

THE ROLE OF SUSTAINABILITY ASSESSMENT IN SUSTAINABILITY MANAGEMENT FOR URBAN REDEVELOPMENT

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Sustainability assessment has the potential to influence decision making and hence to improve the management of sustainability. This paper presents the development and reporting of benchmark sustainability indicators and discusses the challenges of embedding sustainability indicators into existing process for urban infrastructure development. It links sustainability indicators with a range of tools that were implemented within a Sustainability Enhancement and Monitoring Framework for the £1 billion redevelopment of Dundee Waterfront. The sustainability monitoring framework followed the UK and Scottish Government thematic indicator approach and provided a set of Sustainability Benchmark Indicators for assessing and managing a public sector funded urban redevelopment. The process of indicator development was iterative and consisted of three main activities, literature, interviews and document analysis. Indicators were finalised through close working with Dundee City Council, Scottish Enterprise and partnership stakeholders. The indicators were successfully established in 2010 within Dundee City Council at project and departmental level, providing the link across policies, programmes and projects. The indicator development process is discussed and the findings of a January 2015 review of changes in the benchmark indicators will be reported. The transition of the indicators over time and its impact on future sustainability enhancement opportunities are evaluated alongside the implications for sustainability management of Dundee Waterfront. The efficacy of the benchmark indicators to support sustainability management over the planned 30 year programme of urban redevelopment is discussed. The wider implications of the findings of the Dundee Waterfront project are reviewed in the context of current work on sustainability assessment.

Keywords: sustainability assessment, decision making, knowledge management, sustainable development.

INTRODUCTION

Sustainable Development indicators are an important tool in the management of cities, enabling the benchmarking and measurement of progress over time (Siddall *et al.* 2013). Indicators can be used to direct urban decision making and support urban design decisions, assisting engineers make sense of inherently complex cities (Rogers 2012). Engineers and construction managers implement design, control and coordinate activities on site and ensure that management systems work effectively. This role increasingly also involves the management of sustainability, where sustainability assessment can be actively used to support the management of sustainability across the project life cycle (Thompson *et al.* 2011).

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The Local Government in Scotland Act (2003) specifically requires that “*the local authority shall discharge its duties under this section in a way which contributes to the achievement of sustainable development.*” Within this context, the scale and regional importance of the £1billion Dundee Waterfront Development requires adherence to the principles of sustainable development and this must be demonstrated to Partnership bodies, private investors and the public as well as to the Scottish Government in a transparent way.

Abertay University provided support to Dundee City Council Engineers Department between 2007 and 2013 to identify opportunities to enhance the sustainability of Waterfront Infrastructure Provision. The approach was based on a theoretical Sustainability Assessment and Enhancement Framework (Blackwood *et al* 2014) which required a set of Sustainable Development Benchmark Indicators to be developed and embedded in the Waterfront Team’s process to, not only monitor, but also enhance sustainability. The sustainability indicators act as a benchmark for the project reflecting the goals and aspirations of the waterfront project as set out in the Dundee Waterfront Master plan. The Assessment and Enhancement framework is shown in Figure 1.

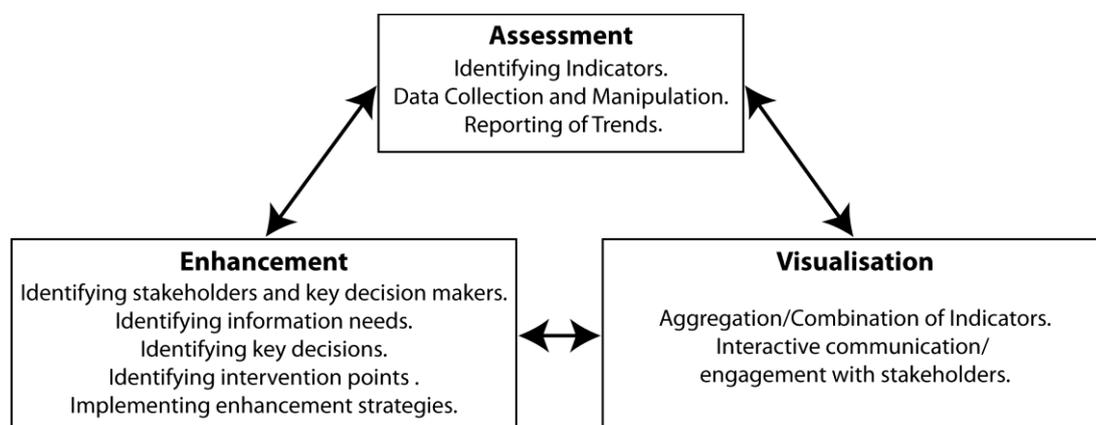


Figure 1: The SAVE Framework

This paper presents the findings of a review of the use of Sustainable Development Benchmark Indicators to enhance the sustainability of the Infrastructure Stage of Dundee Waterfront 2010 -2015. During the period of the study, significant stages of the Waterfront Development have been completed with the demolition and realignment of Tay Road Bridge ramps, demolition of roads and buildings, which previously separated the city centre from the waterfront. In their place, a new grid iron street pattern to make available 5.5 hectares of development area. The sustainability enhancement activities undertaken by Dundee City Council Waterfront Team during this period are summarised and their impact on the benchmark indicators evaluated. The review provides data for each of the indicators alongside an interpretation of the trends in the indicators over the period 2010-2015.

USE OF BENCHMARK INDICATORS

Indicators have been widely used by both policy makers and academics in sustainability assessment (Walton *et al.* 2005; Hak, 2007; UN 2007; Pultz and Ramstiner 2009) with well-chosen indicators considered as an effective technique for assessing sustainability (Reed *et al.* 2006). Indicators help to break down the sustainable development concept, to give it a clearer definition (Porta and Renne 2005), and hence, to make it more comprehensible. Simply put, an indicator is

something that helps us understand “*where we are, which way we are going and how far we are from where we want to be*” (Simon 2003, P2.). Indicators can provide crucial guidance for decision-making in a variety of ways. They can translate physical and social science knowledge into manageable units of information that can facilitate the decision-making process. They can help to measure and calibrate progress towards sustainable development goals. However, Dahl (2012) states that perhaps the most significant effect of an indicator, particularly during its early adoption, can simply be to make a problem visible therefore sensitising decision makers and the public to expand the basis for decision making. Development of indicators of sustainability can be seen as the first step towards the operationalisation of the concept of sustainability.

A sustainability monitoring framework was successfully established for Dundee Waterfront in 2010 (Gilmour *et al.* 2011). The process of indicator development was iterative and consisted of three main activities, literature, interviews and document analysis. Indicators were finalised through close working with Dundee City Council (DCC), Scottish Enterprise and partnership stakeholders. The appropriateness of the development process and currency of the indicators was confirmed through workshops with the Scottish Government and the Improvement Service. The system was designed to utilise Scottish Government Single Outcome Agreement (SOA) meta data to populate indicators in post baseline data compilation and reporting. This use of SOA data as part of the Sustainability Monitoring Framework is in keeping with the use of the SOA strategic Outcomes as the basis for operationalising the principles of sustainable development as illustrated in the DCC Sustainability Development Policy Statement.

The 2009 indicator report (Gilmour and Blackwood, 2009) set out the 6 indicators that were expected to be influenced by activity during the Waterfront Infrastructure Stage. These were:

- Tourism numbers (Economic);
- Tourism spend (Economic);
- Waste (Environmental);
- Air (Environmental);
- Noise (Environmental);
- Acceptability (Social).

The report also established that other indicators were not expected to change due to influence of the Waterfront until Plot Development or completion of the Dundee Waterfront programme. It is expected that the indicators will demonstrate the regional impact as set out in the 2001 Master Plan therefore changes observed in these indicators should be attributed to wider activities undertaken by Dundee City Council to progress towards SOA Outcomes to 2017. Table 1 presents a summary of the benchmark indicator trends across the 26 indicators Economic (10), Environmental (7) and Social (9) categories shows 15 indicators have moved in the desired direction across all the categories, with only 2 indicators moving against the desired direction.

Table 1: Summary of benchmark Indicators trends 2010 -2015

Economic		Environmental		Social	
Demographics		Green space/public space		Housing provision	
(City Wide)	✓	(Direct)	...	(Direct)	✓
Retention of skills base			Waste	Health & Well being	
(City Wide)	✓	(Direct)	✓	(City Wide)	✓
Knowledge based employment			Air	Community	
(City Wide)	×	(Direct)	✓	(City Wide)	×
Employment			Water	Social Inclusion	
(City Wide)	~	(Direct)	...	(City Wide)	✓
Capacity to stimulate investment			Noise	Participation and responsibility	
(Direct)	✓	(Direct)	~	(Direct)	✓
Tourism numbers			Energy	Active community participation	
(City Wide)	✓	(Direct)	...	(City Wide)	✓
Tourism			Travel	Acceptability	
(City Wide)	✓	(City Wide)	✓	(Direct)	...
Regeneration				Confidence	
(Direct)	~			(City Wide)	✓
Job creation				Amenity value	
(Direct)	✓			(City Wide)	...
Economic output					
(City Wide)	~				

Indicator moving in desired direction ✓ Indicator showing no significant change ~
 Indicator moving against desired direction × Not sufficient information ...

INFLUENCE OF SUSTAINABILITY ENHANCEMENT ACTIVITIES

There is a strong evidence of the use of sustainability assessment in promoting learning and informing decision making across the lifecycle of a project. Pope *et al.* (2004) identifies the evolving nature of assessment from purely technical to promoting stakeholder engagement, dialogue and learning. Sustainability assessment is increasingly being viewed as an important tool to aid decision making (Morrissey *et al* 2012). The role of sustainability assessment in sustainability management is identified by Thompson and El-Haram (2014). Kaatz *et al.* (2006) reflects on the opportunities to enhance the effectiveness of assessment practices in influencing construction decision making. Shaw *et al.* (2012) advocate that in order to achieve the best sustainability outcomes it is important to undertake assessment approach that considers all aspects holistically at all phases of construction process.

Sustainability assessment has the potential to influence decision making by providing information to support the decision process and hence result in actions during the design and construction activities that will positively influence the sustainability of the development. Part of the Assessment and Enhancement framework involved the detailed knowledge elicitation and process mapping methodology to identify and classify knowledge and identify Knowledge Disclosure Points has been reported previously in Gilmour *et al.* (2013). These Knowledge Disclosure Points identified where, when and how sustainability could be influenced. Abertay University supported DCC City Engineers Division staff to identify, devise and implement enhancement activities at these points in the process between 2007 and 2013. These were identified based on phase of infrastructure occurring, where activities were developed to positively influence the six infrastructure development phase indicators that were identified above. The activities are shown in figure 2 and described below.

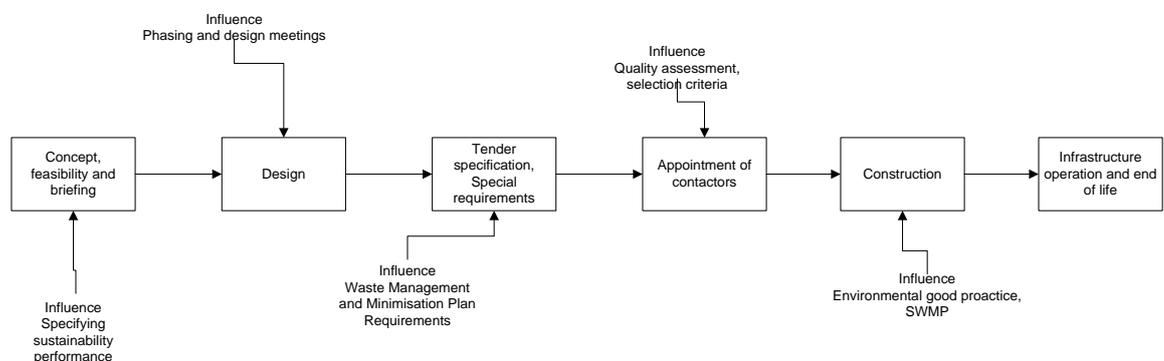


Figure 2: Enhancement Activities

Influence Phasing and Design meetings -This activity involved the creation of a Sustainable Development Issues Register by identifying sustainable development issues arising during the design and phasing meetings which required further consideration. From January 2007 the researcher contributed to over twenty relevant phasing and design meetings with the consultants White Young Green, Fairhurst and Dundee City Council project team. During these meeting the issues driving the design in relation to sustainable development were identified. These were then either raised and dealt with during the meeting if appropriate, or identified in the sustainable issues register to be fed back to design team.

Waste Minimisation and Management Plan -Waste management support was provided through the period of the commission to identify opportunities to recycle materials in the construction process. The aim of this activity was to link an understanding of the phasing of the project and the identification of opportunities for the specification of recycled materials during the design stage and to ensure best practice in recycling of materials. Assistance included developing a strategy to identify quantities and types of waste arising from the tunnel strengthening programme, identifying the management options with reference to the waste hierarchy and monitoring the waste arising and maximise recycling to inform future waste management approaches

Tender document preparation -Sustainability opportunities at tender preparation stage were reviewed for Contract 1 and Waste Management and Minimisation (WMM) was considered the most appropriate sustainability enhancement mechanism. The enhancement framework supported the development of tender documentation, particularly waste management policy wording and client expectations of contractors

approach to environmental best practice. Questions for the quality assessment and interview process were also developed along with a SWMP template based on DTI guidance to be included in the tender documents. In Contract 2 there was an opportunity to increase the emphasis of sustainability through WMM and increase the weighting on environmental performance during the quality assessment scoring. Detailed work was undertaken on developing a more robust quality assessment scoring for SWMP template included in the tender documents.

INTERPRETATION

Of the 26 indicators across Economic, Environmental and Social categories 15 indicators have moved in the desired direction, with only 2 indicators moving in the wrong direction. At the infrastructure stage, the activities were specifically designed to influence 6 of the indicators during Design and phasing and construction of the Waterfront Infrastructure. Table 2 presents these indicators alongside a narrative about the indicator trend and enhancement activities undertaken by the project team related to the indicator.

Table 2: Indicators influence by infrastructure stage enhancement activities

Indicator	Trend	Narrative	Enhancement activity
1f Tourism numbers 1g Tourism Income (City Wide)	✓ ✓	Tourism numbers were expected to be effected through all stages of the waterfront development. This was due to the vicinity to works relating to Discovery Point and Dundee Science Centre. It is positive to report that visitor numbers and tourism spend have not been detrimentally effected by construction period, and in fact both indicators have increased over the period. A contributing factor may be the close working between the waterfront team and tourism locations.	Sustainability Issues Register identified issues during design and phasing of infrastructure in particular traffic routing and disruption to services and ensure the sustainability and Waterfront objectives were maintained in the design.
2b Waste (Direct)	✓	100 % of Dundee Waterfront project contracts have employed Site waste management plans to ensure that waste is re used/ recycled where possible. The amount being reused or recycled is over 96 % across the project exceeding best practice.	Design and Construction Checklist, Waste management, WRAP & SWMP in contract documentation. The register and checklist identified issues during design and phasing of infrastructure, identify opportunities to recycle material in construction Waste management approach to specify during the design stage, ensure best practice to maximise the use of recycled materials in design and embedded in contract documentation.

2c Air (Direct)	✓	With significant traffic management required during the waterfront project, this indicator was put into the monitoring framework indicators to help assess any changes in traffic flow based on Seagate air monitoring station. From these readings a positive trend is occurring.	Sustainability Issues Register - The register identified issues during design and phasing of infrastructure traffic routing and traffic management
2e Noise (Direct)	~	Management of noise and communications to identified noise sensitive receptors (NSR) for the proposed work to be conducted out of normal working hours / or may be particularly disruptive has been successful in keeping complaints to minimum.	Sustainability Issues Register - The register identified issues during design and phasing of infrastructure traffic routing and traffic management, noise level, timing, duration and location of activities.
3e Acceptability (Direct)	...	No additional survey has been undertaken to update the original acceptability of the Waterfront Master plan	The register will identify issues during infrastructure design and phasing as opportunities to engage with stakeholders in the decision process and ensure the sustainability and Waterfront objectives are maintained in the design. Acceptability of public was a main driver in design and phasing considerations, traffic management and night working.

The overall trend data shows 4 out of 6 indicators moving in the desired direction (with 1 with no significant change). This suggests that the implementation of the sustainability enhancement approach by the Waterfront Team to positively influence these indicators has been successful. The indicators are now also used in Dundee City Council at project and departmental level, providing the link across policies, programmes and projects. The process of indicator development was iterative and undertaken over a three year period working closely with the project team and wider stakeholders. However, institutional and governance challenges still remain around identifying those who will be responsible for the continued publication of the indicators and how the data and reporting will be sustained and funded over time during the Plot Development and subsequent stages of the Waterfront Development. The indicators set was closely aligned to existing data collection for the Scottish Government Framework and Single Outcome Agreement which provided a data collection mechanism that would continue in the foreseeable future. If this had not existed the Council would have had to commission an external party to collect the data making it less certain that the indicators would have been successfully accepted within Council. This is exemplified by the absence of data for indicator 3e Acceptability because no additional survey was undertaken to update the original assessment of

acceptability of the Waterfront Master plan since this was out with the Council's Single Outcome Agreement data collection strategy.

DISCUSSION

The three interconnected concepts of sustainability assessment, decision making and knowledge management have been explored through the waterfront case study. The investigation has developed knowledge elicitation and mapping techniques (Gilmour *et al.* 2013) to improve sustainability assessment practice and, in turn, provided closer integration of assessment and decision making. The findings of the work add to current knowledge, in relation to the potential for knowledge management and benchmark indicators, to demonstrate current practice, to improve decision making and support sustainability enhancement.

The use of indicators in the case study supports the case presented in literature for the potential for sustainable assessment to support sustainability management. The wider implications of the findings of indicator development can be related to the current work on sustainability assessment and management as seen in Thompson and El-Haram (2014). In addition, Eames *et al.* (2013) identifies a critical challenge is to develop the knowledge capacity within public organisations for sustainable transitions. Indicators are considered to be effective tools in monitoring communicating sustainability therefore making the concept of sustainability operational. These views are also supported by other authors such as Mascarenhas *et al.* (2010). The literature focuses on the value of information and knowledge for monitoring and communication of sustainability issues but it does not explore how that information and knowledge can be applied to positively influence sustainability in projects. Table 2 suggests that the initiation of planned enhancement activities at key stages in the process (as defined by Knowledge Disclosure Points) has positively influenced sustainability and has demonstrated the potential benefits of an integrated Sustainability Assessment Monitoring and Enhancement Framework.

CONCLUSIONS

A sustainability monitoring framework, incorporating a set of indicators was successfully developed for Dundee Waterfront in line with the assessment component of the theoretical framework. Enhancement activities were successfully identified and implemented by the researchers and the DCC City Engineers staff to positively influence direction of change of selected indicators and hence to enhance the overall sustainability of the Development. There is evidence that the enhancement activities have been successful. This improvement of sustainability practice within the Dundee Waterfront Project supports the case for a wider application and testing of the Sustainability Assessment and Enhancement Framework.

The findings from this study support literature which consistently proposes that the use of indicators can increase transparency and accountability, thereby increasing the availability of information to engage stakeholders and support decision making. It has also supported the use of knowledge mapping to influence sustainability through identifying where, when and how sustainability can be influenced. The case study has however identified a challenge to continued viability of the Framework on long term projects (25years plus), that of ensuring high level support of the concept to ensure its continued application by temporally transient groups of stakeholders. It has also highlighted an expected indicator interpretation issue related to the use of Single Outcome Agreement data for a number of indicators and the challenge of attributing

the influence of enhancement activities on the Waterfront with wider activities undertaken by Dundee Partnership to progress towards SOA Outcomes to 2017.

Overall, it can be concluded that developing theme orientated indicators based on policy and practice is an effective mechanism to improve sustainability practices. The use of sustainability indicators provides the benchmark to measure progress, combined with enhancement activities and presents an approach which can be used by other organisations.

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