sustainable building by means of setting previous unavoidable conditions, e.g. orientation, height, alignments; not to mention other factors like density, green surface per inhabitant, noise levels, services available, accesibility or social integration, which bear an enormous importance to the city economy, the citizens' perception of the city and their level of satisfaction and identification with the cultural values of the community.

Finally, taking into account that buildings support most human activities, and also that people spend an increasingly amount of time indoors – around 90% in Western countries, the decisions made during Project Design phase heavily condition the later use of the building, not only in terms of psychological perception and general satisfaction, but also in terms of productivity, energy efficiency, easy maintenance and refurbishment, etc. In consequence, the development of sound indicators for these phases should be emphasized.

Neskey (New Partnerships for Sustainable Development in the Knowledge Economy) project [15] stated that new economic feedback system should use a core set of measures, indexes, and methods commonly used by businesses, cities and regions, civil society, and governing bodies where global networks and practice communities collaboratively improve measures and methods. The research should focus on intangible reporting for cities and regions and identified city and regional metrics as drivers for corporate and government scorecards linking measures to local and regional quality of life. In the knowledge society (unlike in our industrial society dominated by big corporations) small businesses, civil society, government and education are the real drivers of the economy and offer higher leverage.

Sustainability sets challenges to successfully create and maintain accessible environments for all. It requires usable access to transport, public spaces and buildings for all kinds of users, such as disabled people, elderly citizens and children in prams [16]. Another issue is to provide positive stimulation that may support preventive healthcare and ways to enable special groups to manage their everyday life at home and access to needed services. Such indicators can be specific, or applicable to all. Accessibility is included amongst the performance criteria in many existing tools even though its content may not have been defined at sufficient detail [17].

In order to gain a broader perspective, the abovementioned ideas and actions proposed should be regarded in connection with

- other important phenomena inherent in what has been called Global Change, like massive consumption of fossil fuels and the associated energy conflict, climate change, the loss of biodiversity, the water crisis, the food security issue or the economic uncertainty, among others [18]. Together, they form a rapidly changing scenario that threatens social stability in developed and developing countries alike.
- the fact that more and more cities around the world have lost population in the past 30 years, or are expected to in the future. This will also affect both developed and developing countries, although due to different reasons in each case. But, even if it seems to contradict what has been stated at the beginning of this paper –people are leaving rural areas and moving to cities–, in fact must be regarded as part of the same reality: cities are growing but when the living conditions degrade to such extent that there is an obvious loss of quality of life, their population might tend to shrink.

This is all the more important in a context of competitiveness where cities struggle to get a strong city brand that attracts visitors, businesses, highly qualified workers, events, etc., fostering the creation of value and thus improving their economy [19].

5 Conclusions

- The highly complex and rapidly changing reality we live in calls for the development of sets of indicators that fit better our present and future needs, these considered both at a local and a global level.
- The actions taken must be consistent with the aims of the Sustainable Knowledge Society as defined by the EU Lisbon Strategy to promote a new economy model.
- Although a lot of building performance indicators have been already developed from different points of view, they are mainly used to describe ‘tangible’ or ‘measurable’ concepts.

- Even accepting that, for the time being, many indicators will still remain ‘unmeasurable’, there is a need for further research in order to find adequate value metrics for those somewhat intangible concepts directly related to individual and social well-being. This will require a bigger scope than usual, shifting from urban scale to building scale and vice versa in order to achieve integrated and lasting solutions.
- In parallel to this, future research should also address the interaction between ‘measurable’ and ‘unmeasurable’ concepts and its influence on user’s perception of the built environment.
- This in turn raises the following questions: (1) the need for revitalizing the research on new ways of housing, lifestyles and social trends, very much neglected during these past years of fast growth and rapid-cash economy; and (2) the need for channeling people’s participation into the research process, thus becoming involved from the beginning.
- Since these problems interest both developed and developing countries alike, joint research on these matters should be considered in order to benefit from the mutual transfer of knowledge.

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