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Keynote papers

Reframing environmental performance goals for buildings

Raymond J. Cole

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Although profound changes in buildings and human settlement patterns are unlikely until there is a fundamental shift in societal values and expectations, performance targets are critical in communicating an aspiration and providing guidance for building design. The dramatic and visible increase in unusual and often extreme weather events, floods and storm activity, and the reported enormous social and economic costs associated with such disasters, are creating a more urgent context for concerted action. New goals are being proposed that both capture this emerging sense of urgency and translate it into new directions for building design.

The paper specifically compares the performance goals implicit and explicit in current building environmental assessment methods and the emerging notions of 'zero' energy and carbon 'neutral' buildings. These goals represent qualitatively different aspirations, different ways of relating to the building industry and making links with prevailing societal concerns. Moreover, whereas the former were premised on incremental improvement, the latter accepts that significant performance leaps are required.

The primary aim of the paper is to compare the potency of different goals to act as catalysts for positive change in building performance and, more importantly, to transform market expectation.

Keywords: assessment methods, carbon neutral buildings, ecological footprint, performance targets, regulation, zero energy buildings

Sustainable assessment in New Zealand — 100% pure conjecture?

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New Zealand's international reputation puts great store in its 'clean, green' and '100% Pure' image. The economy is heavily based on primary production and, increasingly, tourism and its drivers can be summarised as:

- Grass grows well in NZ
- NZ's stunning natural environment is a major box-office draw

Faced with global environmental change issues, however, NZ is turning domestic policy to support its current market image and has joined other countries in the race to be 'the world's most sustainable country'.

Landcare Research's involvement in this agenda has grown from part time commitment to an SD report (2001) to over 50 staff today, and is directly involved in

- developing and reviewing national policy
- creating viable products and services of immediate commercial take-up
- providing advice to central and local government and to corporates
- understanding the underlying mechanisms and
- establishing how these can be enhanced to increase sustainability

As such, Landcare Research is well-positioned to take advantage of NZ's relative isolation, deregulated policy environment, and can-do attitude, to participate in real-time experiments on developing sustainability as a kind of global lab.

Of particular interest here are our experiences with assessment techniques. This includes stand-alone indicator sets; corporate reporting, full-cost accounting techniques and an attempt to provide an overall taxonomy. To achieve this we will look at sustainability through a post-normal lens including O'Connor's concept of the Monetisation Frontier and the extent to which this delineates 'models' from 'similes' and why we prefer the latter as offering:

- relevant 'post-normal' technologies that are
- dialogic in nature and that
- enable 'thick' interpretations of data that encompass complexity and uncertainty

There will then be a brief exploration of other technologies, yet in their infancy, that are strong candidates to support the global challenge of sustainability and the forms of expertise needed in the research community to ensure progress.

Keywords: New Zealand

Integration and Complexity

Sustainable transport visions: expert and non-expert stakeholder perspectives on sustainable transport

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Transport systems perform vital societal functions, but in their present state cannot be considered 'sustainable'. Particular concerns in this respect include emissions, accidents, land use, noise and social exclusion. Sustainability is a complex and contested notion; consequently, sustainability assessment involves drawing on diverse stakeholder perspectives and societal values as well as on scientific evidence. In this paper, we report on participatory research conducted within the MATISSE project to assess sustainable transport, drawing on findings from expert and non-expert stakeholder workshops and questionnaires to elucidate criteria and options for sustainable transport. Our findings indicate different stakeholder groups agree on the need to address problems of unsustainability in the transport sector, and identify broadly similar environmental, social and economic criteria for sustainable transport. Non-experts focussed less on technical solutions, and highlighted more institutional and cultural barriers to sustainable transport, than did expert participants. However, we argue that there are important limitations to the categories of 'expert' and 'non-expert' and argue for more inclusive processes of knowledge production and policy assessment. Overall, our research indicates a need for integrated policy approaches to tackle unsustainable transport by addressing the socio-cultural and structural determinants of transport demand, as well as by offering technological solutions. Pathways to sustainable transport with both technological and behavioural elements are necessary.

Keywords: MATISSE project, assessment, stakeholder perspectives, sustainability, transport

Development of an Integrated Sustainability Assessment Toolkit

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Integration of environmental, social and economic issues is still a key challenge for the delivery of sustainable development and accordingly sustainability assessment. In attempting to address this challenge in relation to the built environment, SUE-MoT (a consortium of academic, public and private partners) has been formed with a particular focus on developing holistic metrics, methods and tools in a way that reflects stakeholder values. Currently SUE-MoT is working to develop an Integrated Sustainability Assessment Toolkit (ISAT) that brings together many approaches, allowing key decision-makers to identify the most appropriate for their project and to combine the results based on their values. The objective of this paper is to report on the principles of developing the ISAT so that it will allow a range of key decision-makers to systematically and transparently make holistic sustainability assessment decisions for a variety of projects. This paper begins by defining the principle of sustainability assessment and describing the ISAT framework process, highlighting the major stages and the general tasks involved at each stage. The ISAT's major structures, including the spatial scale of assessment, the life cycle, sustainability issues and their impact, the sustainability assessment tools database, stakeholder values and finally the mechanisms for stakeholder engagement throughout the process of assessment are also described. The sustainability impact assessment methodologies (based on principles of environmental impact assessment, social impact assessment and cost and benefits analysis) are briefly discussed.

Keywords: impact assessment, integrated sustainability assessment, urban development

A review of urban sustainability assessment methodologies

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Sustainability has emerged as a planning concept from its beginnings in economics and ecological thinking and has widely been applied to urban development. Urban sustainability is simply described as a desirable state or set of urban conditions that persists overtime. Just as the task of defining sustainability has progressed in response to early economic thinking, so has the task of its assessment. Many urban sustainability assessment methods can be identified from literature. However an examination of these methods reveals largely three methodological foundations. Focusing on the context of urban development, this paper presents an appraisal of the relative potentials and limitations of methods developed around the three identified methodological foundations. The paper agrees with the much held view that most currently available urban sustainability assessment methods fail to demonstrate sufficient understanding of the interrelations and interdependencies of social, economic and environmental considerations. It further points to a wide gap between assessment theories and practices. To help narrow this rather wide gap, the paper recommends a pragmatic shift in focus, from theory development to application and auditing. A suggestion is made for the application of key assessment methods in a given urban area and across various issues, spatial and time scales so as to allow for method comparison. It is hoped that the parallel application of existing methods will greatly accelerate the urban sustainability assessment learning process and will help in the improvement of both theory and practice.

Keywords: assessment methods, review, urban sustainability

The argument against a reductionist approach for assessing sustainability

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Both sustainability and sustainable development continue to remain elusive concepts even now, 20 years after the Brundtland Commission report that brought them into prominence. There is no consensus over their definition. This situation most likely stems from the fact that sustainability science encompasses the need to address a wide set of issues over different time and spatial scales and thus inevitably accommodates opinions from diverse branches of knowledge and expertise. However, despite this multitude of perspectives, progress towards sustainability is usually assessed through the development and utilisation of single sustainability metrics such as monetary models, composite sustainability indices and biophysical metrics including emergy, exergy and the ecological footprint. But is it really justifiable to assess the progress towards sustainability by using single metrics? This paper argues that such a choice seems increasingly unjustifiable not least due to these metrics' methodological imperfections and limits. Additionally, our recent awareness of economies, societies and ecosystems as complex adaptive systems that cannot be fully captured through a single perspective further adds to the argument. Failure to describe these systems in a holistic manner through the synthesis of their different non-reducible and perfectly legitimate perspectives amounts to reductionism. An implication of the above is the fact that not a single sustainability metric at the moment can claim to comprehensively assess sustainability. In the light of these findings this paper proposes that the further elaboration and refinement of current metrics does not seem sufficient to produce frameworks for comprehensive sustainability assessments. Adoption of diverse metrics seems more likely to be the key for more concrete sustainability assessments. This methodological pluralism coupled with stakeholder involvement will most likely culminate in better informed policy making.

Keywords: reductionism, sustainability assessment, sustainability metrics

Increasing Discrimination in Multi-criteria Analysis

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Multi criteria methods for supporting decision-making procedures are widely used in sustainability assessment. One of the most important steps in decision-making procedures is the evaluation of policy options or alternatives in order to find a hierarchy of option choices. Utility function value distributions are often constructed for the range of indicators for the options to be assessed. This distribution can be presented as an impact matrix stacked with indicator weights to reflect the relative importance of different indicators for the decision-maker. Solving rules are then introduced to integrate all individual indicator evaluations into a single integral utility estimation. These are often based on the averaging procedures, one of the simplest being arithmetic averaging. Whilst averaging rules are very attractive to decision makers due to their simplicity and logical transparency, using averaging as the first step of the decision-making procedures can significantly reduce the discrimination of the options, especially if there are counteractive individual indicator estimations.

This paper proposes a method to evaluate and overcome this loss of discrimination. The paper explains the basis of a discriminatory analysis approach to sustainability assessment, demonstrating its application through the use of illustrative data and describing its application to an existing case study where researchers had applied a number of multi criteria analysis tools. It was concluded that the discriminatory analysis provided a useful addition to the decision-makers toolbox as it provided a means of assessment of the validity of the application of the simple arithmetic averaging technique.

Keywords: multi-criteria decision making tools, sustainability indicators, sustainability metrics

Planning, Regeneration and Infrastructure

Assessment methods and tools for regeneration of large urban distressed areas

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Large urban distressed areas (LUDAs) are present in many European cities where interlinked social, economic, and environmental decline occurs at a significant scale. LUDAs thus far have proved difficult to regenerate in a sustainable manner. The reasons for this have been recognised as: firstly, inappropriate use of ex-ante assessment in decision-making process and a limited spectrum of assessment methods and tools applied; and, secondly, inadequate knowledge about the situation in the distressed areas. In recognition of these shortcomings, the aim of the work described here, undertaken in the EU research project was: 1) to assess the state of knowledge about assessment methods and tools among European researchers and urban practitioners; and, 2) to identify the problems and drivers for change that should be taken into consideration in order to regenerate areas in a sustainable manner. The problems and drivers for change were identified by issuing questionnaires to authorities of six cities with recognised LUDAs: Bratislava, Dresden, Edinburgh, Florence, Lisbon and Valenciennes. The results confirmed the multifaceted character of deprivation in LUDAs. The most significant problems and drivers for change were related to economic situation and urban structure. A list of assessment methods and tools was compiled, and surveys were carried out with ten research institutions and practitioners to identify the theoretical knowledge and practical experience of these methods. The results showed that, while the knowledge of assessment methods was satisfactory, their practical application had been less advanced. The authors emphasise the need for exchange of experiences in regeneration and call for a development of assessment methods specifically related to economic and urban structure concerns.

Keywords: Bratislava, Dresden, Edinburgh, Florence, Lisbon, Valenciennes, assessment methods, distressed areas, ex-ante evaluation, urban regeneration

OIKOS: An integrated approach towards sustainable spatial planning and management

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This paper presents OIKOS, an Integrated System to support spatial planners and developers in the decision making process towards sustainability with significant emphasis on public participation as a key element to reach a full and comprehensive integration of sustainability criteria in the formulation of plans and programmes at the very early stages of spatial planning. On the other hand OIKOS could be used as a decision-making tool (IDSS-Integrated Decision Support System) by the authorities in the Plans and Programmes Approval Stages, as a tool to validate and complement SEA (Strategic Environmental Assessment) results.

OIKOS is conceived as a coherent set of tools, approaches and methods to be used by territorial managers to support the implementation of sustainable territory management strategies on local and regional scales in the Basque Country based on the state of the art of knowledge and experience concerning physical, ecological, social and economic parameters and the overall decision making process involved.

OIKOS aims to answer the following questions: a) How to pursue the aim of designing a Sustainable Planning Integrated System, b) how to achieve the integration of sustainability criteria from early stages of planning c) how to measure sustainability integrating the environmental, social and economical aspects and, d) how to make stakeholders to be interested in and to actively participate in the process.

System configuration follows a tool box (multi-instrument) approach utilising 'state of the art' planning and GIS based methods, which will be complemented with several modules (Data Management, Concept Model Development, Indicator Set Definition, and Multi-Criteria Analysis) and integrated together with Stakeholders Participation Tools all along the OIKOS implementation process. The system will ultimately be validated through scenario based case study dealing with the spatial planning of the urban-periurban area of Vitoria-Gasteiz (Basque Country).

Keywords: GIS, IDSS, OIKOS, multi-criteria analysis, participation tools, urban-periurban areas

The development of the Index 21 housing layout tool: the assessment of non-monetary environmental benefits

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In recent years mass housing developments, built by speculative developers in Scotland, has broadly focused on economically led strategies, with housing built to high densities. Current methods of development have widely ignored environmental issues. In contrast, the wider issues of sustainability, and consequently housing developments, have become ever more complex. Yet local planning authorities are required to incorporate these issues into the planning process. This paper focuses on the development of a housing layout assessment tool, termed Index 21: Housing Layouts, which provides a practical method of assessing the environmental friendliness of housing layouts. This tool has been developed to provide a discursive forum between the designers of housing developments and planners to aid the planning process.

There is a lack of effective tools that would facilitate the effective choice of environmental friendly housing layouts. The Index 21: Housing Layout tool is aimed for use during the planning stages to encourage the adoption of more sustainable housing layouts and also to encourage dialogue between designers of housing layouts and the planning authorities. Index 21: Housing Layouts is based on the assessment of five Indicators, namely Climate, Energy, Resources, Biodiversity and Social Sustainability. Using a case study at Rothesay, on the island of Bute, the tool has been tested on three design layouts for a housing association on a sensitive semi-urban site. The paper concludes with the description of the next phase of development for the tool as it stands and a similar tool that encompass the assessment of social and environmental issues of housing design, to encourage more sustainable methods of housing design.

Keywords: environmental friendliness, housing assessment tool, housing layout, sustainable housing

A spatial decision support system for strategic urban re-development. The case study of Turin Central Station, Italy

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The development of urban and territorial projects requires more effective and supportive visioning and forecasting evaluation methods. Traditionally, MCE (Multi-criteria evaluation) theory aim at foreseeing early warning signals and place them in the context of planning and designing a new or existing project. However, this evaluation lack of visualisation which are essential for assessing other design aspects, such as aesthetical conditions, etc. More recently, spatial decision support tools (e.g. Idrisi) based on the integration of MCE and Spatial Analysis have been usefully adopted for helping decision making processes on a the basis of "visible" rather than "discursive" design conditions. The problem with these tools is the hierarchical structure of decisions underlying the MCE when applied to complex urban regeneration and sustainable development problems.

This paper discusses the potentialities of a new tool, based on the linking of MCE applications with the ANP (Analytic Network Process) technique that makes possible to systematically deal with all kinds of dependencies and feedback in a decision making problem. Some assumptions of this new support system will be explored on a practice level by developing and combining some analyses of a strategic infrastructural re-development area in Turin (Italy).

Keywords: Analytic Network Process, Italy, Turin, multi-criteria evaluation, space syntax, urban transformation

Urban design for sustainability: parameters of place formation as tools of sustainability projects in the case of Temelli, Ankara, Turkey

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This presentation is based on research in Ankara, Turkey, in Polatlı District (township of Temelli) as a case for understanding and approaching urban planning/urban design for a SP where parameters of place formation will be delineated and applied. Although Turkey has taken part in the Rio Summit (1992) and hosted Habitat II in Istanbul (1996), SPs are neglected. This is an attempt to introduce a sustainability policy into the region where an overspill of 350,000 people are expected, resulting from metropolitan growth of Ankara within the next 20 years, specifically into rural-agricultural land.

The research is based on an interrogation of PLACE for discussing a sustainability project because, firstly a place approach promises to handle the three sustainabilities interconnectedly. Secondly, the concept of place has been within architectural paraphernalia long enough but has been mostly reduced to a status of "face lifts" and this research aims to treat place on a wider scale and rediscover its boundaries as an effective tool for urban design. The research is based on observations and interviews on site, official planning documents on the town of Temelli and proposes to apply on Temelli a checklist of 6 dimensions. So the research aims to bring together sustainable development, urban design and place for redefining a planning approach. Place is described as the area in which people establish economic, social, psychological and environmental ties to support their daily life. For a sustainable place this "area" needs to be conceived holistically, since a fragmentation of everyday lives weakens the experience of place, and thus an effective control of everyday spaces.

Research based on a literature survey on the theory of place, and observation of various places of sustainable character have led to the formulation of the following set as basic place dimensions:

1. Historical-geographical/ecological materialist indicators
2. Place-identity
3. Site and natural assets
4. Architectural, historical, cultural heritage
5. Governance and subsidiarity
6. Temporality

Keywords: Ankara, Polatlı District, Temelli, Turkey, boundary, parameter, place, sustainability, urban design

Sustainability Indicators and their Application in Decision-Making Processes for Eastside, Birmingham, UK

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Birmingham Eastside, an area of 130 hectares, is located to the eastern side of Birmingham's city centre. Over a 10 year period this once deprived inner city area is being regenerated through public and private finance estimated at £6 billion. The regeneration scheme is rapidly bringing about changes to the local environment, economy, and the society therein. The key players (e.g. landowners, developers and planners) involved in the decision-making processes for Eastside have the power to see that these changes are brought about in a sustainable manner. For this to happen it is necessary to assess in which direction the development should go, and to provide benchmarks for implementing and measuring sustainable changes along the way. This process can be facilitated by the use of sustainability indicators, of which there are many.

This paper outlines the sustainability indicators (e.g. SPeAR, BREEAM, Sustainability Checklists and other benchmarks) that might be used within the decision-making processes for Eastside. In particular, it details those indicators operating at city level, quarter level and then individual development site level. Several case study sites are included (Masshouse, City Park Gate, the Learning and Leisure Quarter, the New Technology Institute — nti, and Warwick Bar). The paper discusses the role of indicators in achieving a sustainable Eastside, and analyses how they are/are not forming an integral part of the decision-making process for Eastside.

Keywords: Birmingham, Eastside, UK, assessment methods, urban regeneration, urban sustainability

Application of the Analytic Network Process and the Multi-modal framework to an urban upgrading case study

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Multicriteria analysis is often used in planning for evaluating alternative development options against a set of evaluation criteria. In the context of sustainable development, the definition of these criteria is quite controversial because of the complex and fuzzy nature of this emerging topic. Decision making for sustainable (re)development at urban planning level requires an understanding of the multiple issues implied in the problem. The Multi-modal framework (MMF) developed by Brandon & Lombardi (2005) has proved to be able to help decision makers to handle the multiplicity of the issues embodied in the concept of urban sustainability, guiding the selection of appropriate criteria for evaluating alternatives solutions. This paper will apply this framework to an Italian urban (re)development problem by using the Analytic Network Process (ANP), a most advanced network version of the Analytic Hierarchy Process (Saaty, 2006). The ANP is the first mathematical theory that makes possible to systematically deal with all kinds of dependencies and feedback. It requires a network structure to represent the problem, as well as pair-wise comparison to establish relations within the structure. The MMF will be used to structure the problem for decision toward a more sustainable built environment.

Keywords: Analytic Network Process, multi-criteria analysis, multi-modal framework, sustainable built environment

The use of the Analytic Network Process for the sustainability assessment of an urban transformation project

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Environmental problems and the principles of sustainable development in projects and planning processes have become increasingly important over the last years. In this sense, the feasibility studies should involve not only the technical elements and the social-economic aspects but also the factors related to the interferences of the operation with the environmental components. This means that sustainability assessment can be considered as a complex decisions system with several elements that have to be taken into account.

Speaking about complex decisions, the multi-criteria techniques provide a useful support in the choice among several alternatives with different objectives and criteria and allow one to include in the evaluation all the factors, tangible and intangible, related to the specific problem. Particularly, the Analytic Network Process (ANP) is a multi-criteria theory of measurement used to derive relative priority scales of absolute numbers from individual judgments. The ANP offers a general framework to deal with complex decisions which provides a comparison of the different options.

The object of the work is the sustainability assessment of an urban transformation project in Italy. Through the use of the ANP, the analysis will put in evidence the most important elements for the evaluation of the process and their reciprocal influence, with particular reference to the environmental aspects.

Keywords: Analytic Network Process, Italy, environmental compatibility, multi-criteria analysis, sustainability assessment, urban transformation project

Demographic change and infrastructural cost — a calculation tool for regional planning

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Urban densities largely determine the requirements and costs of infrastructures and their operation. The higher the density, the more cost-efficient the infrastructure. Traditional approaches to cost calculations of such structures generally assume that they are used at full capacity. However this assumption does not hold true under conditions of shrinkage. Instead one finds the under-use of infrastructure and utilities, with resulting increases in per capita costs. Reducing costs by simply reducing capacities is made difficult by the high share of capital cost going toward investment and ever longer life expectancies. The tool presented here examines the interplay between small-scale differences in the development paths of population and settlements. The resulting effects on costs helps point the way to ensuring more efficient structures over the long-term. One example region is taken to show that even with a development trend favouring increasing costs, application of a consistent settlement policy based on the current urban stock can avoid higher future costs for infrastructure in the medium-term. With zero population growth, costs for infrastructure can increasingly become a limiting factor in future policies on urban settlement.

Keywords: cost, regional development, urban infrastructure, urban structures

Can Green Infrastructure promote the urban renaissance and aid urban sustainability in the UK?

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The UK government's Department for the Environment, Transport and the Regions (DETR) 'Our towns and cities: the future' (2000) document promoted the prospect of an urban renaissance in the UK developed through a series of urban renewal initiatives to create better places to live, work and recreate. Six years on from the Urban White Paper and there continues to be a policy drive through programmes such as The Northern Way and the Thames Gateway that focus the work of the Office of the Deputy Prime Minister (ODPM) and now the Department for Communities and Local Government (DCLG) on promoting better quality environments through integrative design, social inclusion and public participation. However, whether urban renewal can succeed without a progressive integration of multi-functional greenspaces into the urban matrix is still uncertain?

This paper proposes that Green Infrastructure can play a pivotal role in the urban renaissance by providing a complementary green matrix of spaces that offer multi-level benefits for human populations. Secondly, Green Infrastructure is also viewed as simultaneously providing natural resource sinks to assist urban climate control, water management and provide important green networks in an increasingly urbanised Britain.

Green Infrastructure as a delivery mechanism has been discussed as holding the potential to develop environments that fulfil the remits of the DCLG and the new government manifestation of Natural England. Due to the potential of Green Infrastructure to be 'retrofitted' into most environments this paper will argue that Green Infrastructures can be delivered across diverse urban environments in the UK to promote sustainable community engagement and management with their local environments. It will also suggest that ecological and economic agendas can also be successfully incorporated into Green Infrastructure plans to promote an increased sustainability within urban areas.

Overall this paper will address how Green Infrastructure can be planned within urban environments to promote increased human integration, ecological sustainability and economic regeneration. It will argue that through the integration of green spaces into the urban matrix that urban environments can be developed as multi-functional and sustainable places at both community and municipal levels. This argument will draw on examples from the UK to emphasise the role Green Infrastructures can play. Finally, this paper will suggest the broader implications for climate control and economic regeneration that Green Infrastructure integration can deliver, will in the long-term, provide a base for a continued urban renaissance.

Keywords: Green Infrastructure, climate control, integration, social inclusion, urban renaissance

Transformation processes of large railway stations in Europe: when urban quality is directly related to positional value

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Nowadays, the railway transportation system of many European cities has been undergoing a process of renewal accompanied by extensive urban transformation: not simple adaptations of the stations to the new technologies, but rather real changes in the functional layout of the entire neighbourhood in the vicinity of the railway buildings.

Thus, in some cases, the station has become a basic structural element in a city district in a state of transformation resulting in its progressive integration into the city centre, from which originally it had been excluded. The peculiar nature of railway stations and their neighbouring areas (i.e. the great added value due to their accessibility and attractive capacity, as well as the consolidated profitability of the activities that are, or can be, established in the area) is an element of convergence of different (public and private) interests as concerns the different transformation hypotheses.

This work intends to investigate, on a quality level, the transformation processes of railway stations, paying particular attention to the aspects related to urban strategies, the relationship between accessibility, mobility and utilisation density, financial feasibility and the consequent increase in value.

Keywords: infrastructural development, property value increase, public-private partnerships, urban strategies

Assessment of traffic congestions in Akure (Nigeria) using GIS approach: lessons and challenges for urban sustenance.

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The level of urbanization in developing world indicates that more people live in cities than before. This pattern induces pressure on traffic flow and makes living induces urban area difficult. The situation, described above, has started to manifest in Akure, a medium urban centre in Nigeria. This study was therefore carried out with the aim of applying Geographic Information System (GIS) to investigate traffic congestion patterns in Akure and determine the management techniques suitable for their reduction. Topographical map of Akure as at 1966, Landsat images of Akure as at 1986 and 2002 were acquired and processed to produce the base map on which the major analyses were based. Major entities influencing traffic congestions were identified and modeled. Secondary data collected in form of traffic census for some selected road junctions in Akure were also processed and analyzed. The result shows two major ways by which GIS can provide solutions to traffic congestion in Akure. The first way is the provision of traffic information that enables commuters and motorists to take rational decisions as to which route to take during peak hour travel. The second is the determination of appropriate queries that can evoke graphical response, which could be used to manage traffic congestions. The work recommends that a GIS structure in addition to existing traffic management techniques should be put in place to monitor traffic congestions in the city. It also recommends Traffic Information System (TIS) to the State and Federal Radio from where traffic congestion situations could be relayed not only to motorists but also to commuters. The paper also shows that GIS is a veritable tool that can be used to sustain an endurable flow of traffic in urban environment, provided it is built on a properly designed database, which must also be amenable to constant updating.

Keywords: Akure, Nigeria, TIS, commuters, peak hour travel and database.

Urban sustainability through decentralisation and interconnection of energy, waste and water related solutions: Case EVA Lanxmeer, Culemborg (The Netherlands)

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This paper focuses on the need for interconnection of essential urban infrastructures first of all based on another network philosophy and use, to achieve sustainable urban development, or: whole life urban sustainability. A topic of interest in sustainable urban planning is the lack of integration of the 'essential flows' (water, energy, waste/wastewater). With respect to these flows ecological and spatial conditions in and around cities are under pressure: transportation distances grow, protection and qualities diminish, and (infra)structures get more complex, less robust and less visible, which result in a decline of sustainable commitment and behaviour of users. It also results in growing dependance of the essential utilities. The use of decentralised systems at district, neighbourhood or local scale could introduce new urban functions, options for self-sufficiency of public buildings or entire districts and improved commitment of users. This will be illustrated with an innovative project under development (partially under construction) in Culemborg, the Netherlands. It concerns the spatial integration and technical solution of a system to connect waste, and wastewater treatment with energy generation inside this residential district. Essential is the integrated approach, closing cycles of nutrients, water and carbon and integrating energy generation and waste management through cascading qualities and use of the concept of exergy. Physically this will be realized in a newly introduced device that is called the 'Sustainable Implant' (SI). This SI is integrated spatially in a building in an attractive way and works at the intermediate scale of both this semi-public building and the surrounding city-district (approx. 250 houses). The district is situated in an ecologically sensitive area, because it concerns a former drinking water extraction and retention area. The system layout and backgrounds are explained in this paper.

Keywords: Culemborg, autonomy, energy, heteronomy, sanitation, urban sustainability

Selecting sustainability indicators for urban energy systems

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Literature on the measurement of urban sustainability shows that no single indicator framework is appropriate for all applications. Consequently practitioners must consider the intended goals of indicator use and carefully choose metrics to maximize their relevance and effectiveness. The study of urban energy systems demonstrates these issues, as energy use is integral to many dimensions of urban sustainability and hence encompasses an array of stakeholders with potentially divergent needs. This paper therefore explores the selection of indicators for urban energy use, drawing on the previous work of Maclaren (1996) and Ravetz (2000). Potential urban energy indicators for London are presented to demonstrate the selection procedure and to highlight the challenges posed by the measurement of urban energy use. The paper concludes by suggesting that a mix of data sources, supported by a strong theoretical framework, is required to evaluate both urban energy systems and urban sustainability in general.

Keywords: London, UK, indicators, sustainability, urban energy systems

A decision support system for water cycle management in new developments: user scenarios for consideration of sustainability imperatives

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The Water Cycle Management for New Developments (WaND) project aims to support the delivery of integrated, sustainable water management for new developments by provision of tools and guidelines for project design, implementation and management. WaND is a research consortium of more than 30 researchers and around 25 professional stakeholders, and deals with the provision of water, stormwater and wastewater services.

This paper aims to simulate the practical use of 'Flexiframe' — a browser-based user interface to WaND output and decision support. Two stakeholder groups are considered here: planners and developers. The potential application of Flexiframe for stakeholders is illustrated based on case studies conducted within the WaND project. Existing decision making processes are used as a template for routes through the portal for each professional group. At each stage relevant links and targeted decision support tools developed within WaND for the specialist user are referenced. The practical use of Flexiframe for user groups is demonstrated based on assumptions of requirements. A project assessment tool within Flexiframe enables wider consideration of the relative sustainability of decisions at strategic level. Its use is demonstrated in simulated stakeholder group discussions.

Two user scenarios are considered that illustrate potential consequences of decisions for technical, economic, social and environmental aspects of a new UK housing development. The potential output of the tool is illustrated based on the results of interviews and workshops with professional stakeholders and the WaND consortium.

The paper demonstrates the practical application of the Flexiframe decision support tool; how it encourages communication between professional domains, its explicit incorporation of sustainability principles into decision making and its educational value. The tool's fulfilment of requirements of stakeholders consulted at the start of the project is considered, as is its potential future development.

Keywords: Flexiframe, WaND, accessibility, assessment, decision support, integration

More Sustainable Management of Pollution: Integrated Approach, Models and Tools

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The PUrE (Pollutants in the Urban Environment) research consortium is developing a new decision-support framework for the integrated assessment of options for more sustainable management of urban pollution. This framework involves three steps: (i) mapping the flow of pollutants associated with human activities; (ii) modelling the fate and transport of pollutants in the environment; and (iii) quantifying the environmental, health and socio-economic impacts of urban pollution. The new decision-support framework provides an integrated approach which will facilitate the comparison of different management options based on their sustainability. The decision-support framework includes a suite of different models and tools, to support the sustainability appraisal of two or more options, for example: life cycle assessment, source (emissions) characterisation, pollutant fate and transport modelling, environmental impact assessment, health impact analysis, ecological impacts assessment, and multi-criteria decision analysis. This paper presents examples of the methodologies used by the project researchers to develop various elements of the framework. The new framework can be used at different levels, for example, to conduct a simple screening study as well as for a more detailed assessment. This paper describes many details of the framework and outlines several case studies developed to demonstrate its application.

Keywords: PUrE, decision support, models, pollution, sustainability, tools

Sustainability investigation tools for water management in new developments

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This paper provides an overview of some of the tools being developed, in a UK based multi-disciplinary project on water cycle management for new developments (WaND), to investigate the performance of a range of water management strategies in sustainability context. Models described include tools for forecasting the impact of water demand management measures and new developments on water demand, simulating the environmental, economic and system performance of greywater recycling strategies, evaluating the preliminary design and performance of stormwater drainage systems and assessing flood risk in new developments. In total, 12 tools are introduced in this paper. For each tool, its development strategy (architecture), application and key results are discussed briefly.

Keywords: WaND, flood risk assessment, greywater recycling, storm water drainage sustainability evaluation, water demand forecasting, water management

A GIS tool for modelling and visualising sustainability indicators across three regions of Ireland

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This project uses a Geographic Information System (GIS) as a tool to visualise and model Sustainable Development Indicators for 71 settlements across three regions of Ireland. Tools for simulation models within the GIS are developed to project the effects of policies over time on the sustainability indicators of an area. This project further develops the database created over the last two years at the Centre for Environmental Research (CER) University of Limerick within the Irish Environmental Protection Agency-funded project, Sustainability and Future Settlement Patterns in Ireland. It contains data on 175 environmental and socio-economic indicators for each of the 71 settlements in the Sligo, Midlands and Limerick regions of Ireland.

A Geodatabase data model was used to store and spatially reference the sustainability indicators and indices. Database schema was created using Microsoft Visio and Universal Modelling Language (UML), and generated using Environmental Systems Research Institute's (ESRI's) CASE Tools. This method enables the database and framework to be more easily shared, modified and updated.

A combination of graduated symbols, diagrams and hyperlinks are used to display the indicators and indexes. A visualisation tool for these data facilitates comparison of sustainability across regions, identification of regional tradeoffs between certain indicators, and highlights sustainability issues, including 'hotspots' where policy and resources will be most effectively targeted across the study areas.

Keywords: GIS, Ireland, policy scenarios, sustainability indicators, visualisation

Sustainable timber frame diaphragm development

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The EU Directive on Energy Performance of Buildings has the aim of promoting energy performance within the EU and will have a direct impact on current timber frame construction in the UK. As a result of the directive, changes to Part L of the Building Regulations have been implemented in England and Wales with Scotland undertaking amendments to Section 6.1 of the Technical Standards in 2007.

To reach the requirements of the Directive it is perceived a timber frame wall detail will have to attain a U-value of 0.27 W/m^{2}K. This paper details a study which was undertaken to derive the optimum option giving due consideration to practicality, cost, sustainability and structural performance.

Keywords: EU directive, domestic dwellings, timber frame construction, wall diaphragms

Urban Sustainability and Ageing: Uncovering the critical links between the urban environment and successful ageing in place

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The physical environment is emerging as an important determinant of individual health outcomes. With growing evidence to suggest that health in later life is particularly sensitive to environmental characteristics, this link is of increasing interest to the ageing populations of the developed world. Much attention has focused to date on developing mechanisms for successful ageing in place. The term 'ageing in place' has traditionally referred to individuals growing old in their own homes with an emphasis on modification of the home environment to compensate for the limitations associated with ageing. It is no surprise that research consistently indicates the majority of older people prefer to age in familiar surroundings. It is also no surprise that ageing in place represents a more economically, environmentally and socially sustainable option to institutionalised care. However, the research agenda must be broadened beyond the immediate home environment if all the variables associated with successful ageing in place are to be thoroughly appreciated. This paper commences with an examination of the key concepts associated with ageing, sustainable development and environmental assessment. The key themes in a range of established sustainable urban environment assessment tools are then examined. The examination reveals that the ageing in place concept has not been adequately integrated into the assessment process. The paper argues that ageing in place is a critical factor in urban sustainability, and concludes with a conceptual model for the integration of ageing in place into the assessment of sustainable urban environments.

Keywords: ageing and the built environment, ageing in place, environmental assessment, urban sustainability

Sustainable Buildings: Design, Performance and Assessment

Sustainable housing projects in the UK: a pilot study

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Sustainable development contributes to the economic and social advancement of construction projects. Ignoring sustainability during the cost estimating process associated with a construction projects evaluation phase develops a problem of conventional decision methodology used in construction industry. This research investigates the most important factors of sustainable housing projects. It explores and evaluates the factors which have the most cost impact on the setting of reliable sustainable construction project budget estimated at the early stages of the design process. This paper is drawn from an on-going PhD study in this topic area and considers relevant literature taken from the research strands identified above. An approach to the research is set out and consideration is given to the preliminary results from a pilot study that included interviews and questionnaires conducted with experts in the field of project price forecasting and sustainability.

Keywords: EcoHomes, cost estimation, sustainable construction

Blurring boundaries in the theory and practice of sustainable building design

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The notion of "boundaries" is critical when discussing buildings and sustainability — both technically and professionally, and in the current separation of ecological from social and cultural considerations in building design given that they both play a critical economic role throughout the lifetime of a development.

This paper examines the ways that the notion of "bounding" has proved both valuable and problematic in building environmental research and practice. More significantly, the paper explores the consequences of "blurring" boundaries and the consequences for future advances in the discussion of designing and assessing buildings, projects and communities that support sustainable patterns of living. The paper uses three key distinct realms within the current environmental debate where boundaries play a decisive role:

- The conceptual boundary that defines the scope and structure of building assessment methods.
- The professional boundaries that define the realms of knowledge and responsibility of members of the building design team.
- The designation of distinct building environmental strategies that are capable of being assessed and evaluated within the more blurred realm of social and cultural values and economics.

Keywords: assessment methods, boundaries, professional responsibilities, sustainable building

Design for disassembly: support for urban sustainability in Australia

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Industrial ecologists recognise the impact of industry upon the environment and develop methods with which to reduce these including the reuse and recycling of materials incorporated into products. Worldwide, the reduction of natural resource consumption has been investigated and applied to various industries, with varying degrees of success. This paper focuses on the construction industry, using thematic analysis to locate world's best practice in respect to construction and demolition waste legislation. It identifies the Netherlands and Denmark as the current leaders in construction and demolition waste management and reports on the results of a policy analysis, which concludes that landfill levies, landfill material bans, material segregation and certification are the main contributors to waste reduction. A meta-analysis of Australian state legislation reveals that these policies are largely absent, rendering the legislation ineffective. A model of legislative best practice is presented that is applicable to the Australian context, which incorporates the concept of designing for disassembly, a technique that already exists in other manufacturing industries. The paper concludes that by implementing these policies there is a potential to decrease waste through reuse and recycling within the building industry.

Keywords: Australia, Denmark, Netherlands, construction and demolition waste, disassembly, landfill, policy, recycling

Cradle-to-cradle — A concept for the disposal of buildings at the end of their lives?

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The construction industry has a vital role to play to find solutions which are ecologically compatible, economically acceptable and socially responsible in equal measure. The purpose of this paper is to discuss alternative disposal methods of buildings at their end-of-life with respect to opportunities for cost saving and responsibility for reducing environmental burdens. Tougher laws and increasing charges for land fill encourage the application of new procedures for disposal.

Instead of putting a burden on future generations and the environment, waste salvaged from disposal can become a resource to be recycled and re-used. The application of cradle-to-cradle concepts to disposal of buildings contributes to the recovery of materials out of the life-cycle with zero loss in material performance. The possibilities for sorting waste as well as material separation are not entirely taken into account in present disposal projects.

This paper identifies how significant improvements in the quality of disposal waste can be achieved by the application of selective deconstruction procedures. The efficiency of the selective deconstruction method depends on a high degree on the selecting and sorting of materials. The application of selective deconstruction can contribute to the economic efficiency of disposal projects while simultaneously increasing the quality of the salvaged materials for re-use and recycling.

Keywords: building, cradle-to-cradle, disposal, life-cycle, selective deconstruction

Assessment focus for more sustainable buildings

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Proliferation and complexity of tools for assessing sustainability of buildings calls for facilitating the use of tools by different stakeholders. This consideration entails rethinking of the assessment focus and flexibility of tools. The aim of this paper is to outline how the focus on durability, adaptability and energy efficiency of buildings enables building designers and managers to assess new building designs and existing buildings by considering most significant aspects of the environmental impact of buildings. It also indicates how flexibility can be achieved by enabling changes in the assessment scope and criteria.

The paper considers a recent analysis of existing tools for assessing sustainability of buildings and draws attention to an assessment tool developed by researchers at the University of Strathclyde in 2000, which is available as software and has been used to assess new building designs and existing buildings. The transparency of the assessment criteria and flexibility of the tool regarding the assessment scope and changing performance targets in the assessment criteria enable easy adaptation of the tool for different building types, environmental/geographical context and stakeholders' needs.

The conclusions outline advantages of focusing on the most significant aspects of environmental impact of buildings, providing transparent assessment criteria and flexibility for changing performance requirements and addressing the needs of different stakeholders. This approach can also be applied in developing tools for assessing economic and social aspects in sustainability of buildings.

Keywords: adaptability, assessment focus and flexibility, assessment tools, durability, energy efficiency

Experiences of applying a sustainability assessment model

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A key challenge in moving towards a more sustainable future is adequately embedding sustainability principles into organisational decision-making. The Sustainability Assessment Model (SAM) has been put forward as one option to highlight and assess sustainability principles within various project decisions. Developed originally in the UK, SAM is a Full Cost Accounting tool designed to produce a graphical display for discussion on the monetised costs and benefits of externalities arising from the social, environmental, resource and economic implications of a project — where a "project" consists of any economic activity for which a scope can be defined and acceptable boundaries laid (e.g. development of an oil and gas field or waste disposal). The primary intention of SAM is in its process: to engage a broader range of stakeholders in order to generate dialogue around indirect impacts of a given project, in turn facilitating broader consideration of options and allowing greater sustainability for that project to be achieved.

This paper discusses the experiences gained through the application of SAM in urban case studies in New Zealand, including assessment of different waste management options, housing and transport projects. In particular, a number of challenges were faced in undertaking the assessments, these include; establishing appropriate boundaries for assessment, data limitations, differing levels of engagement achieved with different stakeholders, and the relationship of SAM to more conventional assessments (including cost-benefit analysis and triple bottom line reporting). Some of these challenges are likely to be applicable to any approach that aims to embed sustainability into organisational decision-making.

Keywords: New Zealand, assessment tools, full cost accounting, urban sustainability

Combining environmental impact and financial cost calculations with quality assessment at the building level.

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Buildings are complex products whereof most important design decisions are taken during the first design phase. Environmental impact (EI) and financial cost (FC) are therefore preferably evaluated at this moment. The complexity of buildings and the lack of information during the early design phase however make the evaluation difficult. In this paper a methodology is proposed to overcome these difficulties by incorporating EI assessment in the element method for cost control. This enables, in a first step, to evaluate the initial EI and FC of building elements, whereof the relation to the building is taken into account by expressing the EI and FC per m^2 floor area. A building is in that sense simplified to independent elements and the lack of information is handled by refining rough first estimations to detailed calculations — for the elements of interest — later on in the design process. Moreover the aim is to include the whole life cycle of the building. Life cycle assessment (LCA) and life cycle costing (LCC) are combined, leading to a total EI and FC per m^2 floor area. To enable comparative analysis, a final step is added: a quality evaluation is elaborated via a multi-criteria analysis. The proposed methodology is illustrated by a case study to improve comprehensiveness and prove its viability.

Keywords: element method, life-cycle assessment, life-cycle costing, multi-criteria analysis, quality evaluation

A framework model for assessing sustainability impacts of a built environment

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Urban assets have impacts not just on those who develop, build and operate them, but on people who may be quite remote from them. The impact of a building on greenhouse gas emissions arising from energy use, pollution caused by travel to work patterns, employment opportunities and reductions in crime may be far removed from its immediate locality. There is a growing recognition of the need to internalize these external costs in accountancy frameworks, but this presents major challenges in identifying, evaluating and allocating whole life costs and the external environmental and social costs of a building project. This paper reports progress on the development of a holistic sustainability accounting framework which allows decision makers to identify building sustainability indicators (economic, environmental and social) for different assessment contexts and select the appropriate mechanisms for monetising their impacts so that the holistic, whole life costs and benefits can be evaluated. It builds on a Sustainability Accounting Model (SAM) developed originally in the oil industry covering four major issues: environmental, social, economic and natural resources. The paper describes why the Sustainability Accounting Model was chosen for further development from the many others that have been proposed as candidates. It describes how it has been tailored for the construction industry, how the many sustainability indicators have been prioritised and simplified, and the techniques that have been used for monetising what are regarded by many commentators as intangibles.

Keywords: built environment, full cost accounting, sustainability assessment

Sustainable buildings in significant architectural contexts: a proposal for the area of "La Martella" in Matera.

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Each architectural project is arranged as an organised process according to a sequence of phases, which are in turn characterised by different procedures; from the initial cognitive analysis and the expressive synthesis, to determining the construction techniques and the most appropriate materials, all of which make it possible to define and manage the proposal. Within the course of the project, each phase is connected to the previous and following one according to different criteria but not necessarily according to a set temporal articulation.

The course of the modern bioclimatic project is characterised by two specific factors, the first being the necessary attention to the reaction of each individual element and of the whole building in relation to physical phenomena; the second factor required is that of providing the occupants with a high level of satisfaction: each choice made during the planning stage is dependent on the physiological and psychological well-being of the possible users.

The building plan cannot exclude evaluations regarding the consequences connected to choice of specific constituent methods and materials. Another fundamental requirement of the building materials is their durability and maintainability so as to avoid energy and economic waste.

Sustainable planning is based on the environmental conscience which belonged to traditional construction traditions. Their reproposal today does not mean a return to the past but a modern rereading of their use, as a normal evolution of techniques whose final aims are both the reduction of energy consumption and the restoration of a cultural identity characterised by a general state of well-being.

According to these criteria, the sustainable planning implemented during the course of this research has demonstrated an application contextualised in an area with profound environmental-architectonic characteristics, the village of La Martella of L. Quaroni in Matera (Italy).

Keywords: Italy, L Quaroni, La Martella, Matera, bioclimatic project, durability, environmental sustainability, maintainability, sustainable buildings

Examining the role of building envelopes towards achieving sustainable buildings

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Buildings are long known to be a major resource consumer and contribute substantially to environmental deterioration. The building envelope, being the interface between the building and the environment, controls the interactions between them. It does so by firstly filtering out the undesirable external environmental elements and subsequently affecting the amount and rate of resource consumption and environmental deterioration by the building in order to regulate the interior conditions. This paper aims to investigate the ways in which the building envelope can impact upon the sustainability of the building and the magnitude of the impact through an extensive literature review.

The concept of building sustainability and sustainable building rating systems and guidelines are first reviewed. Criteria of sustainable buildings are established and grouped into 4 aspects, i.e. economic, environmental, social and functional. Based on these 4 aspects, the impact of building envelope on the building sustainability is examined. It was found that the building envelope has significant impact on the initial and running costs of the building. Also, it affects the energy efficiency and the indoor environment of the building significantly. Lastly, the building envelope was also found to be a significant factor of the functional performance of the building through its integration with other building systems.

In conclusion, the in-depth literature review conducted has confirmed that the building envelope is a major contributor to building sustainability and presents great opportunities in enhancing the sustainability of buildings. The concept of a sustainable building envelope is advocated. The paper also provides a framework which further research works on sustainable building envelopes can be built upon.

Keywords: building envelope, sustainable building

Urban sustainability: comparative value of building-top apartments

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This paper discusses the ecological performance of constructing new apartments on top of existing buildings. The emerging architectural typology of 'building-top apartments' in Wellington is discussed as a more 'sustainable' solution to urban apartments compared with conventional 'demolished-site' development.

Apartments built on top of existing buildings are a typology that averts demolishing the host building thereby avoiding waste and improving life-cycle performance. It can be built more economically because it does not require excavation and footings. It contributes to urban population intensification thereby supporting city social and cultural vitality and economic development. It accommodates many people who walk to work thereby reducing motor vehicle congestion and pollution as well as potentially contributing to public health through better fitness. It supports higher numbers of people in the city as casual observers and thereby potentially contributes to reduction in crime. By accommodating a significant proportion of the city's population growth building-top apartments comparatively help reduce land subdivision on the city's boundaries which consume energy and resources at a higher rate.

Wellington has an emerging urban architectural typology that can be shown to be contributing to city sustainability in terms of having less impact on the environment than conventional development while also contributing to better economic performance and to social and cultural endeavours. The paper scopes across a range of matters while focusing on building sustainability, specifically site development, life cycle assessment, cost of demolition, cost of footings and foundations, construction waste and embodied energy and CO_2 emissions.

Building-top apartments in Wellington are a breeding ground for new ideas and are seen as an important vehicle for city renewal with lessons that may be transferable to other cities.

Keywords: New Zealand, Wellington, building-top apartment typology, comparative urban sustainability

Sustainability Development and Capital Investments: Exploring Planning in Public Housing and Higher Education Building Construction

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As public agencies consider costs, management, and environmental impact in developing goods and services with high capital investment in a world of increasingly limited resources, inclusion of sustainability goals becomes increasingly important (Leuenberger 2006 a and 2006b). Focus on sustainable development and financial planning for public services with high long-term capital investment costs is necessary and can have huge long-run impacts. Public housing and higher-education construction projects, which require high investment in capital through building and land costs, also require long-run planning, resource management, and environmental impact assessment. This paper offers examples of sustainable building planning decision making tools and related financial measurement techniques. It investigates the financial impact of initially investing in sustainable properties, the costs of maintenance, projections for resource, and cost savings into the future. This paper discusses economic planning in sustainability management outcomes by looking at system impacts of government decision making. It offers measurement tools for use in planning for existing and new developments (Leuenberger 2006c). Finally, it provides examples of sustainable development outcomes for public housing and higher education building construction projects and explores mechanisms by which costs for capital investments can be managed for maximum short-run efficiency as well as long-run sustainability.

Keywords: capital investment, construction, higher education, public agency planning, public housing

Sustainable Communities

Social capital and energy efficiency in urban householders

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This paper examines social capital in urban householders to further understand social influences in relation to energy use. Social capital, or the social resources available through social networks, and related norms of trust and reciprocity, is a recently popularised term. In UK urban environments, social capital is argued to be declining amongst certain populations. This paper takes a preliminary look at the possible connections with social capital and energy use by examining data derived from the English House Condition Survey 1996. This paper argues that insights of potential relationships between social capital and urban householders can increase understanding of energy consumption. It is hoped that preliminary findings here could indicate the need for further research, which could ultimately assist energy efficiency policymakers, practitioners and researchers understand the broader social framework that underpins individual householders' energy use.

Keywords: English House Condition Survey, UK, household energy consumption , social capital

Determinants of social capital: prioritising issues for holistic urban sustainability assessments

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The concept of social capital is gaining increasing recognition as a concomitant for social and economic development. Robert Putnam's (2000) exposition of the crucial correspondence between the decline of social capital on one hand and the economic lives of American people on the other received wide acclaim at home and abroad. Contemporary literature on development studies is equally replete with references to the World Bank's subscription that social capital has an important role to play fostering sustainable development. There is a general agreement among proponents of social capital that well-governed cities which exhibit strong economic growth do so because of their high stocks of social capital (Portes, 1998). There is also a similar realisation that the design and form of cities, neighbourhoods and individual buildings have significant implications on social capital as they can affect the way people interact and bond with each other and the sense of community among individuals (Dannenberg et al, 2003; Lindstrm et al, 2003). The fundamental premise is that some urban designs encourage social ties and informal contact among residents while others violate the evolutionary pattern of civicness within the urban existence. The aim of this paper is to identify and examine the key determinants of social capital within an urban development context. This should set the platform for a predictive model of social capital, which will enable the incorporation of the concept in a holistic urban sustainability assessment framework. The paper argues that social capital is a subject of self-organisation, whose evolution to higher levels can be catalysed by the prevalence of a critical balance in the design of the physical urban environment.

Keywords: complexity, determinants, social capital, sustainability assessment

Using EIA for the assessment of environmental inequities associated with proposed urban developments in the UK

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Critical to understanding sustainable development, concepts of environmental justice and environmental equity hold that certain groups of people suffer disproportionately from the environmental burdens, such as noise and air pollution, associated with developments like factories and waste treatment centres. Such ideas first evolved from evidence in the US of the siting of polluting facilities near Black or Native-American communities and subsequently, in the US, various assessment approaches have been developed with the aim of ensuring that proposed projects do not lead to an increase in environmental inequity among certain local target populations.

In the UK, issues of environmental justice and equity have been receiving increasing attention among policy makers at the highest levels with both the latest UK and Scottish sustainable development strategies containing reference to them. Meanwhile, in the research community, work has been undertaken examining the evidence-base for existing environmental inequity in both England and Scotland. However, for a UK context, there has been relatively little exploration to date of what an approach for assessing the environmental equity implications of a proposed project might look like.

In response, this paper builds upon a discussion of the main concepts underlying environmental justice and environmental equity, and their interpretation for a UK context to identify generic assessment requirements for such an approach. It then outlines how Environmental Impact Assessment could provide a framework for the assessment of the environmental equity implications associated with proposed urban developments for a UK context and concludes by introducing the next stage of the research which seeks to develop and test an EIA based approach.

Keywords: EIA, UK, environmental justice, urban development

Examining the environmental justice component of urban sustainability: a comprehensive analysis including economics, collective action, ethnicity, and age

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A broader, more holistic understanding of urban sustainability includes social progress and sustainable governance. Within this context, environmental justice is an important component of sustainability. This paper assesses environmental justice using multivariate regression methods to analyze the factors that explain the location of United States Environmental Protection Agency Toxic Release Inventory facilities (TRIFs) within a large county containing 401 such facilities. The data overcomes prior research shortcomings by aligning residential characteristics before firm location over three decades, thereby ensuring that findings do not indicate the movement of residents into the firm's ambit, but location of the firm among the residents. The analysis tests poverty, race, and collective action hypotheses, including the relevance of age, to conclude that potential for collective action decreases the likelihood of TRIF location. Even controlling for other factors, evidence of environmental injustice based on race/ethnicity remains. Perhaps even more disturbing from a sustainability perspective, in these data areas with higher percentages of children have an increased likelihood of new TRIFs.

Keywords: EPA, TRIF, USA, environmental justice, urban sustainability

Sustainable community indexing, a process approach

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A multidisciplinary team with background in environmental, economic, and social disciplines has developed and is piloting a sustainable community index (SCI) and process. The process is designed to invite wide community participation and the index allows the community to benchmark and map how is it doing with its economic vitality, social quality of life, and environmental integrity. An overview of the development of the index and the process for applying it within a community is given. A review of literature and practice examines other sustainable community indicator efforts and highlights the uniqueness of this SCI indexing process. The analytical hierarchy process (AHP) used in developing the SCI index is summarized and the objective basis for the index will be discussed. AHP is a powerful and flexible decision making process to help people set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered. When used for an SCI, AHP offers a unique opportunity to combine multiple objectives, some of which may be contradictory, into a single goal. The sustainability of local, regional and national communities is furthered when communities are able to create and use an SCI to guide their planning and development. The SCI is unique both in its scale and utility, providing communities with a presently unavailable tool. Applying the SCI allows neighborhoods, villages, townships, and larger communities to visualise how the current set of relationships among people and the land measure up in terms of sustainability, where on the landscape the current conditions are more and less sustainable, and what underlying conditions make them so. The process of developing the index is valued by the community because it derives from the values and choices of the people who make up the community. SCI development and piloting is supported with a grant from OSU CARES, OSU Extension, and OSU Outreach and Engagement.

Keywords: community sustainability, sustainable community index

Assessing transitions to sustainable housing and communities in the UK

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We discuss work that is underway in the EU Framework 6 project MATISSE to develop the science and application of Integrated Sustainability Assessment (ISA) in EU policy-making. Many problems in the urban environment are persistent and intractable in nature, or wicked problems. Energy inefficient building stocks, growing energy, water and resource use, social exclusion and growing household numbers on limited land are complex, structural issues — deeply rooted in, and reinforced by, patterns of behaviour, technologies, infrastructures and social institutions. They make housing and communities in the UK unsustainable, environmentally, socially and economically. We focus on systemic shifts, or transitions, as an analytical framework for understanding these types of persistent problems, and aim to simulate the complex, dynamic processes within and between the different levels — niche, regime, and landscape — of societal systems. Using our empirically and theoretically based conceptual framework, we have developed a general modelling tool, which draws on agent-based modelling, as well as behavioural and economic theory, and explores the dynamics of and the barriers to transitions. Here we use this tool to explore the possibility of a transition to sustainable housing and communities in the UK. We look at the interdependency of institutions and infrastructures including the mainstream and 'green' building sectors, planners, house owners and other actors, and explore how the housing sector regime has created various types of lock-in, which stifle large-scale innovation. We review the current unsustainability and map it onto the transition framework. We then present two plausible future narratives for the housing sector: in the first climate change and energy are addressed in a top-down manner, and in the second a broader sustainability agenda is addressed both top-down and bottom-up. Finally, we take steps to tailor our general model to this case study.

Keywords: MATISSE project, UK, communities, complex systems, housing, modelling, sustainability, transitions

Using resident formulated multi-dimensional indicators to assess urban communities' progress toward meeting sustainability goals

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For the past seven years the authors have, in partnership with communities throughout the state of Ohio in the USA, designed and implemented long range urban planning initiatives based on principles of sustainability, linking the social, economic and environmental sectors of community. These programs have all involved inclusionary processes for visioning, goal setting, and long-range plan development in the creation of resident-initiated and supported sustainability goals. For sustainability to be pursued, we have found that a balance among these complex and often competing social, economic and environmental interests in each urban area must be achieved and effective tools must be used to assure that goals remain in balance through continual monitoring and assessment. The assessment technique used is the development of multidimensional indicators which measure how close the community is to reaching its goals and that they remain in balance. We have formulated an approach to the establishment of multi-dimensional indicators that involves both residents and professionals in their development and on-going monitoring. Such stakeholder involvement helps to insures that the indicators will be relevant, politically supportable, usable and that they matter to the community. These qualities maximize their legitimacy in the eyes of local leaders and increase the likelihood of their usage in community decision-making processes.

Our paper will outline the assessment processes that we have developed, their impact on the decision making in urban communities, and how these approaches can be effectively replicated in other communities.

Keywords: Ohio, community planning, indicator development, sustainability

Blueprints for resilient communities — micro-comprehensive sustainability planning in Baltic Sea urban local areas

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Twenty-six common local urban townscape areas were studied in five Swedish, two Russian, two Latvian, one Polish and one Danish city — altogether 11 Baltic Sea Cities. A method was developed during 10 years for multi-dimensional assessment of the sustainability status of the local communities studied according to the United Nations Habitat-agenda. Seven universal key resources were thus analysed for each local area. Physical resources concerned e.g. energy, water and land use in the local community. Economic resources comprised the typical value of houses, equipment, informal activities, the rents and costs in a community. Biological resources were e.g. the entrance-, courtyard-, mid-scale- and large-scale green structure accessible to inhabitants. Organisational resources concerned functional aspects like transport, food service, child care and community communication in the local area. Social resources were — like social capital — the relations between inhabitants in their roles as dwellers or as representatives of clubs or organisations. Cultural resources were defined as the degree of awareness and value of site history, traditions, ceremonies and local arts in the community. Aesthetic resources were the valuable visual, auditive or other sensory input of value to the inhabitants.

From the analysis of strong and weak points of the seven resources — a contextual micro-comprehensive plan for sustainable community development could be outlined for each local area, comprising three components: universal, townscape type specific and unique place specific part-strategies. From our empirics we could also conclude that for each community — a key change factor mostly existed — either a specific problem or a specific vision for positive change. By addressing the key factor, a broader change described in the micro-comprehensive plan, towards a more sustainable community development, could successively be introduced.

Keywords: Baltic Sea, Denmark, Habitat agenda, Latvia, Poland, Russia, Sweden, community resources, sustainability, urban planning

Stakeholders, Participation and Values

Impacts of participants' values on sustainability of construction projects

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This paper examines the processes through which the values relating to construction projects, with particular reference to sustainability, are determined and operationalised. Those values are fundamental in governing the performance of both the project, as a product in occupation and use, and project management, as processes of realisation of the project involving design and construction. The values determine what performance variables are considered and their relative importance which, within the applicable parameters, controls and constraints, yield the performance targets for the project — against which realised performance will be evaluated. Those values are derived from the value structures of the project participants and so, must be elicited and collated under the influence of the evolving membership and power-structure of the project temporary multi-organisation (TMO). The TMO, as a shifting, multi-goal, power-based coalition promotes fluctuations in the values employed to drive the project as it develops and so, makes evaluation of performance highly problematic. Given that the values are human-determined, they are grounded in culture and so, understanding culture, as an operative construct in the project value system, enables the concepts and practices relating to the sustainability of construction projects to be understood and developed.

Keywords: culture, greening, performance, projects, sustainability, values

Carbon-footprint reporting as a tool to support sustainable practices for Scottish SMEs

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Construction Small and Medium Sized Enterprises (SMEs) in Scotland significantly contribute to the local and regional economy, however, their economic performance and business competitiveness lags behind other regions in the UK and EU. This paper reports on the general awareness of Scottish construction SMEs on a spectrum of sustainability issues and the legislation that impacts their business processes. We pose the primary research question; 'What awareness do Scottish SMEs have of sustainable practices and how are they addressing their carbon-footprint?' The research proposition is that construction SMEs are no different to the vast majority of other Scottish SMEs which currently, have little knowledge of sustainable business practices and are unaware of how they can improve to become more sustainable resulting in more competitive practices.

The research examines knowledge of sustainability and factors relating to carbon-footprinting. The research work involves a case study. The case study work has been undertaken on a construction SME eager to improve their carbon-footprint. The research will give an indication of the value of a carbon-footprint as an empirical measure of sustainable function within organisations. The paper is concluded with recommendations on how SMEs may improve their sustainability by managing their carbon-footprint based on the findings from the case study work undertaken.

Keywords: SMEs, carbon footprint, construction, sustainability

Extelligence: a new angle on sustainability?

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Florida's Rise of the Creative Class (2002) seemingly offers city officials a formula to assure their city's economic prosperity. Some strong correlations between several, at first sight, unrelated phenomena — technology, talent and tolerance — have inspired Florida to declare that we are witnesses to the dawn of the creative society. The people at the forefront of this new society are collectively termed 'creative class' and they are particularly demanding of 'overall urban quality of life' when choosing a place to live. This society's economy is bent on continuous innovation. That offers a paradox: the creative class that is at the very heart of creativity/innovation — thereby sometimes inducing taxing societal and environmental changes — also demands a sustainable urban environment.

We start from extelligence, which is both the sum of all the forms of human capital — present and past — and the capability to presently or in the future add to it or change it. We define emergence as the phenomenon whereby a system apparently transcends anything that can be offered by its components. A city is an ecosystem wherefrom continuous recombinations of meta-capitals (specifically relational, intelligence and identity), transformational capitals (e.g. finance, labour, and knowledge capital) and natural resources emerge. The observable manifestations of each type of meta-capital are socio-cultural events: the presentation and execution of an urban ideology, the drafting of SWOT-analyses by a city's civil service, and the functioning of its civic community. Sustainable urban development is about creating a path that avoids wasting mankind's capital bases (i.e. all forms of extelligence and natural resources).

We formulate, through an abstraction of the dynamic interplay of extelligence, socio-cultural structures, generative mechanisms and socio-cultural (incl. economic) events, a systemic approach of urban economic growth. This theoretical approach will be verified through case studies; the presently selected cities being Amsterdam and Antwerp.

Keywords: Amsterdam, Antwerp, creative society, emergence, extelligence, meta-capitals, socio-cultural structures

Defining, identifying and mapping stakeholders in the assessment of urban sustainability

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The assessment of sustainability requires that the diverse values of the stakeholders are represented in the context-specific interpretation of sustainability and in the choice of a desired course of action. Sustainability is a broad concept, and the stakeholders in sustainability are many. In order to have effective stakeholder engagement, it is crucial that all the relevant stakeholders are identified early in the process. In urban development projects, some stakeholders may be obvious, but there might be others who are excluded from the usual decision-making processes and these may even bear disproportionate environmental, social or economic costs leading to inequitable outcomes. This has created the need for a systematic approach to defining and identifying stakeholders for different contexts. This paper will evaluate existing approaches for defining and identifying stakeholders in development projects and the requirements of a sustainability assessment process. Through this analysis, it will identify/develop an approach for defining and identifying stakeholders that is most appropriate for sustainability assessment.

The paper also argues that it is important to map out the levels of interest of different stakeholders in relation to the power that they hold. This is useful in determining the appropriate engagement techniques at the different stages of a project and also in understanding any potential conflicts. It is thus important to understand the relationships between the different stakeholders because this can affect the success of the engagement process. Such a mapping of stakeholders can also be useful in anticipating the expectations of the different stakeholders from the project.

Keywords: identification, mapping, stakeholders, sustainability assessment , urban sustainability

Educating for urban sustainability: a transdisciplinary approach

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Various approaches to life cycle assessment (LCA) have been developed and are increasingly being adopted in order to quantify the human footprint on the planet in terms of urban development. Very often these techniques are intended for different constituencies and are therefore less than ideal when approached by others not familiar with their focus. Furthermore the most mature LCA tools have been developed for use in the built environment and are not intended for use elsewhere. Unfortunately, a mass of design and production decisions that impact upon sustainability are made outside of this domain, and are poorly served both in terms of a shared understanding of the concepts and dedicated LCA tools: similar patterns can be found in the professional training provided by tertiary education. A novel approach to overcome this deficit is being pioneered by the School of Architecture and Built Environment at the University of Newcastle in Australia, where undergraduate architects, industrial designers, design and technology teachers, facilities managers and construction managers are developing a transdisciplinary understanding of sustainability issues as an integrated part of design through the use of learning contracts. This paper details the resultant holistic, multi-criteria problem-solving course design, and the experiences of staff and students who have previously experienced such an approach, highlighting the beneficial outcomes of developing a transdisciplinary, shared understanding of sustainability in the constructed environment.

Keywords: design process, learning contract, life-cycle analysis, transdisciplinary

The role of visualisation in effective sustainability assessment

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Sustainable decision making in urban design is a complex and non-linear process that requires the interaction of a wide variety of stakeholders. A number of sustainable decision support tools have previously been developed but a major barrier to the implementation of these tools is the complexity of the environment in which decisions are made. In particular, engagement with the general public throughout the decision making process presents challenges. These include communicating the complex and interdependent facets of sustainability and also demonstrating the short and long term implications of alternative courses of action. This paper describes the underlying concepts of a prototype visualisation tool (S-City VT) that will allow stakeholders to understand, interact with and influence decisions made regarding sustainability of urban design. The Dundee Waterfront Development Project will be used as a case study. The S-City VT simulation will model the relationship between the various sustainability indicators and the effect of choosing a particular set of indicators will be brought to life through an animation-based simulation. The model can also be used to identify possible trade-offs between the facets of sustainability.

Keywords: modelling, urban sustainability, virtual city, visualisation

Progress toward sustainable development in a knowledge society in Italy and EU

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The Lisbon European Council (CEC, 2000) sought to make Europe "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion." The Knowledge Society is seen as a key factor for achieving Sustainable development in Europe, the so-called eAgora model. Aim of this paper is to show that, though the use of ICTs is recently increased in Italy, the level of citizens participation and involvement in decision making is still very low. This suggests an eDomus rather than eAgora model of using ICTs by citizens. Similar results are recognized in Europe.

The paper is structured in two main parts. The first part discusses current use and access of digital technologies by Italian citizens as depicted by the results of recent surveys and compares this situation with the outcomes illustrated at a European level by the Intelcities EU IP project. The second part discusses the main implications of these findings, in term of risks and/or opportunities, for meeting the Lisboa strategy objectives.

Keywords: ICT use, Intelcities, Italy, benchmarking, e-participation

Surfing the landscape of barriers and incentives to sustainability assessment in an urban development context

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Assessment of urban sustainability can be considered as a means to an end as it is often intended to guide decision-making in a way that contributes to sustainable urban development. The contribution of assessment mechanisms towards the achievement of this goal depends to a large extent on the level of use and adoption of sustainability assessment tools amongst the diversity of users. Since the development of a Sustainable Development Strategy in 1998, the UK Government has given sustainable development prominence on the policy agenda, with similar emphasis being reflected at EU legislation level. Investigation of the barriers and incentives to sustainability assessment can supplement this increasing prominence of sustainability in decision-making processes and the equally increasing need for sustainability assessment. A review of the literature on the subject suggests that although much has been written on barriers and incentives to sustainability, very little work has been done on factors that hinder or encourage uptake of sustainability assessment tools. Against this background, the aim of this paper is to investigate and identify the barriers and incentives to sustainability assessment and the adoption of assessment tools. This should provide a starting point for assessing the potential impact of various approaches and incentives to overcome the barriers to sustainability assessment. Four broad sets of barriers and incentives are identified as perceptual, institutional; economic; and technological factors. The paper further discusses some of the enablers associated with the various policies and legislative instruments at the political hierarchies of: the EU; the UK (including the devolved governments); and local government levels. The paper concludes by suggesting that the identified barriers and incentives should be given due consideration during the development of any sustainability assessment tool.

Keywords: barriers, incentives, sustainability assessment

Sustainability appraisal and public examination of a regional spatial strategy

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UK spatial planning guidance now recognises the importance of engaging stakeholders in appraisal processes at an early stage in the plan-making process. Regional Planning Authorities are required to consult proactively with a wide range of stakeholders on both the development of planning policy and the sustainability appraisal of that policy. However, there is no clear indication as to how they might go about this process, other than to confront the various stakeholders with a Sustainability Appraisal Report. Participation in Sustainability Appraisal therefore still relies on reaction to a technical appraisal of an existing plan — and in this situation stakeholders might lack the incentive to participate. More thoughtful ways need to be devised to involve people in the sustainability debate — so that spatial policy more accurately reflects their knowledge and aspirations. The focus of this paper is to investigate ways in which Sustainability Appraisal of spatial plans can be made more accessible and transparent within the context of wider governance mechanisms. Of particular interest is the Public Examination of a Regional Spatial Strategy. The following research questions attempt to address the gaps in knowledge:

1. How can the quality and extent of engagement of stakeholders be improved, so that policy approaches delivered via Sustainability Appraisal more effectively reflect their ambitions, whilst continuing to meet the objectives for sustainability?

2. How can the sustainability issues that might form the basis of discussions in a proactive engagement of interests be identified, and how can these issues be framed within a contextual setting that is meaningful to a range of stakeholders?

3. What mediatory techniques can be identified to accommodate the various frames of reference that arise in potentially conflict situations?

Keywords: regional plans, stakeholders, sustainability appraisal

Implementing principles of sustainable development: the role of partnership and collaboration in the design and construction of a new housing development at Upton, Northampton, UK

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The urban-fringe development at Upton, Northampton, is shown to illustrate the implementation of current best practice when following principles of sustainable development and has provided an important case study for monitoring and research. A key issue for the research group was to understand how the concepts of sustainable development were understood, transposed into initial plans, designs and the consultation process. Major players were involved in taking innovative and conceptual ideas for the Upton development and transferring these ideas into reality. These people were interviewed and they recounted their part in the process, expressed their perceptions of the barriers and enabling factors that allow people from a diverse range of disciplines and perceptions to collaborate and contribute to the overall plan. This paper takes an overview of these interviews and discusses the role of partnership development, entrepreneurship characteristics and willingness to take a leap into uncharted urban planning territory.

Keywords: Northampton, UK, Upton, multi-skilled collaboration, partnership development, sustainable development, urban planning

A sustainability enhancement framework for the Dundee Central Waterfront Development

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The paper presents ongoing research to develop a Sustainability Enhancement Framework for the major Dundee Central Waterfront urban re-development project. The enhancement concept recognises a need to ensure that sustainability is considered in decision making at all stages of major projects to ensure a more sustainable outcome overall. The paper will describe a set of procedures, developed by the authors and drawn from IT and knowledge management fields, to ensure the effective incorporation of the sustainability throughout the Waterfront Project decision making processes. The procedures include the production of Information Flow Diagrams to identify the wide range of stakeholders involved in the project and their means of interaction and Decision Flow Maps to identify and categorise the use of the information by the stakeholders. The paper will review current sustainability indicators related to infrastructure provision in the UK and Europe, emerging indicators from Scottish Executive, EU commission and research groups and will present a set of indicators suitable for enhancing the sustainability of the Waterfront Project. Two related sets of Indicators are proposed — Strategic 'Sustainable Development Benchmark Indicators' to monitor the overall sustainability of Waterfront Development as it progresses and 'Project level Indicators' to help make each decision within individual projects relatively more sustainable. Conclusions are drawn on the appropriateness of the indicators for assessing sustainable infrastructure provision and on the success of implementing the Sustainability Enhancement Framework

Keywords: Dundee, knowledge management, stakeholder participation, sustainability metrics and indicators, waterfront

The role of knowledge management in urban sustainability assessment

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Urban sustainability assessment is increasingly being seen not just as a technical process to determine the likely sustainability performance of build projects but as a valuable tool in the mediation between the many associated stakeholders with their differing visions, numerous requirements and variations in expertise. This emerging role presents new and considerable challenges for the management of knowledge — during its generation, flow and capture — to ensure the meaningful engagement of such stakeholders in the decision-making process.

This paper explores the role of knowledge management in aiding the delivery of urban sustainability assessment within development projects with multiple stakeholders. Outlined is an approach taken by the SUE-MoT research consortium in the development of a knowledge management system incorporated to supplement the practical application of a planned integrated sustainability assessment toolkit (ISAT). The system aims to deliver a knowledge support system (codification strategy) provided through an ICT resource for capturing, storing and transferring explicit and tacit knowledge generated during assessment. This will be integrated with a personalisation strategy developed to promote the necessary discourse between stakeholders deemed necessary to facilitate the transfer of knowledge required for assessment to function as a tool for mediation and 'social' learning. The integration of these strategies forms the basis for a wider knowledge management system that will be supplemented by a framework for managing sustainability assessment. A series of knowledge maps are to be developed to provide the foundations for understanding the contextual nature of the knowledge flow between stakeholders during assessment. This forms the basis for the development of the mechanisms provided through the system for stimulating knowledge transfer and to ensure the effective mediation of their varying priorities. The paper argues that only by engaging with the contextual nature of this flow, can effective stakeholder engagement during the decision-making process become achievable.

Keywords: ISAT, knowledge management, knowledge support system, stakeholder engagement, sustainability assessment

Sustainable management of urban soils: Seeking expert consensus through computer mediated decision making

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As with air and water, soil systems are an essential finite resource for human existence. Soil characteristics and processes are of high complexity. Moreover, the range of functions and character of soil in an urban setting are considerably more complex, transient and variable. Until recently urban soils did not receive high levels of scientific and political value, importance and appreciation. Thus an understanding of urban soil quality, processes and assessment methodologies for sustainable use lags far behind that of water and air. Recent publication of the soil thematic strategy, raises further the need for policy driven by scientific understanding. Given this, and the context the Aarhus convention, this challenge presents one of even greater urgency. This paper analyses recent case studies that critically assesses online computer mediated decision making, OCMDM, (using an electronic Delphi technique) as a tool to generate urban sustainability metrics and indicators, and for knowledge management for sustainability assessment. The paper describes the methodology of the technique together with its practical application amongst a European wide multidisciplinary expert group engaged in developing a common European methodology for the evaluation of the environmental quality of urban soils for sustainable resource management. The paper concludes with a summary of the identified challenges for OCMDM which would realise its efficient use for sustainable urban management more generally.

Keywords: decision support, environmental quality, heuristic rules, knowledge capture, participation

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