

# **STRIVING FOR SUSTAINABLE DEVELOPMENT IN INFRASTRUCTURE: THE NEXT HORIZON**

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**Abstract:** The pursuit of sustainable development is a universal endeavour, despite great regional variance in definitions and understanding. This paper attempts to look beyond the immediate concerns of sustainability and to speculate on the possible future direction for the implementation of sustainable development, linked to an increased acceptance of underlying principles linked to wider agreement of geographical relevance. The paper reviews ways in which assessment of sustainability is currently conducted as a context for the development of future directions.

## **1.0 Introduction**

Sustainable Development has been a victim of its own success. Since the Brundtland Report of 1987 (WCED Report – Our Common Future), sustainable development has enjoyed widespread acceptance, as a means of expressing the need for a fundamental shift away from the inexorable drive to develop by increasing consumption, and towards a more balanced approach to meeting needs.

Of course the Brundtland definition owes its success at least as much to its ambiguity as it does to its clarity. That sustainable development could be defined in a single sentence is commendable, but the way is open for interpretation of almost every word.

The World Commission on Environment and Development can be seen in a sequence of reports and conferences which maps the global consciousness of concern for food availability, population growth, resource depletion, and environmental harm. The sequence has continued with the Rio de Janeiro Summit in 1992 and the Johannesburg Summit ten years later as two markers in the progression.

As an example of the awakening consciousness, *Silent Spring* by Rachel Carson published in 1962 is seen as having brought widespread attention to the excessive use of pesticides, and their impact on bird life. This book, based on a series of articles and drawn originally from the observations of a friend, has become a focus of attention for supporters and detractors alike. The banning of DDT may have owed much to the book, and there are organisations who regard the ban as detrimental to the control of malaria in Africa. The issue raises the debate around the Precautionary Principle, which has an impact on large scale infrastructure.

The emergence of concern for the environmental damage caused by unfettered growth came at a time in the world when the industrial nations were reaching maturity, and emerging economies were seeking to grow. So the environmental anxiety of the industrial nations has had the effect of constraining the way in which rapidly industrialising countries can operate. The West has

pursued development without significant controls on its resource use, but it is now clear that this trajectory cannot be followed by everyone.

The goal of sustainable development therefore is seen very differently depending on where in the world one is looking. North America and Europe, along with Australia and New Zealand, can and must seek to do more with less, to rectify the damage done locally and design new ways of managing progress for their economies and their people. Emerging economies are faced with a huge deficit of infrastructure with which to deliver civilised standards of living for their people. The notion of “needs” in the Brundtland definition immediately takes on a much starker reality in the emergent economies.

The overriding truth is that most of the sustainability challenges faced by all countries have a global dimension. The most obvious and widely accepted is the emissions of Greenhouse Gases into the atmosphere whose impacts are not confined to national or continental boundaries. Every country will face the effects of climate change associated with the increase in concentrations of CO<sub>2</sub> and other greenhouse gases, whatever their own emissions may have been. Worse than this, many countries with very low historical emissions are likely to be the most adversely affected by the effects of global warming, and countries with limited wealth will have a reduced ability to respond and adapt.

Against this challenging background, we as engineers are under a duty to design ways in which our works can be adequately assessed for their sustainability performance, whilst making allowances for specific circumstances.

## **2. Methods of Assessment**

Many different Sustainability Assessment (SA) frameworks have been developed to facilitate the explicit incorporation of sustainability into decision-making processes. Hacking and Guthrie (2008) attempted to explore the distinguishing characteristics of SD-directed assessment as a basis for comparing and/or reconciling emerging forms of SD-directed assessment. They sought to clarify the process of sustainability assessment by defining three “axes” of assessment against which any system could be measured, namely

- Comprehensiveness
- Integratedness
- Strategicness

Comprehensiveness is the degree to which the sustainable development themes are covered in an assessment. Integratedness is an attempt to address the extent to which the themes covered and the techniques adopted are aligned, connected, and furthermore, compared and combined. The degree of strategicness is an estimate of the ambition of the assessment; in other words how broad was the view, how strategic, and to what extent did the assessment move away from a narrow and project only perspective.

This three-dimensional “space” is a useful way to review and authenticate the assessment of a particular scheme, and an example may help to make the point. In the UK there is a current study of the potential for significant renewable energy to be produced from tidal power on the Severn Estuary. The study has been undertaken by what is now the Department for Energy and Climate Change (DECC). A Strategic Environmental Assessment (SEA) has been undertaken in accordance with the SEA Directive of the EU, which has looked at many schemes and of course at the social and environmental consequences of each option. The technical feasibility of the schemes has also been studied along with estimates of costs. In all these respects the study could be reasonably considered to have been comprehensive, and the nature of the proposals would imply a strategic approach. However the scale and complexity of the schemes under consideration are so major that there had to be a limit defined for the scope of the assessment. In this case the limit was drawn so that the potential impacts (positive and negative) of any transport links that might be associated with the barrage options (which provide a fixed link across the estuary) were excluded from the work.

This is a useful example as the benefit of including such a study on transport opportunities and threats from a link across a barrage seem clear, but the cost and complexity of including such work could be prohibitive to a meaningful outcome. Even for Governments, then, there has to be a limit to the extent to which every scheme can be obliged to look at every aspect beyond the immediate influence of the scheme itself. This tension will remain indefinitely.

In the context of urban planning and design, there is a wealth of assessment frameworks available to practitioners. This proliferation of assessment tools can be unhelpful, and in many cases the frameworks whilst all embracing, may be unworkable in practice. Applying sustainability assessment to the design of infrastructure and large urban spaces is particularly challenging, as the nature of these projects is so variable in terms of scale, context and location.

One approach has been to create standardized methodologies for particular sectors or infrastructure and several examples can be found. These stand-alone assessment systems often provide excellent depth of analysis within a specific sector, but may not be designed to address the broad challenges of large-scale master planning, where elements of many sectors underpin the wider urban planning process.

The challenge for large urban projects is that they must be simultaneously broad in scope and specific in their analysis, encompassing multiple disciplines, scales, and points of view, while establishing credible frameworks for comparative analysis of quantifiable characteristics. The opportunity exists for tailored sustainability assessment methodologies. This is of course contentious in that being able to tailor any assessment to a particular scheme runs the risk of not covering key issues adequately or addressing areas of difficulty in sufficient depth, but there is a place for project specific approaches, using where possible assessment systems for elements of a scheme.

### **3.0 Developing Tailored Assessment Methodologies**

#### **3.1 Drivers for Tailoring of Assessment to Urban Planning Projects**

Real progress has been made in the development of assessment systems in the buildings sector. Systems include: BREEAM, the earliest building rating system for environmental performance, which has developed into multiple systems for different types of buildings and new development; the LEED rating system, which has versions in USA and in Canada; Green Star in Australia; CASBEE in Japan and several others. BREEAM has developed international versions also for many countries, allowing for different conditions including the different carbon implications of energy generation in different countries.

Established project level systems can be highly effective in capturing the range of impacts associated with large projects, but the focus tends towards environmental sustainability. This is because the origin of all the systems was in environmental impacts, and a desire to see the negative environmental effects minimised, but also because the social aspects of projects are subject to more political processes which can be controversial. Socio-environmental impacts such as noise and vibration are widely accepted as being integral to assessment, but there can be more difficulty with assessing the degree to which a project delivers improved social equity.

Experience suggests that the complexity and scope of many infrastructure projects, including large scale mixed developments which require masterplanning, can warrant a customized approach to assessment. There is inherent here an underlying belief that opportunities to articulate and influence drivers of sustainable development are greatest at the earliest, planning, stages. It may also be the case that that most progress towards sustainable development can be achieved through a focused effort on establishing relevant benchmarks and setting appropriate standards for performance.

#### **3.2 Defining tailored Sustainability Assessment**

A tailored approach to sustainability assessment would embrace the broad objectives of wider stakeholders towards a consensus approach, identifying common goals, defining specific objectives, outlining the process for documenting and implementing revisions. Either as a starting point, or as a result of the early work, a policy for sustainability performance would be set for the project. This would conform to government policy of course but extend the sustainability aspirations to be specific and deliverable for the project itself. All attempts at sustainability work with the positions of many people principally concerned with nature and environmental protection, environmental development and commercial advancement, and social advancement and increased satisfaction. The sustainability agenda prepares the way for all these stakeholders to work together in a common arena.

Although there is little consensus regarding a fixed definition of ‘Sustainability Assessment’ (Guthrie and Hacking, 2008) the systems described here fall under general definitions of Sustainability Appraisal/Assessment as a form of strategic assessment that covers environmental,

social and economic impacts (Dalal-Clayton and Sadler, 2005) and under general definitions of Integrated Assessment, in that they link different categories of impacts (Horizontal Integration), link separate assessments undertaken at different levels/stages (Vertical Integration), and integrate assessments into decision-making. (Lee, 2002).

Tailored sustainability assessment systems could be said to share a common set of characteristics:

1. They are a collection of goals, objectives and indicators that drive a procedure for assessment and response to a design proposal, with the overarching goal of movement towards sustainability.
2. They define their goals and objectives through a multi-stakeholder and multi-disciplinary approach involving client/owner, design and planning team and other stakeholders.
3. They have been developed as a commercial offering for a private client and pursued simultaneous to a conventional planning or design process for the implementation of construction.
4. Unlike standard approaches to sustainability assessment, the tailored approach is the result of a creative process carried out by project stakeholders.
5. They often draw on standardised assessment tools to clearly define performance goals for sectors within the overall project, saving time and resources while providing defensible methods for assessment of specific sectors within a larger planning effort (i.e. buildings, water quality, and transportation.)

As with all forms of sustainability assessment, the setting of appropriate boundaries is key. The malleability of tailored SA with respect to boundary delineation can make it prone to compartmentalization of sustainability issues to suit particular interests. It should also be recognized at this stage that tailored assessment is not necessarily a robust approach if the goal of assessment is to obtain an objective quantification or comparison of ‘sustainability’ with other projects, precisely because of the bespoke nature of the system. It is central to the integrity of the approach that the objectivity and accountability of inputs and indicators is maintained. The risk of tailored assessment being commandeered in pursuance of objectives not concurrent with commonly established principles of sustainable development is perhaps the major risk and challenge of this approach (Mulligan et al., in preparation).

### **3.3 Process of tailored assessment development and use**

Development and execution of the tailored sustainability assessment methodologies presented in this paper consisted of three primary phases:

**PHASE 1) Visioning:** Goals, objectives, metrics, and process are transparently established by consensus in a multi-disciplinary group, resulting in an overall vision for sustainability.

**PHASE 2) Execution of Assessment:** Data gathering, quantification of proposed designs and reporting. This phase follows the procedures designed and defined in Phase 1.

**PHASE 3) Learning and Response:** After thorough analysis of the results of Phase 2 by all stakeholders, the design team takes corrective action to alter the design proposals. Typically, Phase 2 and Phase 3 repeat iteratively until a satisfactory level of performance is measured or a final milestone is met.

In any project where tailored sustainability assessment is used, it needs to be developed alongside the overall engineering and architectural design. This simultaneous evolution of design and assessment along with disciplined administrative maintenance allows for constant, timely and practical feedback, relating the evolving design proposal to the original project goals and objectives while advancing in detail.

The use of tailored sustainability assessment has been successfully applied in many instances but three may be worth mentioning

Orange County Great Park in California is an ambitious and impressive reinvention of a decommissioned US airbase near Irvine. The project has been imaginatively founded on the release of some of the land area to be developed for housing and the proceeds of this disposal, alongside support from the local authority have facilitated the design and development of a Country Park for the wider community, on a grand scale. In such circumstances where the conditions and the ambitions are both so unusual it would have been almost meaningless to follow standard methods of assessment for the park's design. The vision of the Park as articulated by its proponents had to be developed alongside a process of setting ambitions for the sustainability goals of the scheme. With international support for the design of the Park and its features, the result has been a Park of world class with new approaches to delivery against the goal of sustainable development.

The London Olympics in 2012 will be staged mainly at the Olympic Park in Stratford, East London. This an area of industrial decline and social deprivation, where the investment for a legacy of growth and development is much needed. The whole basis of the Park in this case has been to design facilities for a long term future, with the necessary planning for the staging of the Olympic Games and the Paralympic Games in 2012. The location of the Park close to major transport interchanges at Stratford, in an area of social need, and on land badly contaminated by past industrial practices all mean that the sustainability "story" for the Olympic Park is starting from a positive position. The work of the Olympic Delivery Authority (ODA) and their partners has further led to some groundbreaking progress in terms of sustainability. Over 97% of all demolition material (by weight) has been recycled for beneficial use. The choice of materials has been driven at least partly by environmental impact and the transport of materials to site has been encouraged to be by rail or barge, avoiding road based deliveries as far as possible.

Dunsfold Park Eco Village was proposed to be a small (2,600 home) new development in Surrey in England south of London, on the site of a currently working airfield. Although the application for this development was refused and the appeal was also lost, there are some interesting features of this design that are worth noting. In a relatively rural location so close to London, road traffic is always a problem. The road network around the site is single carriageway roads and so the imperative for the developer was to design a new settlement which as far as possible would not rely on the private car. Strenuous efforts were made to encourage fewer trips to be made, and for those that were made to be by walking, cycling, or using public transport. A cordon charge was

proposed for entering of leaving the village in a car, and this would have been the first on this scale. One of the interesting aspects of this scheme was that many of the innovations proposed by the developer could not be fully considered by the Inspector as the measures could not be enforced through the Planning system. This represents a major obstacle to innovation.

#### **4. The Next Horizon**

The process of tailoring sustainability assessments can be seen as a way of taking the process to a next stage of maturity. The development of standardised systems has been enormously helpful in producing a common base from which all schemes can be compared, and driving up standards of performance. For sustainability to become more aligned with the original Brundtland definition however, the next generation of understanding of sustainability and the way it is assessed is to see it in a systematic context, not confined by a single project or proposal. Indeed the development of the Environmental Impact Assessment Directives of the EU (85/337 and 97/11) through to the SEA Directive demonstrates movement already in this direction. The language of sustainable development must now move towards systems thinking where it will be seen as natural and inevitable that decisions have to be made against a wide spectrum, geographically, politically, and temporally. The fact that sustainability thinking has changed so dramatically over the last twenty years and yet is at least partly geared towards the next century and beyond shows that we need now to develop a framework of understanding that will endure.

The climate change agenda has recently emerged as dominant in the political thinking about sustainable development and there are many voices who would have us shift the focus away from sustainability and onto Carbon alone. Governments (and the UK government has played a leading role in this respect) have moved swiftly to consideration of low carbon strategies and this is entirely welcome. But such enthusiasm for change cannot come at the expense of the broader agenda of sustainability where the complexities of competing priorities are ignored. In countries which have the greatest need for improved infrastructure for example, we need a framework which recognises their right to develop, using the resources available to them. If there is an international case for refocusing their resource use (such as using less carbon dioxide generating fuel sources) then it is an international obligation to resolve the challenge. This of course sits at the heart of Kyoto and more recently but less successfully Copenhagen. Sustainability is the language of the framework that would allow such debate to be held taking account of all features.

Implicit in the Brundtland definition is this ambition, that we all be allowed to work for a future that meets our needs while respecting the needs of others, and that we care for future generations as if they were here to be considered. But the ambition now needs to be wider that in all our endeavours we see the work we are engaged in against a broad and global background, mindful that all actions are accountable to a wide constituency, many of whom have no voice of their own in our deliberations.

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