A Holistic Method of Evaluating Sustainability

This article presents a holistic method for evaluating sustainability. Primarily developed for buildings and urban development, it can also be applied to other products – as well as for evaluating sustainability in a broad sense. It is not an abstract model but a concrete tool for planning and design as well as evaluation and comparison of projects. In contrast to existing assessment tools, it operationalises the concept of sustainability in its full sense. The method has been developed by Chris Butters in NABU, Norwegian Architects for Sustainable Development. Sustainability is evaluated and presented in the form of a *value map*.

Chris Butters

In the past decade we have seen a variety of tools for evaluating buildings and other products in an environmental perspective. Many are theoretical and still too unsystematic or complicated to be useful in practice. Most are *environmental* assessment tools, which cover only limited parts of the concept of *sustainability*.

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Benchmarking and sustainability

Sustainability cannot be precisely defined – nor is this necessary, since sustainable development refers to a dynamic process from one state towards another. All buildings, towns or societies evolve, for better or worse, through time. Our horizons – both our ambition levels and our technical possibilities – will also change. Broadly defined, we can say that sustainability means positive social and economic development on a long-term basis within the framework of the carrying capacity of the earth's ecosystems.

If human settlements are to fulfil the goal of sustainability, then we need tools to set targets, plan, design, and evaluate. We also need such tools as a scientific basis for comparing different projects, and for evaluating how they develop over time.

Benchmarking, the setting of defined quantitative goals, is already common in some fields, for example space requirements, energy norms, permissible emission levels, etc. Some people still understand sustainability as a question of *technology*, related to pollution, wastes, energy and the like. But these are only the eco-technical or *material* aspects. There is now universal acceptance that sustainability has three components: *ecological*, *economic* and *social*. And all three are essential; rather like a three-legged stool; if one leg is missing, the whole thing will fall over.

Existing systems

There are already a number of tools for evaluating the environmental profile of buildings, as well as other products. Do we need another? As noted, the main weakness of these systems is that they are *environmental* assessment tools that do not address *sustainability* in its full sense.

BREEAM, Norway's Ecoprofile and Arup's SPeaR are amongst the systems that use a

graphic presentation inspired by circular "wind rose" diagrams. This was probably first applied to buildings for assessment of indoor climate, as in the Swedish Örebro-model. The wind rose visualisation is attractive, but has been transposed to the field of buildings in a rather unthinking fashion. The selection of parameters is often unsystematic. Important factors are left out, and different kinds of parameters are sometimes jumbled together. Wind roses show frequency of wind according to the compass points, but when one uses points rather than segments to demarcate values, then the area covered becomes visually misleading.

The manner of visualisation is also basically counter-intuitive. Almost without exception, these tools show the degree of *negative* environmental effect. Their "goal" is the zero-point in the middle of the circle; in other words, the worse the building, the bigger the star it gets. But we read the size of a star intuitively as denoting *positive* quality. (And we must present the positive, not the negative image.) So the picture must be structured in the opposite way.

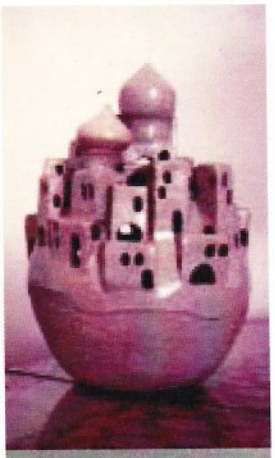
The highest value in these systems is often a rather vaguely defined "excellent", which does not always correspond to the very best practice that already exists. Why set an upper goal of 50 kilowatt hours per m2 when zero energy buildings already exist? Users do not get a true picture of what the goal is, or what is already possible. Though we cannot define sustainability precisely, it is beyond doubt not a matter of improving today's systems by 10 or 20 %, but of big changes. The horizon we are aiming for is a long way off, and this horizon must be *communicated* graphically.

The Value Map

Although sustainability is an imperfect concept, it provides a common basis for holistic, cross-sectoral understanding. The Value Map visualises the goal that *all* architecture, city building and other production should fulfil the three conditions of sustainability. *Ecology* refers to environment and resources, *economy* encompasses financial and institutional factors, whilst society encompasses cultural, human and community aspects.

In contrast to the systems described above, the Value Map has the following characteristics:

- the circle is divided into three equal parts, one each for the three basic components of sustainability
- the value scale is outwards, so that best result corresponds to biggest star
- segments, rather than "compass points", are used to depict values, giving visually correct geometrical weighting
- the selection of parameters is, though provisional, systematic
- the values are scaled so that the outer rim, corresponding to a "horizon" of full sustainability, is clearly shown to be far off.



Oikos: The world as our common house. (Photo: CB)

Each of the three main areas of sustainability is here defined by eight parameters. It is stressed that these parameters are provisional, and that they both can and should vary to some extent depending on project scale. In a full assessment most will also need a more detailed breakdown – for example the various types of energy supply and consumption.

For each of the 24 parameters, benchmarks can be defined in detail. Many exist already. Assessment can be done both in a

detailed way and in a simplified form.

A relative weighting of the various factors, which some ecoprofile tools try to do, should *not* be attempted. Weighting is a hopeless project; it will always be relative, with priorities that will quite rightly vary from one project to another. On the other hand, it seems principally important that the three areas of ecology, economy and society should be given visually equal weight.

The method shows the user the relative effect of different choices. Even without an exact value, one will clearly be far better than another. Exact scores will often matter less than the process that the user goes through to arrive at decisions.

The value scale

The scale is from 0 to 5. Value 0 means extremely poor standard, value 1 is poor, and value 2 corresponds to "normal practice" or quality expected in new projects today – for example latest building requirements. Value 3 shows a result well above today's practice, and value 4 extremely advanced solutions. The outer ring, value 5, corresponds to what we at the present time can envisage as more or less "fully sustainable" – for example a near-zero energy building. Very few projects in today's world will touch this outer perimeter at more than one or two points.

Applications

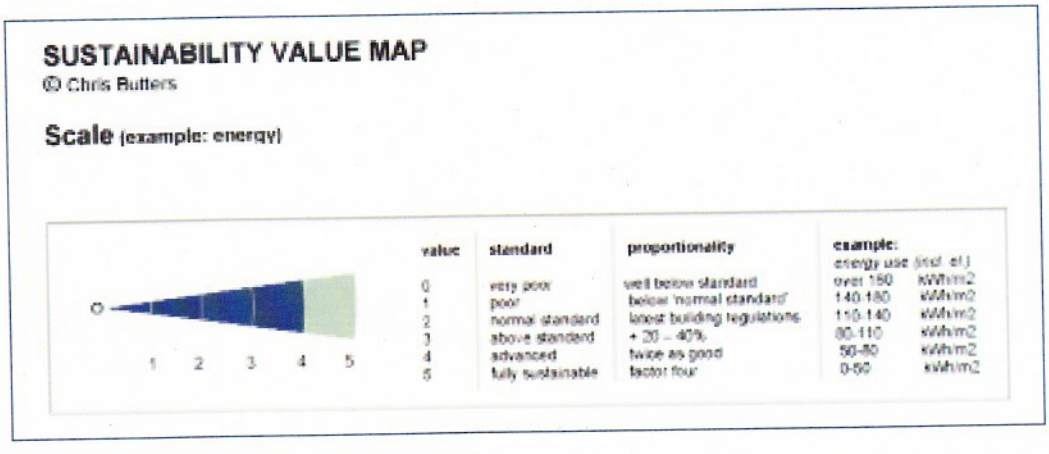
The Value Map can be applied at many *levels*, from a product to a building, a housing area or an entire region. It can also be used in relation to *time*, to assess how the sustainability of a building or community develops from year to year. And it can be used to make *comparative* studies between projects.

In its *simplified* form, it provides a checklist and framework for designers, and for discussion amongst participants in a planning process. In its *detailed* form, ideally, it gives a complete qualitative and quantitative picture of the condition of a project or community.

If we build a house that requires zero energy but is both expensive (economics) and awful to live in (society), is such a product of any interest at all? Our goal is an optimum of all requirements, not maximisation of one or two. The Value Map visualises these connections; it shows whether a high score in one area is only at the expense of satisfactory scores in others. Quality must be assessed in relation to *all three areas*.

Architects, engineers, developers – all have a tendency to view the world in a static fashion: Our job ends when our product is delivered. Seen in a sustainable perspective, this is not enough. We have to work with life cycle assessment – the dynamic reality which is the life of a building, a town, a community. Maintenance, renewal and decay are part of that reality. A successful district may go into serious decline after some years. People use buildings in unexpected ways. A house built to zero energy standard may have a high energy use from day one if the users misunderstand or misuse the systems.

In other words, sustainability is not something that can be *delivered*. Nor can it be evaluated once and for all. It is a *condition* that must be evaluated over time.



Quantities and qualities

Research in this field is often coloured by sectoral interests. There is no getting away from the fact that this favourises technical research with visible cost-benefit value. Research is increasingly funded or co-funded by market interests – for example an energy company or a manufacturer of materials. So there is little incentive in the system to think in wholes. What is called interdisciplinary research is often little more than cooperation between three or four kinds of *engineers*. Yet cross-disciplinary and cross-sectoral integration is recognised as being the very key to achieving sustainability.

Material factors can be quantified; this may be why researchers tend to confine their work on sustainability to the few factors, such as energy, water and wastes, which can be measured in a fairly objective way. The performance of a technical system can be calculated (even so, this does not mean that it will perform that way in practice, as noted above, since there is a troublesome little variable called people which always has the final say). It is obvious, on the other hand, that social parameters are not quantifiable but largely qualitative. This does not mean that they cannot be assessed.

Qualitative factors also have to be designed at the drawing board stage; this both can and must be done, but the results are to a far larger degree dependent on users' perceptions. Assessment must be post-occupancy, using sociological methods. The following are examples of typical issues related to quantities and qualities.

Energy

Energy is a typical *ecological* parameter. The value scale shown here for energy use in housing already contains simplifications. We must distinguish between detached houses, row houses and apartment blocks; different climatic zones must be correlated; assessment of energy use per m^2 has its limitations. Embodied energy also has to be taken into account.

Energy saving can be achieved by technical changes, improved information, or simply lifestyle preference. Energy is a complex issue - it is a *sociotechnical,* not a technical field. A Danish case illustrates this. A large urban project aimed to reduce energy consumption by 25 % through technical upgrading. The project was delayed for various reasons. When it ultimately started, it turned out that energy consumption had already fallen by nearly 20 % – without any building measures – simply because of the *information* about energy which had been given to the residents in connection with the project proposal – *before* the technical work began!

Management

Economic sustainability denotes a system that is robust, diverse, adaptable, and well enough organised to provide welfare on a long-term basis. This implies that it must also be based on environmentally sound production and consumption. Money is only a part of this. Finances, institutions and management are the instruments that ensure a sustainable, or unsustainable, relationship between society and its environment.

Quality and robustness over time depend on how a housing association or city district is organised, whether citizens and stakeholders participate in decision-making, and how efficient the management is. Financial indicators, organisational structures and participation can also be assessed objectively to some extent – but they are qualities which users may perceive as poor however good the systems may appear in theory.

Security

Security is a typical societal, qualitative issue. To a degree it can also be assessed quantitatively – for example neighbourhood statistics on criminality – but it is largely subjective. Like many of the other societal parameters it thus requires post-occupancy surveys.

Such factors have to be considered at the design stage, and of course they can be. Planners have experience of how different housing layouts affect criminality, for example. We can design for security with building form, street lighting, alarm systems, etc. But the users may still have a different, lived perception of the security of the area. An area

What is sustainable urban development?

Sustainable urban development is largely a question of transformation processes within existing cities - a process of improving a messy and very imperfect reality. More than the individual pieces of urban fabric, it is the overall spatial and infrastructural conditions that are most important, and these are even more difficult to change. Cities must also be viewed together with their regional hinterland.

Sustainable urban development needs eco-technology, institutions and people. It requires a long-term vision and a community dynamic. There are now large-scale projects in Scandinavia and Europe. The City of Oslo Urban Ecology programme is a good example of a sustainability framework. Some initiatives focus on specific aspects such as transports, wastes, etc, including well-known EU and international networks such as ICLEI and CEMR. But the intentions are as yet not often supported by large-scale political or financial commitment.

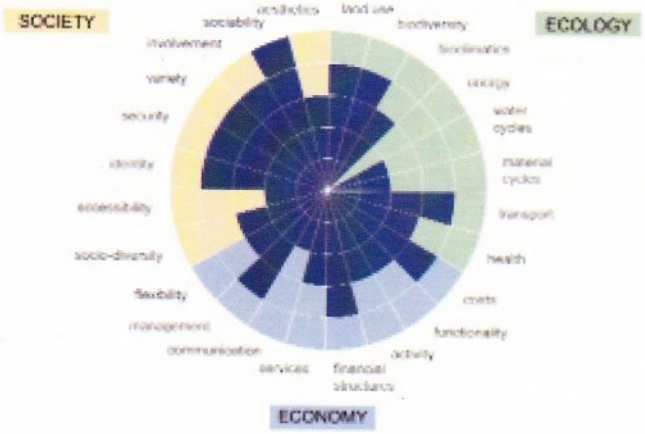
Mixed use, low ecological footprint and a healthy environment comprise the keywords. The best projects address social qualities as much as ecological ones and, in the spirit of Agenda 21, build heavily on user participation.

(See colour brochure on Urban Ecology by the Oslo Ports Authority / NABU, distributed free at IFHP-2004)

Four examples. Note: these are illustratic

Nordic cluster housing – Oksval 3, Nesodden: excellent social qualities, car-free, low costs, integrated into nature, moderate space use and footprint. Poor energy and resource efficiency (old standards). Excellent planning from the 1970s! (Rosland architects. Photo CB)

Pilestredet Park urban ecology project, Oslo: generally good eco-technology, especially materials recycling. But extremely dense, no user participation, and sky-high costs. Old surgical block converted to apartments. (Thon AS. Photo: Stein Stoknes)



can also change, become run-down and criminalised. Again we are reminded how sustainability is not something that can be delivered once and for all, but must be assessed continually, in dialogue with the real users, and with *time* as the sternest judge.

Sustainability and architecture

NABU's work is based on a broad understanding of sustainability; not just ecological design but a holistic field – thus encompassing the *whole* of architecture and planning. This is reflected in the policy document produced for our parent organisation, the National Association of Norwegian Architects, where we describe sustainability as a cornerstone for the profession.

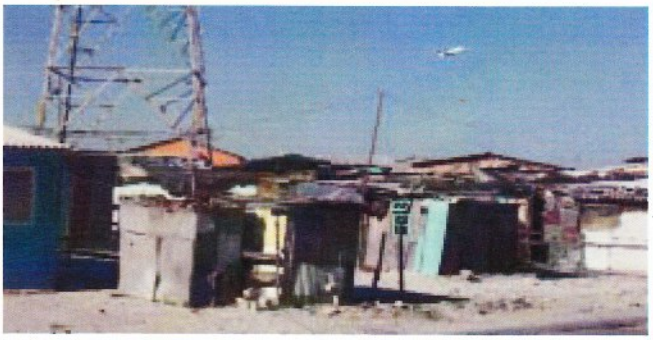
It is important to note that sustainable design combines well-established knowledge and new factors - and integrates solutions in new ways. Much of the *ecological* knowledge is new, but the *social* qualities achieved in Nordic housing, for example, are well recognised and are several decades old.

The Value Map provides some sorely needed clarity in understanding sustainability. The concept had its roots in the environmental failures of our societies, and ecology is still the area that needs particular improvement in design; however, environment is only one aspect of sustainable development. Quite simply, sustainability is about *quality:* social, aesthetic, technical, economic, and environmental.

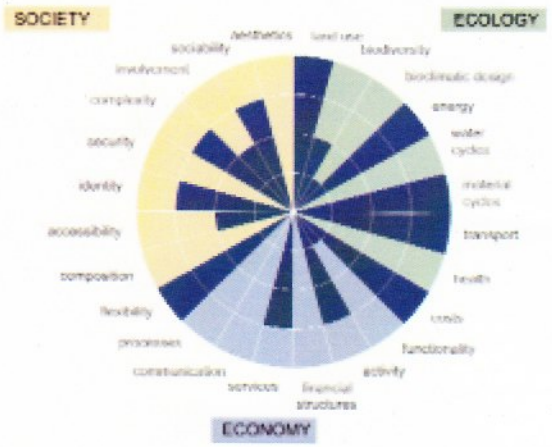
Energy and resource-conscious architecture is *ecological,* but is not *sustainable* if it is non-

ns only and not based on full evaluations

Sustainable district Südstadt, Tübingen, Germany: low energy building, car-free areas, public transport, high biodiversity, user participation processes, reasonable costs: No special theme - integrated solutions. Excellent in most aspects! Apartments in massive timber. (Eble Architects. Photo: CB)



Typical slum – Capetown: Use of land, private cars and energy are all near zero (they can't afford any!). 100 % recycled materials. Totally flexible, the whole thing can be moved in an hour. Extremely low cost. On the other hand empowerment, sanitation, health and security are a disaster. Very "sustainable" – in one sense – these are some of the planet's most resource-saving people. (Photo: CB)



functional, ugly or just too expensive. On the other hand, architecture that is *beautiful* cannot be designated *sustainable* for that reason alone. There is no reason today why a building or urban plan cannot be both beautiful and reasonably costed – *as well as* ecological.

Conclusion

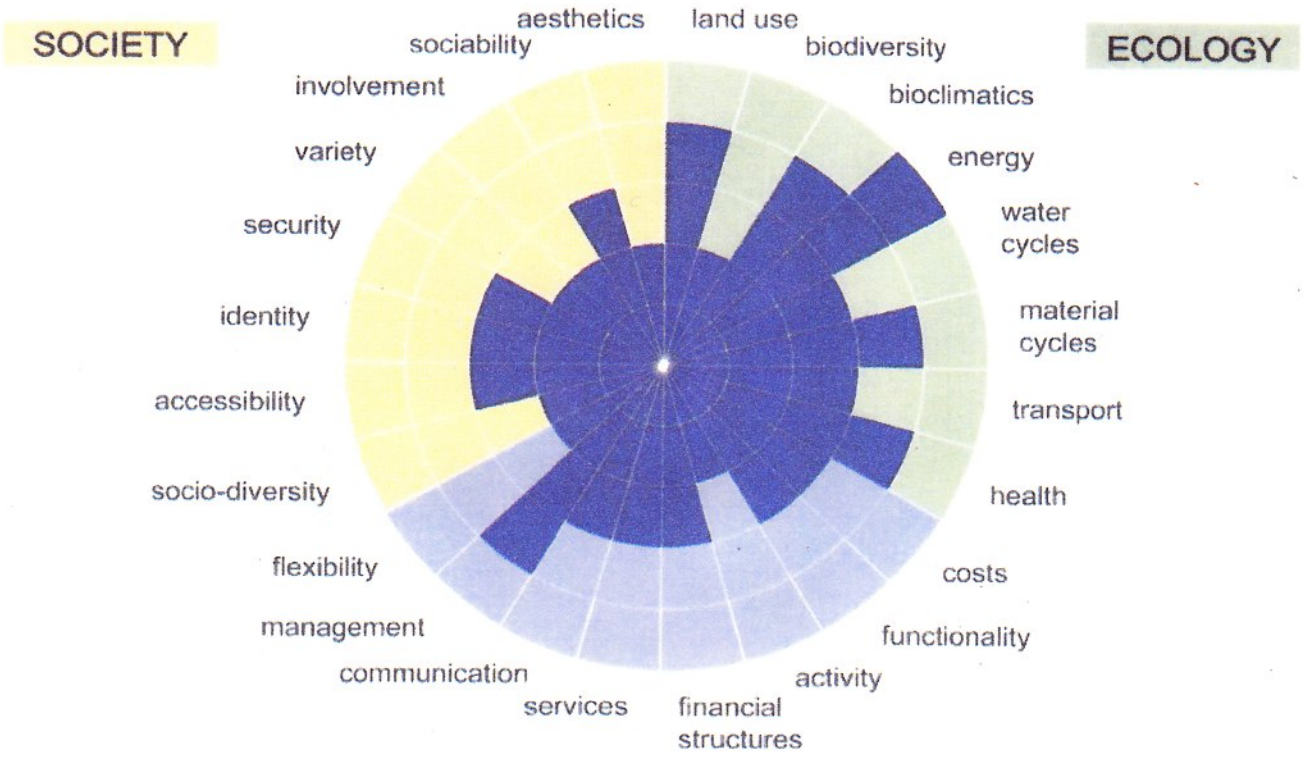
The design and assessment method described here has a broad range of applications. It can be applied in both simple and detailed form. It is important that the "horizon" clearly shows a high level of ambition corresponding roughly to what we can conceive of today as "fully sustainable". Above all, the Value Map visualises sustainability for the first time in a comprehensive manner.

The Value Map has already been tested in Norway and other countries, and now needs further development, including the parameters and benchmarks as well as a software program.

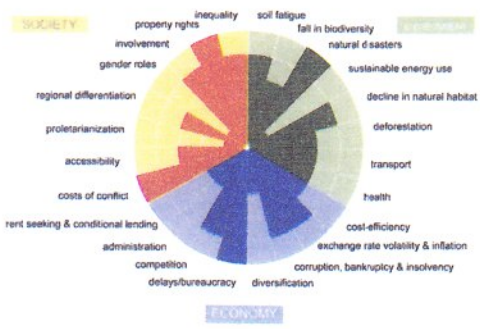
Technical and other specialists need to work with the interdependence of quantities and qualities, of objective and subjective values. We must shift our focus from environmental assessment to sustainability – from eco-technology to the whole picture. And if sustainable development is our goal then we need integrated design processes and evaluation tools. Our methodology must render explicit the fundamental links between ecology, economy and society.

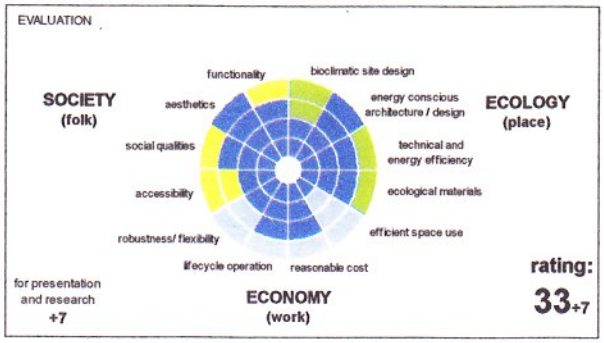
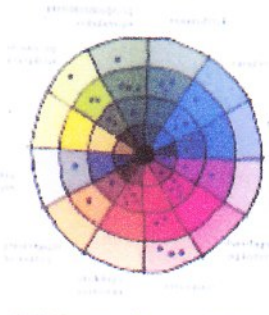
CHRIS BUTTERS: THE SUSTAINABILITY VALUE MAP

showing the "basic" set of 3 x 8 parameters



NABU - sustainability Value Map
Chris Butters



The Sustainability Value Map has been applied in a wide variety of discussion, planning and decision making processes – and in before/after evaluation.

Left: Risk assessment, development project, Africa
Below: Evaluation of architecture student projects
Below right: Community sustainability workshop, as part of toolkit for user feedback