

Sustainable Housing in the Urban Context: International Sustainable Development Indicator Sets and Housing

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Abstract Housing, an essential aspect of quality of life, is also significant for sustainable development (SD). All of the major international statements on SD refer to housing or settlement strategies. However, indicator sets derived from these statements often fail to include good indicators of sustainable housing. This article outlines the conceptualisation of SD and housing from the international statements. It proceeds by describing the international indicator sets which have been constructed based on these policy statements. International organisations such as the United Nations Commission on Sustainable Development (UNCSD), the Organisation for Economic Co-operation and Development (OECD) and the European Union (EU) have all produced indicator sets. However, this article contends that housing is an underdeveloped indicator and calls for more attention to be paid to the importance of aspects of housing for SD and the measurement of progress towards it via social indicators.

Keywords Housing · Indicators · Sustainable development · Sustainability indicators · Urban sustainability indicators · Housing and the environment · Quality of life

1 Introduction

Sustainable development (SD) is increasingly linked with the concepts of quality of life, well-being and liveability (Michalos 1997; Moore and Scott 2005; Low Choy, 2004, 2005). Housing is an essential component of both quality of life and SD. For example, quality of

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life depends on various aspects of the location of one's home such as residing in a clean and secure area with access to natural resources such as green space and/or water. Similarly, the condition of the home is essential for quality of life, including structural and design elements such as damp-proofing, sound-proofing, and energy efficiency. As will be shown below, housing is linked to sustainability in a number of important ways. For example, various aspects of the location, construction, design, management/maintenance and use of housing can have significant negative effects on the environment (Tosics 2004; Winston 2007). However, housing is one of the more neglected aspects of sustainability and the availability of housing indicators in international SD indicator sets is extremely limited, despite relatively advanced SD policies which refer to the importance of housing (UNCED 1992; WCED 1987).

There is an extensive debate about the meaning of SD (Carley and Christie 1992; Redclift 1987; Jacobs 1995; O'Riordan and Voisey 1998). The most frequently cited definition of SD was produced by the World Commission on Environment and Development (WCED or the Brundtland Commission), which defined it as development that meets 'the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987, p. 8). Its vision of SD entailed economic, social and environmental pillars, a model which some have extended by adding an institutional or governance pillar (e.g. Pareja-Eastaway and Stoa 2004; UNCED 1992). This model is now one of the most common models of SD (Hodge 1997), utilised by many sustainable housing researchers (e.g. Tosics 2004; Winston 2007), and it is the definition which is employed here.

This article is particularly concerned with sustainable development indicators in the urban context. MacLaren (1996) outlines key characteristics of urban sustainability: inter-generational equity; intra-generational equity (including social equity, geographical equity and equity in governance); protection of the natural environment (living within its carrying capacity); minimal use of non-renewable resources; economic vitality and diversity; community self-reliance; individual well-being; and satisfaction with basic human needs. Hodge (1997, p. 8) argues that the 'concept of sustainability has at its core a value set that is best described as a parallel care and respect for the ecosystem and people within it—not one or the other, not one more than the other but both together as one'. Furthermore, he contends that the aim of achieving sustainability is 'to maintain or improve human and eco-system well-being' (Hodge 1997, p. 9).

With regard to housing, WCED called for 'explicit settlement strategies to guide the process of urbanisation, taking the pressure off the largest urban centres and building up smaller towns and cities, more closely integrating them with their rural hinterlands' (WCED 1987, p. 32). Subsequently, at the first UN Earth Summit on Environment and Development held in Rio in 1992, the UN produced its global action plan for SD in the form of the 'Agenda 21 protocol' (UNCED 1992). Agenda 21 is a charter of 27 basic principles for sustainable development covering rights and responsibilities of states and their citizens. While it is the most prominent and influential guiding document for sustainable development, it is a non-binding agreement. Employing the WCED definition of SD, Agenda 21 added an institutional pillar to the environmental, economic and social pillars outlined in report of the WCED. Some of the programme areas it identified include: providing adequate shelter for all; the improvement of human settlement management; the promotion of sustainable land-use planning and management; promoting sustainable energy use and transport systems in human settlements; and promoting sustainable construction industry activities.

This article examines the key international SD indicator sets to assess the extent to which they include housing indicators. It investigates whether or not these housing indicators have environmental, economic and social dimensions. Finally, the article describes what might be considered the current ‘best practice’ with regard to sustainable housing indicator selection. Some important characteristics of sustainable housing include: sustainable land-use planning; resisting scattered settlements; housing close to employment and public transport; higher residential densities; sustainable construction; high standards of energy efficiency in use of dwellings; housing availability, affordability and quality; access to green space, and a high quality residential environment (Winston 2007).

Many SD indicator sets are derived from conceptual models. Hodge (1997) reviewed 29 different approaches to modelling the ‘human ecosystem interface’ with the aim of developing a conceptual framework for assessing progress towards sustainability. He classified the models as follows: (1) the common ‘social-economic-environmental’ model, (2) models from economic literature, (3) stress and stress response models, (4) general ecological models, (5) additional models from the SD literature, (6) Agenda 21, (7) miscellaneous models from regional analysis, watershed analysis, carrying capacity, aboriginal development, and quality of life (Hodge 1997, p. 8). Outlining the advantages and disadvantages of each, he proposed a new framework consisting of four indicator domains: ecosystem, interaction between people and the ecosystem; well being of people; and synthesis (Hodge 1997). Others classify frameworks for developing sustainability indicators as follows: domain based (e.g. economy); goal-based (economic prosperity; quality of life); sectoral frameworks (e.g. housing); issue based (urban sprawl); causal (condition-stress-response); capital approach (stocks and flows of natural, financial, produced assets and human capital) and combination frameworks (MacLaren 1996; Stevens 2005). Within any of these frameworks, different approaches may be adopted for the construction of indicators. One is to develop a single, composite index, the second is to develop an indicator set, while the third uses the notion of ‘capital stock’ as a unifying concept to select indicators. As none of the international organisations has adopted the index approach and indicator sets are most common, they are the focus of this article. While there have been interesting attempts to measure SD at local (city, regional) and national levels (Hass et al. 2002; Hodge 1997; MacLaren 1996; Stevens 2005, Wheeler 2004), this article focuses on international indicator sets, as regional approaches are most appropriate for a co-ordinated approach to sustainable development.

2 The Importance of Housing for Sustainable Development Indicator Sets

Housing is one of the most important public policies affecting urban development and, as such, it has a significant potential to contribute to sustainability (Tosics 2004). Various aspects of housing construction, design, use and demolition can have significant impacts on the environment (Huby 1998). First, the extent of land used for constructing housing as well as its type and location will determine the impact on environmental resources such as wildlife, landscape, and amenity value. Building on land which has previously been used for industry or housing (brown-field) is considered more sustainable than green-field developments. Higher density developments are more sustainable than low density developments as they use less land and are more likely to sustain services such as public transport, education, employment and commercial facilities. In addition, construction consumes a considerable amount of valuable environmental resources such as wood,

minerals, energy, and water. Many of the hardwoods used in housing are consumed at the expense of tropical forests and this contributes to deforestation, leading to a deterioration of soil conditions, increased greenhouse gas production, and a reduction in biodiversity. Similarly, paints and chemicals used for treating timber can have toxic effects on land, water and air. Some insulation, air conditioning and refrigeration materials contain CFCs which can damage the ozone layer if they leak (Huby 1998).

The use of housing entails the consumption of energy and water as well as the production of waste, all of which can be reduced depending on the design of housing and its facilities (Edwards and Torrent 2000). The introduction of the Energy Rating Certificate, whereby homes must have an energy rating before they can be sold, has the potential to make significant improvements in the thermal efficiency of new and existing buildings. Another aspect of the way housing is used relates to the location of a house, which affects the extent to which residents use public transport. Housing located at a distance from public transport is more likely to result in a higher level of car use compared with that which is located close to good public transport. Finally, the demolition of housing involves the production of waste, some of which is potentially toxic. Given the importance of all these aspects of housing for sustainable development, it is essential that it be included in sustainability indicators sets.

The effects of the environmental impacts associated with housing may be worst for lower income groups (Huby 1998). Poorer households have less choice of environment and may be concentrated in areas of dereliction, with considerable air and noise pollution, and limited access to quality green space. In addition, they are less likely to be able to afford to undertake energy efficiency improvements to their homes without financial support. These environmental factors may detract from the quality of life of poorer households and have a negative impact on their physical and mental health.

3 The Nature and Quality of Sustainability Indicators

Urban sustainability indicators have been defined as ‘bellwether tests of sustainability and reflect on something basic and fundamental to the long term economic, social or environmental health of a community over generations’ (Sustainable Seattle 1995, p. 4). Michalos (1997) contends that no single set of indicators is adequate to monitor sustainability. Those that have been developed have been described as inadequate, especially those which attempt to capture the social aspect of sustainable development (UNCSD 1996; Hodge 1997; Atkinson et al. 1997). In addition, there is a real difficulty in cross-country comparability as different countries employ different definitions of SD (Hass et al. 2002). Where there are opposing views, indicators become contested as people seek to use indicators to confirm their view of SD (Astleithner et al. 2004, p. 21).

Sustainability indicators must be: (a) *integrating*, in that they attempt to portray linkages among the economic, environmental and social dimensions (e.g. the cost of recycling taps into both economic and environmental aspects); (b) *forward looking*, for example trend indicators which are linked to targets and thresholds that define intermediate and final steps towards goals; (c) *distributional*, as they are required for inter and intra-generational equity to account for the distribution of social, economic and environmental conditions in the population or across regions; (d) *developed with input from multiple stakeholders*—the most influential, valid and reliable social indicators have been those developed with input from a wide range of participants (MacLaren 1996).

An international working group on indicators, led by the International Institute for Sustainable Development, devised the “Bellagio principles” to identify progress towards SD. These principles include having: a guiding vision and goals; an holistic perspective; essential elements (equity and disparity within the current population and between present and future generations, dealing with such concerns as resource use, over-consumption, poverty, human rights and access to services); adequate scope (time horizon long enough to capture both human and ecosystem timescales and space to include local and distant impacts on people and ecosystems); practical focus (standardising to ensure comparability); openness (data and methods available to all); effective communication; broad participation; ongoing assessment; and institutional capacity (Hardi and Zdan 1997). To these principles we can add the following criteria for quality indicators: availability of time-series data; ability to aggregate data; sensitivity to small changes; and reliability (Hardi and Zdan 1997).

4 The Emergence of International Sustainable Development Indicator Sets

Following the publication of the report of the WCED, the first UN Earth Summit in Rio in 1992 urged countries to construct indicators of sustainable development. Since then, considerable work has been undertaken in this area by a range of international and national organisations. Table 1 outlines the key dates and events in the development of urban sustainability indicators.

The United Nations Commission on Sustainable Development (UNCSD) was the first international organisation to publish a set of indicators in 1996. Subsequently, these were tested in 22 countries with a revised set of themes and indicators produced in 2001. The housing related indicators are: floor area per person; population of urban formal and informal settlements; distance travelled per capita by mode of transport; and intensity of energy use. The earlier version contained an indicator of affordable housing (the ratio of average house price to average industrial wage) but this was dropped from the revised edition (UNCSD 1996). The very limited nature of this set may be attributed to the fact that it was not designed specifically for developed countries. The revised UNCSD themes were the starting point for many countries in their national indicator sets (Hass et al. 2002).

Table 1 Key dates in the development of urban sustainability indicators

Year	Development
1992	Agenda 21 (Rio Declaration on Environment and Development) calls for the construction of indicators
1996	UNCSD initial set of indicators
1999	European Common Indicators Project established
2000	European system of social indicators
2001	UNCSD revised core indicators
2001	EU Sustainable Development Strategy
2003	European Common Indicators report
2004	Aalborg + 10 targets for the sustainability of European Cities and Towns
2005	EU sustainable development indicators
2006	Renewed EU Sustainable Development Strategy

At European level, the first major initiative was the European Common Indicators (ECI) project, which was established in 1999 to monitor and evaluate sustainability in European Cities and Towns. Participation in the ECI project is voluntary and in 2003 there were 144 signatories, representing 22 countries but only 42 urban areas provided data for the assessment phase of the project (Tarzia 2003). In 2003, its working group on sustainability indicators produced a report which included some relevant indicators: satisfaction with housing availability, affordability and standards; accessibility of council housing; urbanized or artificially modelled land (size of artificially modelled area as a percentage of the total municipal area); derelict or contaminated land (m^2); intensity of use (number of inhabitants per km^2 of the area classified as ‘urbanised land’); new development [new building on Greenfield sites and new building on contaminated or derelict areas (Brownfield) compared to total area (%)]; restoration of urban areas (renovation and conversion of derelict buildings—total number, total of m^2 of each floor); redevelopment of derelict areas for new uses, including public open spaces (area in m^2); cleansing of contaminated land (area in m^2); local mobility and passenger transportation; and noise pollution. These indicators cover each of the environmental, economic and social dimensions although the social indicators are relatively limited.

In the late 1990s, a cross-national European project began which aimed to monitor and assess welfare development and social change in Europe, part of which involved the construction of the European System of Social Indicators (EUSI) (Berger-Schmitt 2001; Berger-Schmitt and Noll 2000). This system currently covers the EU15 but is being extended to include the EU25. The study adopts the WCED multidimensional (economic, social and environmental) approach to SD but extends it considerably from a conceptual point of view. It draws on the World Bank’s 4 capital approach (physical, social, human and natural) (World Bank 1997) and the OECD’s Pressure-State-Response model for environmental indicators (OECD 1998). However, the creators of EUSI argue that there are inevitable assumptions made about causality in these models, which are problematic (Berger-Schmitt and Noll 2000, p. 23). In addition, they argue that the links between the economic, social and environmental dimensions are not addressed sufficiently. The EUSI framework links sustainability to other welfare concepts such as social cohesion, social exclusion, social capital and quality of life, as outlined in Fig. 1. Quality of life is central to the model, including the improvement of objective living conditions and the enhancement of subjective well-being. Their definition of quality of life is a broad one incorporating both social cohesion and sustainability. Social cohesion is considered essential because its counterpart, exclusion, is associated with economic, social and/political deprivation. Sustainability is intrinsically linked to both quality of life and social cohesion, with the emphasis on preserving natural, human and social capital for current and future generations. Both social cohesion and sustainability are concerned with the goals of attaining equal opportunities and promoting social capital, hence social cohesion comes under sustainability in the model. Social capital is envisaged as enhancing quality of life as it refers to informal relations between individuals, membership of voluntary associations, feelings of belonging, trust, and solidarity. Finally, the preservation of both human and natural capital enhances the objective living conditions of individuals, and hence, their quality of life (Berger-Schmitt and Noll 2000).

In the EUSI model, housing is one of a number of life domains, the others include: population, households and family; labour market and working conditions; education and



Fig. 1 Conceptual framework for the European System of Social Indicators. Source: Berger-Schmitt and Noll 2000:43

vocational training; income, standard of living and consumption patterns; health; crime and public safety; and total life situation. Each life domain contains the following dimensions:

- The improvement of objective living conditions
- The enhancement of subjective well-being
- The reduction of disparities, inequalities and social exclusion, promotion of equal opportunities
- Strengthening social connections and ties—social capital
- Preserving natural capital
- Preservation of human capital (Berger-Schmitt and Noll 2000).

The housing indicators are outlined in Table 2. While this indicator set is still being refined, it has a number of strengths. First, it has a strong conceptual foundation. Second, it covers a range of measures of each of the social, economic and environmental dimensions including: tenure; affordability; facilities in the residential area such as public transport; subjective evaluation of housing conditions and the residential area; regional disparities in housing conditions; income related inequalities in housing conditions; type of accommodation; environmental quality of the residential area; area used for settlement (per capita); and energy consumption. The indicator set meets many of the criteria for quality indicators: scientific validity; reliability; guiding vision; holistic perspective; broad range of conditions; relevance; essential elements; an emphasis on inequality and distributional issues; adequate scope; responsive to change; comparability; easily understood; unambiguous; practical focus; openness; inputs from key stakeholders including the consumer.

Table 2 European System of Social Indicators—goal and measurement dimensions

Goal dimensions	Measurement dimensions
Availability of dwellings	Relative size of dwelling stock
Size of dwelling	Rooms per person and living space per person (under preparation)
Amenities	Availability of flushing toilet, bath/shower; central heating; balcony, terrace/garden
State of repair of dwelling	Dwellings in deficient state of repair
Tenure status	Percentage of owners
Type of accommodation	Households living in one-family house/in a large apartment house
Affordability of housing	Burden of housing costs; average rent/qm in ppp (under preparation); average rental burden
Facilities in residential area	Accessibility of shops; public transport; family doctor
Environmental quality of residential area	Noise pollution; air pollution; accessibility of green space
Public safety	Crime in residential area
Subjective evaluation of housing conditions	Shortage of space; high burden of housing costs; satisfaction with housing situation
Subjective evaluation of the residential area	Subjective safety in the residential area, Satisfaction with neighbourhood
Regional disparities in housing conditions	Regional disparities in availability of amenities and rental burden
Income related inequality of housing conditions	Income related inequality in: dwelling size; availability of amenities; and tenure status.
Homelessness (data not currently available)	Percentage of homeless people
Poor housing conditions	Overcrowded dwellings; lack of basic amenities
Area used for settlement	Built up land per inhabitant (under prep)
Energy consumption	Use of environment-friendly energy sources for heating; energy consumption for space heating; energy loss per building (under prep); insulation of housing stock (under prep)
Preferences related to dwelling	Need for own room per household member; need for a garden, balcony or terrace; preference for a one family house (data currently not available)
Preferences related to residential area (data currently not available)	Preference for living in rural/urban area

Source: http://www.gesis.org/en/social_monitoring/social_indicators/Data/EUSI/index.htm

In 2005 the EU produced indicators based on its 2001 SD strategy (European Commission/Eurostat 2005).¹ The housing related indicators are: adequacy of housing conditions or access to decent housing (data which it argues are required but with which there are problems of

¹ In 1998, the European Commission highlighted the importance of evaluating local sustainability and monitoring progress on Local Agenda 21 (COM 1998, 605). In 2001, it published the European Sustainable Development Strategy (Gothenberg Strategy) (based on WCED definition) and the 6th Environment Action Programme, including a theme on urban environment indicators. This was done to build on the Lisbon Agenda which failed to include an environmental dimension, and which had given rise to structural indicators, none of which was dedicated to housing. The EU published a list of guiding principles for sustainable development in 2005 and, in 2006, a renewed Sustainable Development Strategy building on its original strategy (European Council 2006 DOC 10117/06)

definition, availability and/or quality); proportion living in households considering they suffer from noise and other pollution; land use change by category (required but problems of definition, data availability/quality); car share of inland passenger transport; access to public transport (required but problems of definition, availability and/or quality). This list is relatively weak in that most of the indicators are environmental.

Another European initiative is the Aalborg targets (2004) for progress towards a range of sustainable development goals in urban areas. These are derived from the Aalborg Charter (1994), produced following the publication of Agenda 21, which aims to encourage urban local authorities to create a vision of sustainable development. At European level, the 1994 Aalborg Charter is important in understanding what LA21 has come to mean. Produced at a European Conference on Sustainable Cities and Towns, the Charter outlines basic values and options for sustainable development in European urban areas. These options included encouraging local authorities to create a vision of the sustainable community and monitoring and evaluation their LA21 activities. Of central importance to housing is the commitment to a 'strategic role for urban planning and design in addressing environmental, social, economic, health and cultural issues for the benefit of all'. This entails commitments to:

- Re-use and regenerate derelict or disadvantaged areas
- Avoid urban sprawl, achieving appropriate urban densities and prioritising Brownfield site over Greenfield site development
- Ensure mixed use of buildings and developments, with a good balance of jobs, housing and services giving priority to residential use in city centres
- Ensuring appropriate conservation, renovation and use/re-use of urban cultural heritage
- Apply requirements for sustainable design and construction and promote high quality architecture and building technologies.

The targets are relatively limited in that they focus on the environmental aspect of sustainable housing.

The OECD has invested considerable effort in the preparation of SD indicators (OECD 2000, 2001). However, there are no housing indicators in its proposed set despite the fact that a 1982 list of OECD social indicators included a number of housing measures such as housing conditions, accessibility to services, and environmental nuisances (OECD 1982, p. 13). From the available documentation, it is not clear why these were excluded from the SD indicators. Despite some limitations, that 1982 social indicator set has been referred to as the 'most serious and sustained effort to systemically identify a set of indicators which has broad applicability, reasonably comprehensive coverage, and feasibility (Scott et al. 1996, p. 90). Hence, they could have been considered useful for the social pillar of their SD indicators.

5 Conclusion

The work of international organisations such as the UNCSO, OECD and EU is contributing to the development of indicators and there are now a large number of them available. Despite the fact that housing has significant potential to contribute to sustainability, this article has shown that there is considerable scope for the improvement of housing indicators as some of these sets fail to include any housing measures, for example the OECD. Others include housing indicators but these are very limited when applied to first world

countries, e.g. UNCSO. While not designed specifically as a SD indicator set, the EUSI set captures many of the important dimensions of sustainable housing—economic, social and environmental. It links sustainability to other important welfare concepts such as social cohesion, and quality of life. In addition, it meets many of the criteria for good sustainability indicators outlined by MacLaren (1996) and Hardi and Zdan (1997) including: scientific validity; reliability; guiding vision; holistic perspective; broad range of conditions; relevance; essential elements; emphasis on inequality and distributional issues; adequate scope; responsive to change; comparability; easily understood; unambiguous; practical focus; openness; inputs from key stakeholders, including the consumer. However, it could be improved by having more indicators on sustainable construction practices and land use planning.

Creating indicators is difficult, time consuming, and expensive. Most importantly, it involves political commitment and, as Stephens (2005, p. 6) points out, their selection is a political act. Without political commitment to act on them, the development of indicators is a symbolic exercise (Wheeler 2004, p. 92). The European Commission has stated that it is open to ‘developing new indicators and improving the quality of the existing indicators’ (Commission of the European Communities 2005, p. 8). The EU SD indicator set is relatively weak as there is little emphasis on the social or economic aspects of sustainable housing. Given the importance of various aspects of housing for SD, such as its location, design and use, the EU and other international organisations should incorporate housing related indicators in their SD indicator sets. In devising these indicators, they could refer to the work of the EUSI group and its on-going work in this area.

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