Valuing Attractive Landscapes in the Urban Economy

Final Report

Action 1.2

Baseline Analysis of Existing Economic Valuation Tools for Application to Green Infrastructure Investments

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Edited by Simone Allin and John Henneberry

Department of Town and Regional Planning, University of Sheffield,

Western Bank, Sheffield, S10 2TN, UK.

<s.allin@sheffield.ac.uk>, <j.henneberry@sheffield.ac.uk>

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0. Foreword and Overall Report Structure

(Simone Allin and John Henneberry)

The overall aim of this report is to describe and to discuss the main outcomes of a baseline analysis of existing economic valuation tools for application to green infrastructure investments (see VALUE Action 1.2). In this regard, it covers approaches to evaluation both at the site scale and the city/region scale.

In addition, it outlines an evaluation framework for the particular VALUE investments in the six partners' cities and regions. This framework was presented and discussed at the VALUE partners' meeting in Stuttgart in November 2009. At this venue, specific evaluation approaches matching the characteristics of selected VALUE investments in each of the six participating cities were jointly discussed and agreed by all the partners. The subsequent research on VALUE Work Package 4 ('Economic Valuation of Green Infrastructure Networks') will be developed and pursued within this framework.

The literature and practice reviews related to this report were mainly undertaken in the period between January 2009 and September 2009. The interim results of this work were incorporated in a series of working papers and other written outputs (see p. 7). These were presented and discussed variously at the VALUE partners' meetings in Liege in January 2009 and in Manchester in June 2009. A technical workshop focusing on the core themes and specific methodological issues of VALUE Action 1.2 took place on 18 September 2009 in Brussels. The joint agreements and initial decisions that resulted were important milestones in the successful completion of the present report.

The report incorporates the work of many members of the VALUE team. The authors are assigned to the particular chapters and sections of this report that they produced. Colleagues' contributions took three main forms, as follows:

- Coordination and management, substantial research contributions by Prof. John Henneberry and Dr Simone Allin (University of Sheffield, Department of Town and Regional Planning).
- Substantial research contributions by Dr Karsten Rusche (Institut für Landes- und Stadtentwicklungsforschung gGmbH), Prof. Jean-Marie Halleux and Pierre Guilliams (Université de Liège, SEGEFA – Service d'Étude en Géographie Économique Fondamentale et Appliquée), Nel Ghyselinck and Frank Stubbe (Vlaamse Landmaatschappij) in cooperation with Dr Bert Vermeire and Ann Verspecht (Universiteit Gent), and Arno Goossens (Gemeente Amersfoort) in cooperation with Derk Jan Stobbelaar and Wim Timmermans (Wageningen University and Research Centre).
- Substantial information and data provision, comments on interim drafts of the report and the authorship of particular parts of this report by Betty Anyika, Krys Craik and Maria Wilding (Sheffield City Council/South Yorkshire Forest Partnership), Pete Stringer (Manchester City Council/Community Forest Northwest/Red Rose Forest Partnership), Julie Moreau (City of Verviers/Agence de développement économique en province de Liège), and Stefanie Clauß and Suzan Ünver (Verband Region Stuttgart).

The overall structure of the Action 1.2 report and its contents can be described as follows. Chapter 1 (‘Introduction’) focuses on the main objectives of Action 1.2, its linkages to other VALUE work packages and the transnational added value and beneficiaries of related research and investigations. Chapter 2 represents the core part of the theoretical and practical analyses. It concentrates on the main outcomes of a review of existing evaluation techniques for economic appraisal of green infrastructure investments at the site scale and the city/region scale. Chapter 3 provides an overview of the current state of selected VALUE investments in the six European project partners’ cities. It highlights their main characteristics at the site scale and the city/region scale. In addition, it identifies the expected economic benefits of each green infrastructure investment at the site scale and of each green infrastructure strategy at the city/region scale. Chapter 4 develops the evaluation framework. Thus, it identifies and matches optimum evaluation techniques to each of the VALUE partners’ cities and regions and their particular green infrastructure investments. Chapter 5 summarises the main conclusions of the report and presents the framework within which the valuation of green infrastructures will be undertaken (in Work Package 4).

1. Introduction

(Simone Allin and John Henneberry)

This report describes the outcomes of Action 1.2 within the overall framework of the VALUE project. To contextualise the discussion, this Chapter outlines the main objectives of Action 1.2 and describes its linkages to the other work packages and actions of VALUE. The chapter also introduces the partners' institutions and highlights individuals' contributions to this report. In addition, the chapter describes the transnational added value and the beneficiaries of the related research. Finally, it outlines the geographic scope of the research as well as some general issues concerning the timeframe of the research work and of particular actions.

1.1 Main Objectives of Action 1.2 and Linkage to other Work Packages

(Simone Allin and John Henneberry)

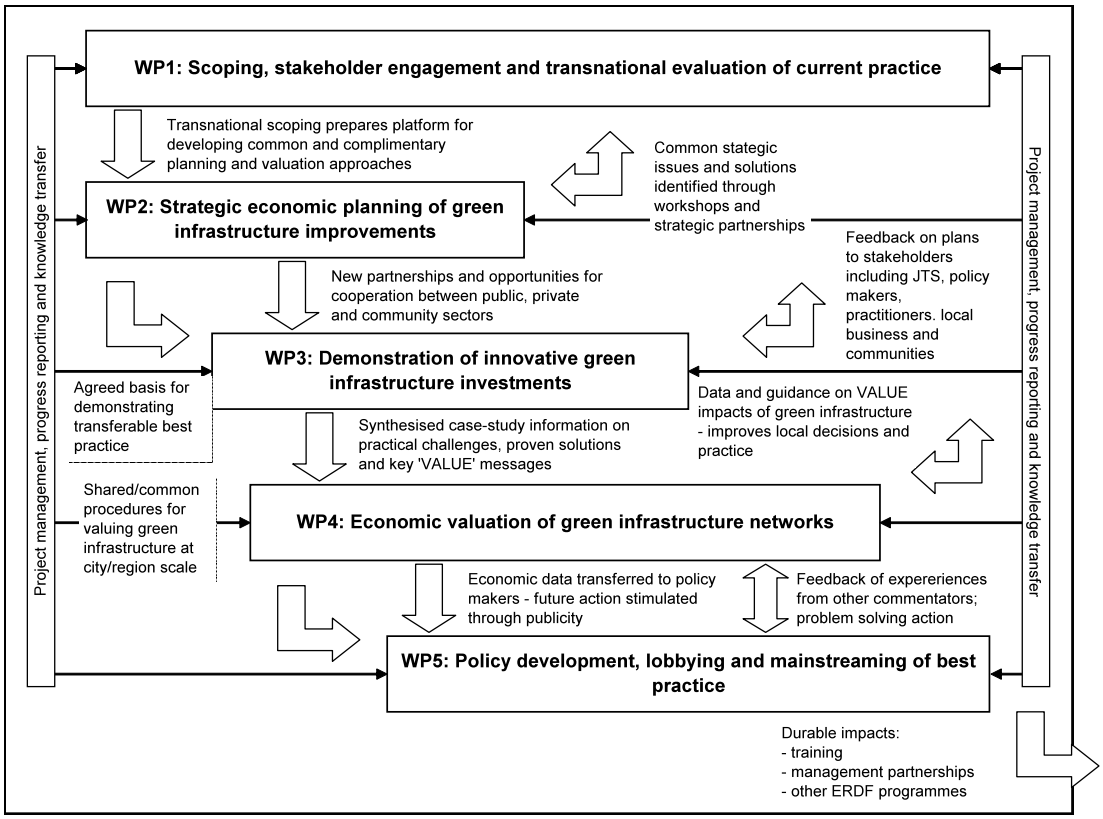
Action 1.2 is the core part of Work Package (WP) 1. It is designed to build strategic alliances across the involved NWE partners and key actors, using the resulting working relationships to bring wide-ranging expertise and valuable knowledge into the project. Consequently, WP 1 prepares the ground for all other work packages by engaging key stakeholders. Furthermore, it produces a platform for informing further partnership decisions and developing common and complementary planning and evaluation approaches (see Figure 1).

In this regard, the main objectives of Action 1.2 are as follows:

- to scope existing economic valuation tools for application to green infrastructure investments,
- to audit and contrast different approaches, and
- to identify optimum evaluation techniques at the city/region scale and the site scale.

Thus, the present report, which is the main output of Action 1.2, demonstrates how cities and regions can select appropriate appraisal techniques in order to integrate the particular values and individual needs of different stakeholders. It refers to the strengths and weaknesses, opportunities and threats of existing and novel approaches. Furthermore, it describes the valuation tools to be applied in each of the VALUE cities at both the city/region scale (I) and the site or neighbourhood scale (II). The Action 1.2 report provides the basis for the evaluation of impacts in WP 4 ('Economic Valuation of Green Infrastructure Networks'). Beyond this, the baseline analysis of valuation tools is considered to be of wide interest to related professional and scientific audiences. Thus, the outcomes have been and will be presented through publications and at events.

Figure 1: Linkages and relationships between the VALUE work packages and outcomes



1.2 Involved Partners' Institutions

(Simone Allin and John Henneberry)

VALUE Action 1.2 is coordinated by the University of Sheffield (SU), Department of Town and Regional Planning, through Prof. John Henneberry and Dr Simone Allin. Thus, SU has been responsible for initiating an intensive and constructive dialogue with colleagues in the partners' institutions and for managing the work on the related research and analyses. SU's contribution to Action 1.2 also includes a series of working papers, the editing and writing of an executive summary produced for the VALUE partners' meeting in Manchester in June 2009, and – last but not least – the editing of and various substantial contributions to the present final report.

The other VALUE partners' institutions involved in the work on Action 1.2 and, thus, in the writing of associated working papers, literature reviews and this report are as follows (see also Foreword, Chapter 0):

- Institut für Landes- und Stadtentwicklungsforschung gGmbH (ILS), Dr Karsten Rusche,
- Université de Liège (ULg), Service d'Étude en Géographie Économique Fondamentale et Appliquée (SEGEFA), Prof. Jean-Marie Halleux and Pierre Guilliams,

- Vlaamse Landmaatschappij (VLM), Nel Ghyselinck and Frank Stubbe in cooperation with Universiteit Gent (GU), Dr Bert Vermeire and Ann Verspecht,
- Gemeente Amersfoort (GA), Arno Goossens in cooperation with Wageningen University and Research Center (WUR), Dr Derk Jan Stobbelaar and Drs Wim Timmermans.

A detailed list of written outputs of VALUE Action 1.2 to date reads as follows:

- Allin, S. & Henneberry, J.: Overview of Existing Economic Valuation Techniques – Summary Report, Working Paper 1.2.1, Sheffield/UK, February 2009.
- Allin, S. & Henneberry, J.: Stated Preferences Techniques in Combination with Visualisations – An Initial Literature and Practice Review, Working Paper 1.2.2, Sheffield/UK, March 2009.
- Allin, S. & Henneberry, J.: Stated Preferences Techniques in Combination with Virtual Reality Technologies and Visualisations – A Literature and Practice Review, Working Paper 1.2.3, Sheffield/UK, April 2009.
- Rusche, K.: Revealed Preferences on the Regional Scale – Quality of Life and Quality of Business Environment – An Initial Review, Working Paper 1.2.4, Dortmund/Germany, April 2009.
- Guilliams, P. & Halleux, J.-M. (under the supervision of Merenne-Schoumaker, B.): Revealed (expressed) Preferences Techniques – Focus on the Hedonic Price Method and its Implementation – State of the Art, Working Paper 1.2.5, Liege/Belgium, April 2009.
- Allin, S. & Henneberry, J.: Stated Preferences Techniques in Combination with Virtual Reality Technologies and Visualisations – A Review of International Case Studies, Working Paper 1.2.6, Sheffield/UK, June 2009.
- Vermeire, B., Verspecht, A., Gellynck, X., Ghyselinck, N., Gellinck, L. & Stubbe, F.: Development of an Economic Valuation Model for Green Infrastructure on the Basis of a Literature Review, Ghent/Bruges/Belgium, January 2009.
- Allin, S. & Henneberry, J. (eds.): Executive Summary – Work Package 1/Action 1.2: Baseline Analysis of Existing Economic Valuation Tools for Application to Green Infrastructure Investments – Working papers/Literature Review January – June 2009, Sheffield/UK, June 2009.

The above-mentioned partners have been widely supported by the provision of further information and data, on-site knowledge and helpful comments delivered by:

- Sheffield City Council/South Yorkshire Forest Partnership (Lead Partner), Betty Anyika, Krys Craik, and Maria Wilding,
- Manchester City Council/Community Forest Northwest/Red Rose Forest Partnership, Pete Stringer,

- City of Verviers/Agence de développement économique en province de Liège (SPI+), Julie Moreau,
- Verband Region Stuttgart (VRS), Stefanie Clauß and Suzan Ünver.

1.3 Transnational Added Value and Beneficiaries

(Simone Allin and John Henneberry)

In WP 1, all involved VALUE partners work together to establish how to tackle the shared transnational challenge of stimulating balanced economic growth by targeting landscape improvements at the city/region scale and the site scale. This requires an accordant effort across the NWE regions as well as a critical mass of experience. The latter is mainly generated by means of the compilation of this report. In order to write the Action 1.2 report, the involved partners' institutions have been working jointly to identify the best ways to establish the economic value of green infrastructure and to promote the efficiency of related investments coordinated across the private and the public sector.

Consequently, all VALUE partners benefit from the shared know-how developed in WP 1 in general and within the Action 1.2 research in particular. Furthermore, they are all involved in the implementation of this know-how. This means that all participating partners' institutions and cities/regions will enjoy improved conditions and infrastructure for economic growth.

1.4 Geographic Scope and Timeframe

(Simone Allin and John Henneberry)

The VALUE project mainly addresses green infrastructure at the city/region scale and the site scale in the following European regions:

- UKE32 (NUTS 3): Sheffield,
- UKD31 (NUTS 3): Greater Manchester South, Manchester,
- BE251 (NUTS 3): Arrondissement de Bruges, Bruges,
- BE332 (NUTS 3): Arrondissement de Liège, Liège,
- DE111: Stuttgart (Stadtkreis), DE112: Böblingen, DE113: Esslingen, DE115: Ludwigsburg, DE116: Rems-Murr-Kreis (all NUTS 3), and
- NL310 (NUTS 3): Province of Utrecht, Amersfoort.

The official start of WP1 was scheduled for June 2008. However, administrative and contractual issues delayed the start of significant work on WP 1 in general and Action 1.2 in particular until January 2009. So far, this slippage of about six months has not been caught up completely. A draft version of the Action 1.2 report was discussed and approved by all partners at the VALUE partners' meeting in Stuttgart in November 2009. Following the discussions, minor amendments and clarifications were incorporated in the present final report.

2. Review of Existing Evaluation Techniques at the Site Scale and the City/Region Scale

(Simone Allin and John Henneberry)

This chapter represents the core part of the theoretical and practical analyses within the present report. It focuses on the main outcomes of a review of existing evaluation techniques for economic appraisal of green infrastructure investments at the site scale and the city/region scale.

The chapter outlines the main evaluation techniques that may be applied at the site scale (II) and describes their particular aims and objectives and strengths and weaknesses (see Section 2.1). It also considers the current focus of related theoretical debates (including, for example, specific methodological shortcomings) and the issues raised by the practical applications of individual techniques (especially referring to restrictions and pitfalls). A similar approach is applied to the review of evaluation techniques at the city/region scale (I), which is covered by Section 2.2.

2.1 Evaluation Techniques at the Site Scale

2.1.1 Cost Benefit Analysis

(Nel Ghyselinck, Frank Stubbe, Bert Vermeire and Ann Verspecht)

Cost Benefit Analysis (CBA) is an economic valuation method used to assess the economic return of a project to an investor. In CBA, the total economic value of a project is determined by analysing the project in terms of costs and benefits. In order to qualify on cost-benefit principles, a project's benefits must exceed its costs. The main criterion for evaluation is economic efficiency. Therefore monetary values are attributed to all costs and benefits.

In general, CBA can be applied to any resource allocation in the economy. It is most commonly used at company level (to underpin investment decisions) or at society level (through social cost benefit analysis).

CBA displays several weaknesses. The first one is linked with the fact that costs and benefits might be unequally distributed. The ideal situation is that, when a project is cost-benefit positive, all stakeholders obtain benefits and no stakeholders suffer costs. In reality this is not the case. A second problem relates to uncertainty. The uncertainty is caused by simplifications that have to be made in the valuation procedure because in the real world prices are often distorted. Consequently, the quality of CBA is strongly dependent upon the approximations that are made. Therefore, CBA conclusions give no definite answer on whether or not to undertake an investment; rather, they will give an overview on how efficient the investment is in terms of costs and benefits.

Description of the overall CBA framework

Traditionally, CBA is undertaken in six stages as illustrated by Figure 2 (Layard/Glaister, 1994; Brent, 1997; Pearce et al., 2006).

1. Project definition

This includes the objectives and scope of the green investment, particularly the reallocation of resources being proposed and the population of gainers and losers to be considered. This identification process should be based on a clear understanding of the level of detail of the CBA, both in geographical terms and in relation to the group of stakeholders. The scope of the project should be neither too broad nor too narrow. If it is too broad, the risk exists that the project actually encompasses several contradicting sets of benefits and costs. If it is too narrow, the project may actually be a component of a larger project rather than a discrete investment.

2. Identification of project options

If there exist different project options for examination, these should be defined at this stage. The range of options will depend on the political context in which the green investment is made. Within the context of VALUE, this is relevant in the ex-ante evaluation, where the aim is to evaluate the value added of the chosen measures against other measures. Because VALUE aims to demonstrate that green infrastructure is valuable, it might be interesting to select alternative options that are preferred by opponents of the green investment.

3. Identify relevant value impacts and select indicators

In the third stage, all relevant value impacts resulting from the project's implementation are identified. Only the impacts that affect the members of the population identified in the first stage are subject to further analysis. In combination with the identification of the impacts, indicators are selected to quantify their value. The selection is motivated by the nature of the value, the measurement tool to be used and data availability.

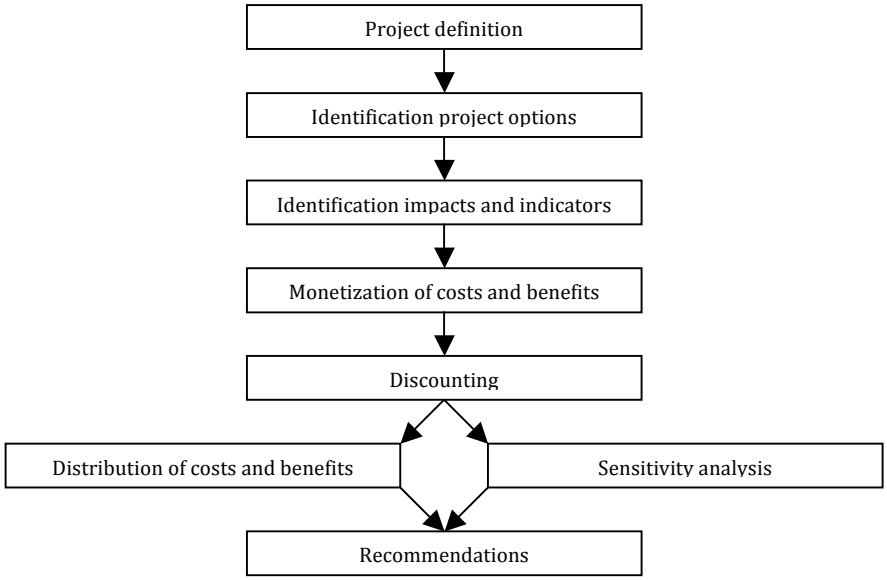
4. Monetising costs and benefits

This stage involves determining the amount of costs and benefits of the project, and their temporal incidence. They must be predicted relative to a well-defined 'base case': what would have happened without the green investment. In most cases, this will be the situation as it was (is) before the development of the green investment. However, it is also possible that the green infrastructure replaces another development vision for the area.

All calculations will take varying levels of uncertainty into account, as the changing environment influences future costs and benefits. These uncertainty levels will be used in the sensitivity analysis in stage 6. Monetisation is often the most difficult step in CBA, especially in the context of ecological and environmental projects. It is most

appropriate to use market prices; however, these are often not available. In this case a range of quantification tools can be applied, as described in 'the toolkit'.

Figure 2: CBA Procedure



5. Discounting future costs and benefits

Discounting is required because the monetary value of a future cost or benefit is not identical to its present value. Therefore, monetary values should be reduced to a common time dimension: the base year. The value, which is constructed in this way, is called Net Present Value (NPV). The changing monetary value of costs and benefits over a certain period of time can be explained by analysing inflation levels and the evolution of particular prices/costs (for example, labour, raw materials). Discounting starts with the identification of the base year, the selection of the evaluation discount rate and the definition of the evaluation period.

6. Describe the distribution of costs and benefits

The distribution of costs and benefits will be taken into account in the final investment decision. Consequently, it should be identified and quantified in NPV terms. The evaluation of these distributional aspects is a political one.

7. Sensitivity analysis

In order to deal with the uncertainty of the predictions made, the sensitivity of the NPV to variations in costs and benefits should be tested. Such sensitivity analysis assesses the overall robustness of the CBA result. This analysis is undertaken by formulating feasible variations to the assumptions made, relating to

- different discount rates (for example, expected inflation rates);

- uncertain future costs or benefits (for example, evolution of tourist expenditure);
- uncertain assumptions motivating the choice for a cost or benefit (for example, the assumption that nearby farms are competitive may underpin the prediction of their production losses); and
- furthermore, sensitivity analysis might be used to measure the impact of specific risks, if relevant (for example, environmental disaster).

The interpretation of this variability leads to the formulation of a number of different scenarios, with a particular focus on the 'worst case scenario' and the likelihood that it may take place. If the green infrastructure is cost-benefit positive under various scenarios, than it can be classified as robust.

8. Recommendations

The recommendations following from CBA generally relate the NPV of the project or the option to the highest NPV and assess the sensitivity and distribution of the project's/option's NPV. This leads to the identification of a 'preferred option' from a cost-benefit perspective. However, an evaluation of whether the green infrastructure is acceptable or not has to be taken by the policy-maker.

The Toolkit – a range of particular techniques and methods

In order to conduct an economic valuation, monetary measurements are required. For several values, however, these measurements are not easy to obtain because empirical data are generally not collected or values are not expressed in monetary terms. Several techniques have been developed to deal with this problem (Berends et al., 2001). The use of each of these techniques is illustrated in Figure 3.

Ideally, valuation is based on market prices, if efficient prices are available. In situations where market prices are distorted, shadow prices are used. Oftentimes, and particularly in the context of non-use values, no market prices are available. Regarding goods or services with an existing consumer demand, demand curve approaches can be applied. In this regard, revealed preference approaches are based on observations of actual consumer behaviour while stated preference approaches are based on an expression of consumer's willingness-to-pay. If no demand curve can be drawn, these values can be estimated through cost-based methods.

In most applications, only one or a limited number of valuation tools is applied. Ideally, the valuation will be based on observed market values. However, if these are not available, the researcher relies on non-market values and is confronted with the problem that there is no consensus in current guidance as to how these should be derived and used.

As each instrument has specific qualities to measure specific values, a combination of the different tools, applied in their specific areas, seems most promising. However, there are also some disadvantages:

- One must be aware that different methods may have different results. Consequently, the decision to use a particular technique will have a strong

impact on the outcomes. In a research context that is politically driven, the risk exists that these decisions are not made on the base of methodological arguments only.

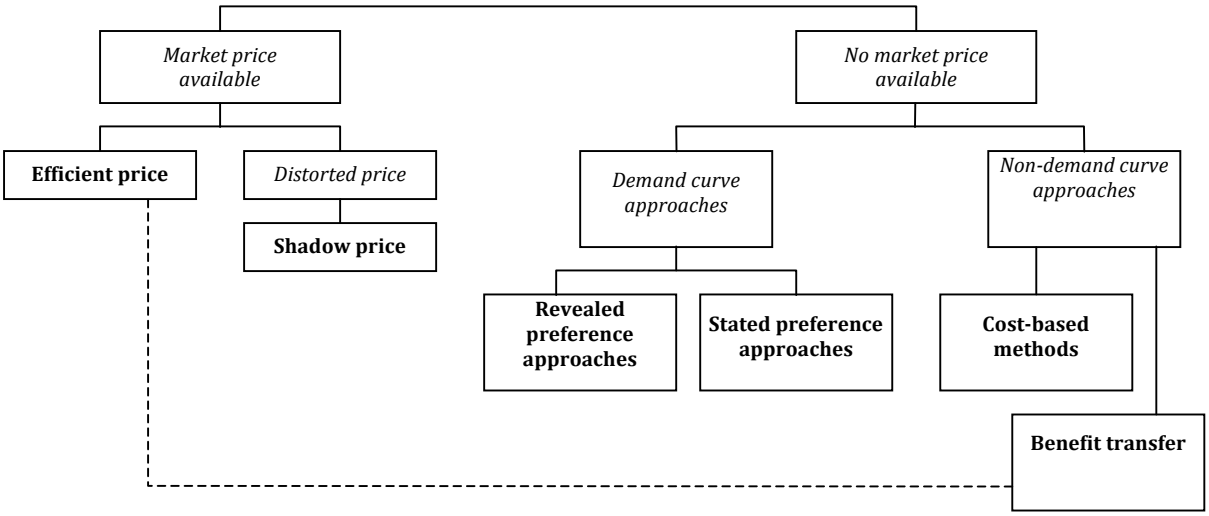
- Some techniques require considerable budgets and if different techniques are combined the overall cost might be high.

Furthermore, the following recommendations from the HEATCO guidelines are important (Bickel et al., 2004).

- Non-market valuation studies should be undertaken where the impact to be valued is likely to be significant in determining the outcome of the CBA, and where the possibilities for robust value transfer are limited.
- Non-market valuation techniques should be selected on the basis of available expertise and previous experience in the EU relating to the specific impact.
- The resulting non-market values should be validated through comparison with the values from other studies.

In practice, the research context shaped by political orientations and time and/or budget constraints will influence these methodological choices.

Figure 3: Taxonomy of economic valuation tools



Source: adapted from Merlo & Croitoru, 2008

Prices reflect the value of the good and are available. Some direct use values are marketable and therefore market prices can be used (> 'efficient price'). Sometimes the prices are not entirely the result of supply-demand but are distorted because of, for example, policy interventions. In these cases, shadow prices should be used.

Revealed preferences approaches (see also Section 2.1.2)

Revealed preferences approaches are based on observations of actual consumer behaviour. Thereby, the value of a particular behaviour is revealed by their behaviour in other, related markets. By observing real choices within a market, the preferences for other goods and services can be deduced. The main advantage of these methods is that they are based on real market prices, which guarantee a certain level of objectivity. On the other hand, the relationship of the reference value with the revealed value is assumed and this assumption cannot be tested.

Stated preferences approaches (see also Section 2.1.3)

Stated preferences approaches measure people's intended future behaviour in constructed markets. By means of a questionnaire, a hypothetical market is described where the good in question can be traded. This includes a definition of the good itself, the institutional context in which it would be provided, and the way it would be financed. A random sample of people is then directly asked to express their maximum willingness-to-pay for (or willingness-to-accept) a change in the level of provision of the good. Respondents are assumed to behave as if they were in a real market. One of the strengths of stated preferences methods lies in their flexibility. For example, the contingent valuation method, in general, is applicable to almost all non-market goods and to ex-ante and ex-post valuations. Furthermore, it is one of the few available methodologies able to capture all types of benefits from a non-market good or service, including those unrelated to current or future provision. The main drawbacks result from the fact that respondents are assumed to behave as if they were in a real market. As the individual faces hypothetical situations, we are not sure that the stated preferences are real because they may incorporate hypothetical bias.

Cost-based methods

If no market prices are available and these cannot be estimated by establishing a demand curve, value can be identified indirectly by non-demand curve approaches. The principal assumption of these methods is that if people incur costs to replace the services of green infrastructure or to avoid damages caused by a lack of green infrastructure, then these green goods or services are worth at least what people have paid to replace them. The most commonly used techniques are the replacement cost, the damage avoided cost, the substitute (or alternative) cost, and the productivity change cost (Damigos, 2006). All these techniques identify market prices that are associated with the absence of the valued aspect. Examples of areas where these methods might be applied include

- valuing improved water quality by measuring the cost of filtering and chemically treating water, and
- valuing walking (recreation) by measuring the cost of travelling further (to the next green infrastructure where inhabitants can walk).

Benefit transfer

This method is based on the application of the results obtained from a particular case to another area. This process is a time- and cost-effective way to estimate the value of

green infrastructure when original research is not possible because of budget constraints and/or time limitations. However, primary research is the 'first-best' strategy. A range of conditions will affect the effectiveness and efficiency of the benefit transfer approach. They include the quality of the original study, the different research methods that may have been used for data collection, the different statistical methods that may have been applied for estimating models, and the issue of temporality or stability of data over time, because the subject and comparator studies occurred at different times.

Conclusions and Further Investigations

(Simone Allin and John Henneberry)

The initial review of the toolkit of CBA (above) indicates that revealed and stated preferences approaches display substantial potential for application to the economic appraisal of green infrastructure investments. Consequently, they will be analysed in more detail in Subsections 2.1.2 and 2.1.3. As complementary theory and practice reviews have highlighted (see, for example, in Working Papers 1.2.3 and 1.2.5), they are the two most commonly and successfully applied approaches to the estimation of money values for non-market goods or services.

2.1.2 Revealed Preferences Techniques

(Pierre Guilliams and Jean-Marie Halleux)

Following a general literature review on revealed preference techniques, attention focused on the Hedonic Price Method (HPM). This method has been extensively explored in the current literature. It is very relevant to the economic valuation of urban green infrastructure, especially the estimation of its impact on real estate prices.

This subsection is the outcome of a three-step approach. Firstly, the theoretical development of the method was studied (see Working Paper 1.2.5). Secondly, the literature on existing case studies was reviewed. Finally, the implementation of the HPM in the framework of the VALUE project was discussed and the strengths and weaknesses of the method were highlighted.

The aim here is to synthesise these steps and to consider the implementation of the HPM within the framework of the VALUE project in a pragmatic way. In order to achieve this goal, we start with an abstract of the main observations emerging from the theoretical and case studies review before presenting the main strengths and weaknesses of the method. Finally, we discuss its implementation in practice.

Observations emerging from the theoretical review

The HPM is well known and largely explored in the literature (Tyrväinen/Miettinen, 1999). The fundamental principle of the method, developed by Lancaster (1966), provides a powerful analytical tool. HPM is based on the hypothesis that value indicators – such as property prices – reflect the spatial variations of the effect of a public good's attributes on different communities (Brookshire et al, 1982, p. 165). Thus, the HPM is able to estimate the individual demand for environmental attributes

of public goods and is extensively used for the analysis of physical components of the environment.

The literature review of the HPM attests to the flexibility of the method. However, the particular elements of a study reflect the author's/researcher's preferences and differ from one case to another - and can have a significant impact upon a study's results.

The first element of interest is the *choice of attributes (variables)*. Real estate is made up of specific physical attributes (number of rooms, age and so on) but also of location-specific attributes, which are determined by the quality of the neighbourhood and its global accessibility. Open and green spaces are two of the elements influencing neighbourhood quality. The way that different authors consider green space attributes varies. Some use the size or the surface area of the green infrastructure, others make a distinction between its aesthetic and recreational functions or between private and public goods. As these attributes are used to justify the implicit price of the real estate, it is obvious that their choice will influence the results.

The different attributes can then be *integrated and rated in different ways* (binary, quantities and so on). The types of classifications again depend on the choices of the authors.

Another major difficulty is the *availability of data*. Data sources in different countries are very important for the further implementation of the method within the framework of the VALUE project. The availability of external data (relating to location and so on) also underpins the calibration of the hedonic model. Concerning the latter, current developments in the context of cartographic tools are very promising. The use of Geographical Information Systems (GIS) allows the determination of accessibility, for which numerous measures have been developed (such as the distance to the city.centre, market potential isochrones and so on). In the same way, remote sensing methods can be applied to measure the environmental quality of a neighbourhood (Geoghegan et al., 1998). Thus, documents and data availability, which permit these technologies to be exploited in the different countries and regions, are of fundamental importance.

In the HPM, the influence of the attributes' (qualitative and quantitative) characteristics depends on the *form of the hedonic function*. The latter broadly influences the results and, thus, must be highlighted. The bibliographic review also identified the importance of *market segmentation*. It can be obtained through a judicious sample choice and the identification of homogenous segments and spatial entities, which are appropriately delimited. In addition to the functional form and the market segmentation, other *difficulties and error terms* will be encountered during the implementation of the HPM: these include the multi-collinearity between exogenous variables, the heteroscedasticity of the remainders and the spatial autocorrelation of the remainders.

Observations emerging from the case studies review

The case studies review showed that the flexibility of the method is influenced more by *data availability* than by the preferences of the authors. Consequently, the biggest practical challenge for any HPM study is gathering sufficient, appropriate, accurate data to support robust analysis. Two kinds of data are necessary: green infrastructure data and real estate data.

In terms of *property types*, the literature review revealed a large number of case studies applying HPM to residential properties. Several studies successfully make the link between house prices and green infrastructure. In contrast, studies of the determinants of shopping centre and retail rents generally treat green infrastructure as a marginal variable (Des Rosiers et al., 2004; Sirmans/Guidry, 1992; Mejia/Benjamin, 2002; Benjamin et al., 1990; Mérenne-Schoumaker, 2004). This is mainly because certain variables are highly significant to the commercial sector, notably those relating to location (such as visibility, closeness to competitors, high levels of foot-fall and so on). Between these two extremes, the office sector offers the opportunity – regarding scientific relevance and feasibility – to implement the HPM in a relatively novel way within the framework of the VALUE project.

Strengths and Weaknesses

Considering the implementation of the HPM within the framework of the VALUE project, a number of strengths and weaknesses can be identified.

Strengths

The HPM is a very *powerful analytical method*. It can provide strong statistical evidence of the economic impact of green infrastructure through the analysis of real estate values. However, the impact of green infrastructure investments on the office sector still needs further investigation. The Commission for Architecture and the Built Environment (CABE, 2005) maintains that the quality of the environment is an important influence on the location decisions of building occupiers (office occupiers). This claim needs to be substantiated. And, with regard to the question "Is HPM able to elicit the impact of green infrastructure on economic development?", the answer, in theory, is "Yes, it is".

The HPM is also applicable at *different scales*. If the market is well defined, it is a powerful tool to study a city as a whole, to compare different neighbourhoods, and to work at the neighbourhood scale itself. Thus, HPM can achieve results at the site scale by carrying out assessments plot by plot.

A third strength of the method is that the *precise data* about green infrastructure and real estate that are used are also valuable for other techniques and can help to support their assumptions. For example, a general comparison of the green infrastructure investments with real estate prices can be obtained immediately. The use of modern cartographic tools and geographical information systems can then support the generation of a broad range of further results.

Weaknesses

However, the method also displays many weaknesses. Firstly, the HPM is *data-intensive*. The data gathered, their accuracy and the period of time depend on the case study location, on the authors' investigations and on public administration patterns. Thus, the search for data is very time consuming because the authors often depend on the cooperation of public administrations to obtain them and, consequently, the time required for this may be considerable.

Secondly, researchers have to deal with important *econometric problems*. The management of these problems depend on data availability and the specifics of the urban context. For each case study, researchers need to have a very strong general knowledge of their city and its different neighbourhoods (for example, in terms of architecture, history, clusters, hubs, centres of attraction and so on). This knowledge normally also has to be supported and confirmed by studying references, documents, and interviewing local actors.

Finally, the implementation of the HPM in the office sector (the most relevant from a scientific point of view) needs a *metropolitan context* with a significant dynamic regarding economic development (for example, substantial office transactions flows, a CBD and so on). Consequently, a consistent statistical approach that compares green infrastructure attributes with real estate prices (application of mathematical regression) needs a significant number of relevant transactions.

Conclusions

The implementation of the HPM within the framework of the VALUE project may be feasible and may potentially provide very robust results if sufficient data of appropriate character are available. The method allows for eliciting the impact of green infrastructure on economic development through the study of real estate values. In addition, this method offers the opportunity to work at a very small scale (plot by plot) and combines strong statistical and GIS tools with very precise data.

However, in order successfully to apply this powerful method, *many difficulties* have to be addressed. Firstly, this method cannot be used to compare different case studies. The *hazards* concerning the accuracy of the available data, the time required to collect them and the econometric problems faced prevent the standardisation of the methodology in the different case studies. In addition, these problems also prevent any relevant comparison of the results. Due to data property issues in the context of public administration, even for a single case study, some data will never be exploitable within the framework of scientific research. Consequently, data availability is the fundamental element that determines the success or failure of the HPM.

Secondly, the literature suggests that the application of HPM to the valuation of the impact of green infrastructure on offices' values may be scientifically attractive and may verify the impact of green infrastructure on economic development. However, the metropolitan context needed in terms of office transactions and green infrastructure developments limits the potential case studies in the partner regions of the VALUE project. In the former industrial regions of the VALUE partners, and more particularly referring to the investment sites themselves, the possibilities of finding such a context are very limited.

Nevertheless, even if it would be less innovative from a scientific point of view, the application of HPM to residential real estate is more easily conceivable within the framework of the VALUE project. Data gathered and preliminary interviews conducted as part of the HPM implementation might be exploited by other valuation methods. This multiple approach, implementing different methods in the context of one case study, could make it possible to reinforce the experiment and to confirm or to contradict the results.

Summarising, the author of a HPM case study needs to have three principal skills:

- the ability to get sufficient, accurate data relating to real estate transactions and green infrastructures,
- an extensive knowledge of the case study city and neighbourhood, and
- strong statistical competencies.

2.1.3 Stated Preferences Techniques

(Simone Allin and John Henneberry)

Stated Preferences Techniques (SPTs) are monetary economic valuation techniques that fall within the overall framework of CBA (see Allin/Henneberry, 2009 and Moons, 2003, p. 5). In general, SPTs rely on asking individuals how much they value a specific good or service in question. Potentially, SPTs can be applied in almost any valuation context. They are based on a hypothetical payment scenario, which is defined and presented in great detail by means of a (mainly textual) questionnaire (DTLR, 2002, Introduction). SPTs can be contrasted with Revealed (or 'Expressed') Preferences Techniques (RPTs) which aim to deduce people's willingness to pay for a good or service from observed market evidence (DTLR, 2002, Introduction; see also Allin/Henneberry, 2009 and Moug, 2008, p. 5).

In current practice, one of the limitations of SPTs is related to cognition. This means that people may have difficulties in understanding the complexity of the (hypothetical) question(s) they are asked in the survey (DTLR, 2002, p. 28). Against this background, visual representations of the good or service in question play an increasingly important role in the context of SP studies (see further below). Furthermore, SPTs are complex and time consuming (for example, regarding the creation of primary data (Moug, 2008, pp. 5ff)). Finally, the use of a sound methodology is crucial for the credibility of their results (DTLR, 2002, Introduction).

Consequently, after choosing the SP approach as a means of economic valuation, a number of important decisions need to be taken. These relate to the survey method (for example, face-to-face interviews, telephone interviews, mail surveys or combinations of these), the sampling (including the definition of the target population, the sample structure and sample size), and the questionnaire design (including piloting and revision) (DTLR, 2002, p. 9).

There are two basic types of SPT: the 'Contingent Valuation Method' (CVM) and 'Choice Modelling' (CM). They can be used together in one study in order to increase the robustness of results and to check the underlying components of values (DTLR, 2002, p. 32). However, if a study requires rankings or ratings for individual attributes (or alternatives) of a good or service, CM should be used. If the goal is to identify the value of a good or service in its entirety, CVM is the preferable approach (DTLR, 2002, pp. 30ff.).

<u>The Contingent Valuation Method</u>

CVM can estimate the value, both for users and for non-users, of the good or service in question. It is the most common approach adopted in SP research and is particularly used for the economic valuation of large-scale projects and investments

(Moons, 2003, p. 5). Conventional CVM studies concentrate on the investigation of the value of the (non-market) good or service in its entirety (DTLR, 2002, Background). They can generally be seen as a procedure to convert (qualitative or quantitative) changes in (environmental) goods or services into monetary terms (in particular 'Willingness to Pay' (WTP) or 'Willingness to Accept' (WTA)) (Moons, 2003, p. 11, see also Allin/Henneberry, 2009).

So far, the hypothetical nature of the method has given it a rather controversial status in practice (Moons, 2003, p. 11). First mentioned in the 1940s and then used as an empirical base of study in the 1950s, CVM achieved worldwide attention when applied to the assessment of the non-use damages caused by the Exxon Valdez oil tanker disaster in 1989 (Moons, 2003, p. 11f). As a consequence of the disagreement on the validity of the method between the State of Alaska and the Exxon Company, a systematic investigation of CVM was carried out in 1993 (Arrow et al. 1993). It came to the conclusion that CVM can be used as a starting point in judicial processes, provided the study follows a set of explicit guidelines. These guidelines include, for example, a 'conservative' study design (anticipating the underestimation of WTP), the necessity to offer people the option not to participate, and the usage of the binary valuation question (Moons, 2003, p. 12, see also Arrow et al., 1993).

Survey method

The appropriate choice of survey method in CVM (and CM) studies depends on the availability of (project) resources. Generally, the quality and reliability of the survey and its particular outcomes are determined by the time and money devoted to it (DTLR, 2002, p. 41). As CVM (and CM) studies exclusively rely on collected survey data (Moons, 2003, p. 12), both gains and losses of information and accuracy are strongly associated with the survey methods that are used.

So far, practitioners – in spite of the higher costs involved – generally recommend face-to-face surveys (DTLR, 2002, p. 41). Their crucial advantages relate to two main areas: firstly, the possibility of probing and clarification of the questions (Moons, 2003, p. 12) and, secondly, the use of visualisations and demonstrations to illustrate complex (and, thus, flexible) evaluation scenarios. Thanks to the use of visual aids, the particular research context in question and its complexity can be represented in a more adequate way. In addition to this, face-to-face surveys also provide a greater potential both for controlling the sample and for achieving higher response rates (DTLR, 2002, p. 41).

Sampling

After choosing the survey method, another crucial decision is needed on sampling. To this end, a sequence of critical steps has to be undertaken (DTLR, 2002, pp. 43ff).

- Firstly, the target population needs to be defined. This can be the whole population of a country or region/city, or a defined group of people or sub-sample (for example, drivers of cars, pedestrians or public transport users, people of specified age groups, residents, visitors, and so on). The correct identification of the target population can be judged as the most critical task within the process of sampling. Getting it wrong can strongly bias subsequent valuation results. The definition of the relevant target population may require

the analysis of secondary sources (which indicate people who benefit from or pay for a good/service). It is affected by the good/service and its impact in question, as well as by the forms of value that are of interest. For example, assessments of non-use values (which are likely to be important in VALUE and the context of green infrastructure investments) generally require a wider geographic coverage. It is also possible to have more than one target population. This can provide a range of values in the final results of the study.

- Secondly, a sample frame with a population that is as consistent as possible with the target population has to be identified (for example, all the dwelling units within a city, all the visitors to a particular park, beach and so on). Generally, the sample frame is an explicit list. Practical experience indicates that lists of specific, smaller populations are more easily accessible. Problems most commonly encountered with the sample frame relate to the omission of certain members of the target population, or to the multiple inclusion of members, or to the inclusion of people not of interest to the study.
- Thirdly, a sample of potential respondents is selected from the frame in order to apply the survey. Commonly, this is done by the use of randomised procedures/probability approaches (for example, a computer-generated list of random numbers). In practice, there exist various types of probability sampling methods that meet the particular requirements of different sample selection processes (for example, simple, systematic, stratified, clustered multi-stage random).

Finally, the sample size adequate for the particular purpose of study has to be chosen (DTLR, 2002, p. 45). In this regard, the relation between the budget and the precision of the estimate (> a larger sample size leads to a higher precision of estimates) plays a key role. Generally, the choice of sample size is determined by the following main factors (DTLR, 2002, p. 45):

- the variance in the underlying population (relative to the average; the bigger the variance, the bigger the required sample);
- the precision required in the estimates (benchmark = 95% confidence interval);
- the expected response rate;
- the need for any disaggregated information (the more sub-samples, the bigger the overall sample); and
- the resources available for the study.

Some reduction of sample size may be possible if more information per respondent is collected (for example, in CM studies where multiple choices or valuations are elicited from each respondent) (see DTLR, 2002, p. 46 and below). However, it has to be pointed out that - both for statistical and survey research reasons - there is no automatism that allows a reduction of sample size by just increasing the amount of collected data per respondent (DTLR, 2002, p. 46).

In conclusion, the choice of sample size is a sophisticated statistical task, which usually requires professional advice from a statistician or survey specialist. However,

some rules of thumb are given in DTLR (2002, p. 45, Table 8.2). For further details and an introduction to statistical methods in general and the statistical basis of sampling in particular, see Norcliffe (1982).

Questionnaire design

The structure of a typical CVM questionnaire comprises the following components (DTLR, 2002, pp. 47ff. and Moons, 2003, pp. 12ff):

- A statement on the purpose of the questionnaire including an introduction to the interviewing organisation(s) to ensure that respondents understand the context of research, are motivated to cooperate and thus are able to participate in an informed manner. In addition, the potential respondents should be assured that their answers will be treated confidentially.
- A set of attitudinal questions that aims to identify the respondent's attitude to general issues related to the good or service in question.
- A set of questions that aims to determine the (non-)use of the good or service in question. The respondents are asked questions concerning their familiarity with the good/service in order to distinguish users from non-users.
- The (visual and text based) presentation of the hypothetical valuation scenario itself (including the description of the payment vehicle; for example, taxes, fees/charges, price increases and so on). This presentation is accompanied by a set of questions related to it, the most important of which is the value elicitation question (for example, open-ended elicitation, bidding game elicitation, payment card elicitation, single- or double-bounded dichotomous choice; concerning the particular question format see Moons, 2003, pp. 13ff). In addition, a number of follow-up questions may be used to clarify the motives for and validity of the responses. A carefully designed valuation scenario is the central part of the survey as it defines the (nature of change in the provision of the) good or service in question and the institution that is responsible for providing it. Consequently, this forms the main basis for the respondents' statements on preferences and values.
- A set of questions asking for the socio-economic characteristics (such as age, sex, interests, income, education and nationality) of the respondents. With the aid of this information, the statements given on the actual scenario can be tested against their conformity with theoretical expectations (for example, whether WTP varies with income).

Many economic valuation studies using SPTs (CVM and CM) can be criticised for devoting inadequate effort to the design and testing of the (draft) questionnaire (DTLR, 2002, p. 57). However, questionnaires need to be tested in terms of potential biases (for further details on types of biases see DTLR, 2002, p. 59, Table 11.1 and Garrod/Willis, 1999, pp. 153ff.). This, for example, is achieved through the use of focus groups (discussion conducted by a moderator among a small group of respondents) and/or a pilot survey (using 25-100 questionnaires) which normally lead to a revision and perhaps retest of the questionnaire as many times as necessary (DTLR, 2002, p. 57).

Finally, the use of questionnaires within CVM studies generally faces one specific problem: the risk of 'embedding'. However, this risk can be reduced by designing questionnaires and scenarios carefully and thereby defining the change in the provision of the good or service in question as precisely as possible (DTLR, 2002, p. 53).

Choice Modelling

The application of CM within the context of economic valuation aims to measure the value of the individual characteristics/attributes of a specific good or service (Garrod/Willis, 1999, p. 9). Individuals participating in such experiments have to choose between different combinations of characteristics of a good or service over other combinations at various prices (Garrod/Willis, 1999, p. 9). Over recent years, the use of CM has become increasingly common (Moug, 2008, p. 7).

The main types of CM techniques are 'Choice Experiments' (choice between (usually) two alternatives, versus the status quo), 'Contingent Ranking' (ranking a series of alternatives), 'Contingent Rating' (scoring alternative scenarios) and 'Paired Comparisons' (scoring pairs of scenarios) (DTLR, 2002, p. 54).

Amongst these, the only technique that can be judged as consistent with the underlying theory of welfare economics is 'Choice Experiments' (DTLR, 2002, pp. 54ff). These experiments aim to present respondents with a baseline scenario (the status quo) and several alternative options in which attributes are changed in quantity and quality. The set of attributes may also be determined by focus groups. Chosen attributes should include a money value representing a payment vehicle and, because of the potential limits to the cognitive abilities of the participating respondents, the number of attributes should be limited (DTLR, 2002, p. 55).

Thus, recent research on the operational pitfalls of CM focuses on the exploration of significant 'interviewer effects' (for example, physical appearance) and 'information effects' (e.g. level/type of information) on people's responses in SP studies (see, for example, Bateman/Mawby, 2004; for more details on the outcomes of research on advantages and pitfalls within CM in particular or SP studies in general see also Moug, 2008, pp. 7ff.).

With regard to the details of the practical implementation of CM studies, the main methodological issues highlighted in relation to CVM studies (see above) are similarly applicable. However, some major differences occur in the design of questionnaires (DTLR, 2002, pp. 54ff.). Whereas CM questionnaires have more or less the same structure as CVM questionnaires, they obviously differ in terms of the contents of the 'valuation scenario' (DTLR, 2002, p. 47). Accordingly, in CM studies the scenario describes a good or service in terms of its particular attributes/characteristics and their (qualitative/quantitative) change (DTLR, 2002, pp. 54f).

The common design stages in CM studies are as follows (DTLR, 2002, p. 55, Table 10.2 and Garrod/Willis, 1999, p. 205).

- Identification of the good or service to be investigated, the selection of key attributes and the determination of their levels. The number of attributes per good/service should be limited to four or five, including a monetary cost to allow the estimation of WTP. The selection of attributes is usually achieved

through literature reviews, the use of focus group discussions (> initial screening of attributes) or direct questioning.

- Assignment of levels: the attribute levels should be realistic and span the range over which respondents can be expected to have preferences. They may include policy targets and should comprise the 'do-nothing' level and a range about the existing level in order to elicit a WTP for a gain or to avoid a loss.
- Choice of experimental design: generally, statistical design theory is used to combine the levels of attributes into a number of alternative (environmental) scenarios or profiles to be presented to the respondents.
- Construction of choice sets: the profiles identified by the experimental design are grouped into certain choice sets that are presented to the respondents. This presentation of profiles can be undertaken individually, in pairs or in groups.
- Measurement of preferences: concerning the choice of survey procedure and conduct of the survey itself, it can again be related to the specifications for the context of CVM studies (see above).

Choice Modelling (and CVM) in combination with Virtual Reality technologies (VR) and visualisations

The use of (interactive) 'virtual' environments, their modelling, generic simulation and visualisation has increased in importance within many recent CM (and also CVM) studies, particularly in the context of landscape planning and design (for further information see Lange/Bishop, 2005).

As already mentioned above, virtual environments and computer visualisations support the presentation of alternative and complex choice scenarios and provide a genuine advance in the delivery and perception of information within environmental economic studies (see also Working Paper 1.2.6). Thus, they make a particularly significant contribution to the quality of participatory planning and design processes (Garrod et al., undated, p. 9 and Greenspace, 2005, p. 57).

So far, some of the key issues regarding the current and future use (and, thus, the further development) of VR and visualisation techniques in CM studies are the provision of real-time and interactive simulations/virtual environments/visualisations, maximised realism and (3 and/or 4D-) immersion scenarios, as well as the discussion of the constraints arising from the respondents' (visual) cognition/perception and its role in complex mental processes such as reasoning or decision-making.

Summarising, VR and visualisation techniques represent an appropriate means of promoting the perception of the issue(s) in question and offer a valid foundation for the articulation of choices/preferences by the respondents (Greenspace, 2005, p. 57). However, at the moment visualisation techniques appear mainly to be limited to the representation of the visual attributes of a given decision or choice context (neglecting other attributes of urban environments such as noise, smell, safety, social issues and so on).

2.2 Evaluation Techniques at the City/Region Scale

2.2.1 General Overview of Existing Approaches

(Simone Allin, John Henneberry and Karsten Rusche)

Two broad approaches to modelling the impact of green investments on urban and regional economies may be highlighted. The first is based on the determination of regional income and employment. A central feature of regional economic models is that they build on input-output linkages between economic agents such as firms (that sell goods and services, including to other firms) and households (who sell their labour services and buy goods and services). These linkages, which include direct as well as indirect or induced effects on income and employment, occur both within and between regions (Armstrong/Taylor, 2000, p. 7). Furthermore, a new production activity (for example, the building of a new plant) has impacts on a local economy as a result of feedback effects (multiplier processes). Consequently, an initial injection of capital is followed by (complex) consecutive rounds of expenditure until the multiplier effect has worked its way through the economic system (Armstrong/Taylor, 2000, pp. 7f). Against this background, a regional version of the Keynesian model can be used to estimate the effects of expenditure injections on (total) local and regional economies. In particular, this implies the usage of regional multiplier analysis (Armstrong/Taylor, 2000, p. 33).

The input-output approach to modelling the regional economy is based on the simple notion that the production of output requires inputs (goods, services) and, consequently, it is possible to identify these input-output linkages within a region (Armstrong/Taylor, 2000, pp. 35f). Over recent decades, a large number of regional input-output models have been constructed. They are meant to provide a consistent and detailed industry-by-industry breakdown of the predicted effects of specific changes in demand in the longer term (Armstrong/Taylor, 2000, pp. 43, 50). Furthermore, output, income and employment multipliers can be obtained from the input-output model (Armstrong/Taylor, 2000, pp. 43ff.).

Alternative approaches to assessing the impact of green infrastructure investments at the city/region scale derive from the literature on competitiveness or competitive economic performance of city-regions in knowledge-driven economies. One main issue of concern in this context is the provision of socio-cultural facilities and assets. They strongly influence the ‘quality of life’ and thus the attractiveness of a city-region and are an important source of competitive advantage (DCLG, 2006, p. 55ff). Current definitions of ‘quality of life’ generally combine social, environmental and place characteristics (DCLG, 2006, p. 99).

The above approaches are considered in more detail in the following sub-sections of the report.

2.2.2 Input-Output Analysis in Combination with Multiplier Analysis

(Nel Ghyselinck, Frank Stubbe, Bert Vermeire and Ann Verspecht)

Any economic activity has an impact on other economic activities and all are connected through input-output relationships. Consequently, a green infrastructure investment will generate effects both on the demand and on the supply side. These will ripple through the local economy, generating additional activity and supporting the economic competitiveness of the region as a whole. Thus, in contrast to their common interpretation in CBA, such investments are treated as positive capital injections into the city/region economy, rather than as costs. Multipliers measure the total change throughout the economy arising from one unit change in a given sector. For example, if the multiplier is 1.5, for every €1 invested in green infrastructure an additional value of €0.5 will be produced further downstream in the economy. The advantage of this technique is that it shows how sectors are interrelated. It also gives an overview of the indirect and induced effects of investments across sectors.

Generally, the input-output analyses described in the literature demonstrate the importance of an industry or sector to the regional economy in its entirety. The role of nature, forest, landscape and natural heritage within the local economy has been described by Courtney et al. (2006), Berends & Vreke (2002), Bos & Van Leeuwen (2001) and others. The small scale of the impact of a green investment requires very local input-output tables, which oftentimes are not available (Bogaert et al. 2004). Berends & Vreke (2002) and Bos & Van Leeuwen (2001) provide a possible solution, which is to 'localise' national input-output tables. An important bottleneck for this multiplier analysis is the general lack of adequate and compatible data. This applies in particular where data is needed across 'traditional' borders of different economic 'sectors' (Knickel/Renting 2000).

Description of overall input/output framework

The term 'multiplier effect' relates to effects that are indirect either in spatial terms or in terms of the actors and activities involved. From a conceptual point of view, multiplier effects are related to other segments of the rural economy and not to the specific enterprises which have been the focus of analysis (Knickel/Renting, 2000). In general, multiplier effects are positive (that is, they produce additional benefits, income or employment). In this context, the development of green bicycle trails can serve as an example. A green investment (for example, the construction of a bike way) creates economic activity. This is a direct effect. Changes in final demand (for example, more tourists) infuse local industries with new funds, which increase overall output and employment (Ribeiro/Warner, 2004). Enterprises such as shops, restaurants and local tourist entrepreneurs may also benefit from the spending of these tourists. These are induced effects (see below).

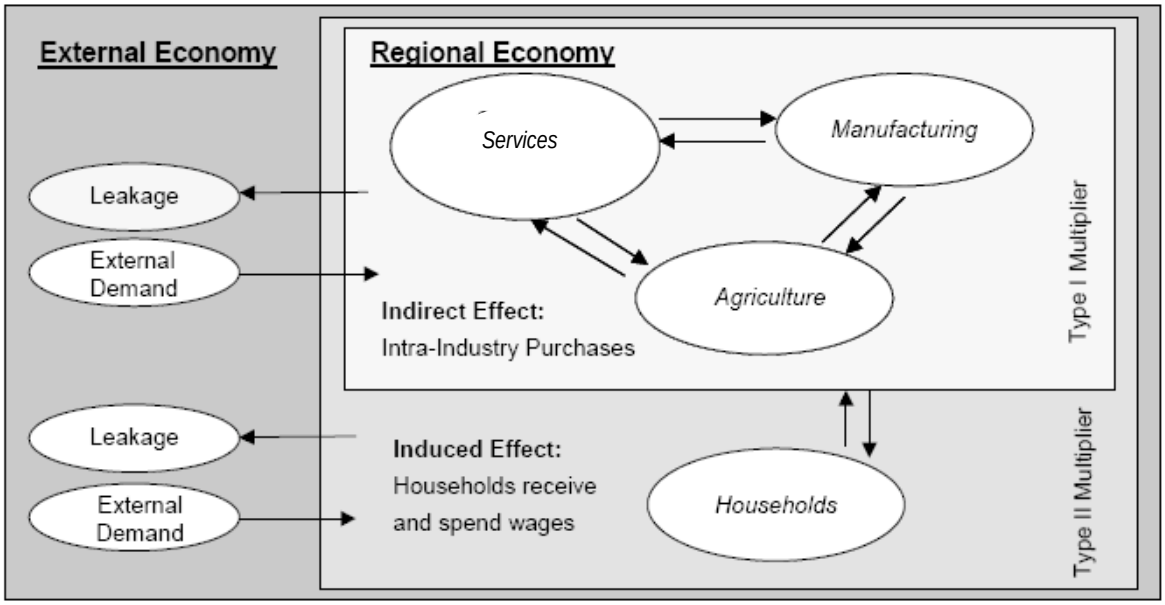
Through input-output analysis, the multiplier can be calculated. It is a technique for tracing resources and products within an economy. The system of producers and consumers is divided into different branches, which are defined in terms of the resources they require (inputs) and their products (outputs). The quantities of input and output for a given period of time, usually expressed in monetary terms, are incorporated into an input-output matrix. Input-output analysis can be used for different analytical purposes (Berends et al., 2001; Dwyer et al., 2004). There are two

types of linkage effects which can be measured by input-output analysis and which result in a multiplier.

- Multiplier I: Indirect effects count the multiple rounds of inter-industry purchases needed, for example, for land consolidation projects. These projects demand building materials, trees and other supplies from other industries, in turn stimulating output in those industries.
- Multiplier II: Induced effects capture the impact of household spending. Employees spend their wages in the larger economy and these expenditures generate demand in other industry sectors (for example, housing, groceries).

The direct, indirect and induced effects are shown in Figure 4, which relates to the example of inputs-outputs in the childcare sector.

Figure 4: Input-Output Analysis in a Regional Economy



(Based on Ribeiro/Warner, 2004).

Input-output analysis normally assumes that demand is generated outside the local economy. Thus it treats export demand (or the ability of industries to sell their goods/products to the external economy) as the engine that generates activity within the regional economy (Ribeiro/Warner, 2004). Type I multipliers treat households as external (exogenous) to the economy being modelled. Type I multipliers include only the direct effects and the indirect effects of inter-industry purchases. Type I multipliers do not include the induced effects of household spending. In order to increase their spending, households would have to reduce their spending on some other sector in the regional economy and, consequently, induced effects on changes in internal demand are not calculated. The Type I multiplier is related to changes in sales to final demand (McKean/Weber, 1983).

The Type II income multiplier identifies the direct plus indirect plus induced income generated by an additional unit of income paid directly to households (McKean/Weber, 1983).

Green investments can have this kind of macro-economic impact. Thus, it is essential that the (indirect) effects of such projects are translated into economically measureable variables. But how, for example, is the effect of a green investment on consumption, or the effect of a green investment on private investments measured? This exercise results in development pathways for macro-economic variables, such as employment, consumption, state income through taxes, government spending and so on. The kinds of development pathways that are triggered by a green investment can be compared to pathways without such an investment. Furthermore, Jongeneel et al. (2005) suggest that the multipliers for nature investment projects calculated in the input-output analysis can complement CBA to value their indirect costs and benefits.

Multiplier analysis relies on the assumption that the value created through the investment would not have been created (by somebody else, elsewhere), if the activity did not take place. This, of course, is a disputable argument. While a green investment does induce change in the pattern of economic activity, it does not necessarily involve a net increase in economic activity. In order to cope with this challenge, computable general equilibrium (CGE) models have been developed. They are based upon and further develop input-output analysis by modelling these interactions. However, avoiding the unwanted abstractions of input-output analysis through the use of these techniques is quite time-consuming and complex and the results will still rely strongly on the assumptions made (Dwyer et al., 2004).

2.2.3 Quality of Life and Quality of Business Environment Approach

(Karsten Rusche)

The economic concepts of ‘quality of life’ and ‘quality of business environment’ provide useful bases for the valuation of different regional amenities. Both concepts represent ways of determining the WTP of individuals for (dis-)amenities and local characteristics on the regional scale (for example, NUTS-3). The underlying methodology is based on the idea of revealed preferences that supports HPM (Allin/Henneberry, 2009).

Quality of life vs. quality of business environment

Research on the impact of green infrastructure, especially in urban areas, has a broad historical tradition in economic literature. A wide range of analyses focuses on the relationship between utility, WTP and the development of open urban spaces. However, results differ quite significantly depending on the spatial scale and the methods used in the study. The aims of research within the literature generally are very similar, but the techniques used to determine the economic impact of green infrastructure are changing rapidly. Referring to the two most common approaches applied at the local level – SP analysis by survey techniques and RP analysis by HPM – in recent years a huge amount of new empirical assessments have been developed. In both cases, the growing use of GIS and the availability of geo-referenced data were major catalysts for this development.

Focusing on the more aggregated spatial level of regions instead of neighbourhoods, methods and empirical assessments have become much more selective. When thinking of a possible way in which urban open spaces have an impact on the regional

scale, the concepts of quality of life (QoL) and quality of business environment (QoBE) have to be considered. Economic theory suggests that when people and firms value a certain quality and quantity of green open space, it will be capitalised in local prices and wages.

Referring to the concept of regional QoL, it is assumed that in a theoretical situation of spatial equilibrium all people have sorted themselves among all regions regarding their individual utility functions. The latter are in accordance with the maximisation of individual utilities. In this utility function there are not only regional economic characteristics (for example, income and rate of unemployment), but also regional sets of amenities such as nature, climate, culture and the amount of parks and other open spaces. Consequently, when focusing on the impact of green investments at the regional scale, the strength of the relative impact of urban landscapes on the QoL and QoBE has to be assessed.

Concerning QoL, economic theory concludes that amenities can be seen as attractors of people. In relation to some reference location, people are willing to forgo a certain amount of real wage when they are localising in a region with a high quality of life. In addition, they will be willing to pay a higher price for housing to have access to the regional housing market. On the one hand, house prices will be higher in 'nicer' places compared to regions with a lower QoL. On the other hand, firms that offer jobs in the more highly valued regions will have to pay less to attract employees, because the region has a high net value of its own. Consequently, after correcting for the higher prices of property, the hourly wages will be relatively low in these places.

A similar rationale can be hypothesised for firms. They are supposed to optimise profits. Based on this assumption, they have to decide where to locate their plants. It is important to keep in mind that here the considerations of firms differ from those of households. Firms choose a certain region for their location that best fits their needs for competitive and effective production (that is, a region with a high QoBE). Again, compared to some reference location, firms are willing to pay higher prices for commercial or industrial land in a more attractive region. With regard to cost effectiveness, firms are willing to incur higher input costs (that is, wages) in a relatively attractive region.

Summarising, firms and households differ in their ways of evaluating regional attractiveness. It cannot be assumed that places with high QoL also have a high QoBE and vice versa. One important implication of this result is that research on amenities and dis-amenities has to analyse both qualities in order properly to assess the impact of a certain characteristic. In relation to green infrastructure, an interesting question is whether open spaces have a common and similar impact on both QoL and QoBE or not.

Hedonic Pricing Model

The empirical assessment of the QoL and QoBE concepts is based on similar equations. In contrast to SPTs, these estimations are exclusively based on revealed preference analysis; that is, they are derived mainly from spatial HPMs. In general, the HPM deduces information of the qualitative and environmental characteristics of a good from market data. Consequently, the information used in the empirical work can be divided into two subsets that relate to structural/physical (personal/individual) traits and local amenity attributes for housing (wage) equations (Gyourko/Tracy,

1991, and Blomquist et. al., 1988). The estimation of each form of regional quality is calculated in a hedonic regression, which analyses the impact of local attributes and local amenities on the respective price or wage variable (Chen/Rosenthal, 2008):

$$p_{i,s} = \varphi + \sum_{j=1}^{k} \theta_j \cdot a_{ij} + \sigma C_s + u_{i,s}$$

$$w_{i,s} = \alpha + \sum_{j=1}^{k} \beta_j \cdot a_{ij} + \gamma I_s + \varepsilon_{i,s}$$

In a housing equation, for example, the monthly rent per square meter of housing (p) is set in relation to housing characteristics 'C' (for example, number of rooms, age, garage, lot size, living space) and a variety of regional variables/amenities 'a' (socio-economic and environmental data). The wage regression refers to hourly wages 'w' in relation to individual characteristics 'I' (for example, age, education, family status) and the local amenities 'a' (Gabriel/Rosenthal, 2004). Regarding the calculation of the QoL and QoBE indices, the regression coefficients for the amenities are of particular interest. Following further manipulation, they are used to determine the implicit prices.

Recalculation on the basis of monthly expenditures

Once the HPM setup is defined and the results of the estimations are available, some further steps of transformation need to be followed. The values of the regression coefficients do not yet mirror implicit prices. They take the form of Euros per square meter and Euros per hour. Therefore, in order to attain implicit prices belonging to a monthly household budget, the coefficients have to be recalculated. To this end, some equal basis has to be taken into account (for example, the average monthly expenditure on housing or the average monthly salary in the super-ordinate region). Using this basic reference, all regression coefficients are re-based (Blomquist, 2006, and Buettner/Ebertz, 2009) and then aggregated to the QoL and QoBE.

Extensions regarding green infrastructure

Most research on the QoL and the QoBE does not deal with the quantities and qualities of green infrastructure in a precise and detailed way. The two main papers on QoBE (Gabriel/Rosenthal, 2004, and Chen/Rosenthal, 2008) use region-specific dummy variables to encode local sets of amenities. Consequently, they do not differentiate between different types of regional characteristics. Research on QoL has a far longer tradition in this context and, thus, related academic papers use a wide range of amenity variables for regional description (Blomquist, 1988, and Gyourko/Tracy, 1991). However, the main focus here is on air pollution as a driver of quality of life. The more recent analyses add only weak assessments of green infrastructure at the regional scale (for example, number of Superfund Sites or the proportion of an area consisting of forest and water) (Blomquist, 2006, and Buettner/Ebertz, 2009).

In contrast to the limited use of green space variables, there exists a lively discussion on its theoretical impact on regional QoL. Green investments can be interpreted as investments that increase the comparative advantage of a region (Crompton, 2001). This is because green open spaces in urban areas have an impact not only on the local quality of place, but also on the wider perception of whether that location is a good place to live (Andrews, 2001). Consequently, the development of green open spaces should affect the relative attractiveness of that city or region to people and firms.

Following this line of argument, one important addition that has to be made to the research on QoL and QoBE is in how far green investments have an effect on the regional WTP in terms of significant implicit prices (Tyrväinen/Miettinen, 2000). Referring to the literature on HPM, at a local scale there is a large number of papers that deal with the value of open space (see McConnell/Walls, 2005 for a review). The methods used to encode qualities and quantities of green infrastructure in these analyses are transferable to the city/region level.

With the growing usability of GIS software and the availability of small-scale geo-referenced data, HPM analyses have concentrated on adding this information to conventional approaches. For example, Goeghegan et al (1997) used GIS information to a broader extent within their approach that had, as a particular focus, the encoding of the quantities and qualities of open space.

Regarding the quantity of green infrastructure, an easy method of assessment is the use of simple distance measures of the relative proximity of open spaces such as meters of linear distance to the nearest park (Cho et al., 2006). The qualities of different types of parks may then be considered – such as evergreen forest area, deciduous forest area, mixed species forest area (Cho et al, 2008). Additional measures of quantity are the number of forested areas within a certain radius or the average size of forested areas.

Geoghegan et al (1997) also suggest that there has to be a set of variables that measure qualities of green spaces in order to allow for a realistic assessment of its effects on local housing markets. Within this approach, the two most commonly used measures of ecological landscape character are diversity and fragmentation.

Diversity

$$H = -\sum_k (P_K) \cdot ln(P_K)$$

where Pk = proportion of landscape in cover type k

Fragmentation

$$R = \sum \frac{P_i}{A_i}$$

where P = perimeter length, A = area of interior, i = land cover type

Diversity can be seen as a measure of the complexity of a landscape, fragmentation is a kind of perimeter to interior ratio (Cho et al., 2008). Besides more complex variations of these measures, a promising classification is whether the green space is developable or not (Irwin/Bockstael, 2001, and Geoghegan, 2002).

Summarising, it can be stated that there are some interesting approaches in the empirical literature concerning green investments. However, they are either related more to the local than to the regional scale or they do not use the variety of possible GIS based information on green open spaces for the analysis of QoL or QoBE. For the VALUE project it would be necessary to integrate contemporary measures of qualities and quantities of green open spaces into the concepts of regional QoL and QoBE.

Possible Restrictions

The first best approach to the determination of the effect of green investments on the QoL and QoBE would be a sHPM model that implements

- a wide-ranging (all NUTS-3 or even LAU 1/2 regions of a country), representative data set;
- a variety of local amenity statistics to deal with overlapping effects;
- geo-referenced land use data for the coding of qualities and quantities of regional green open spaces; and
- socio-economic, house-specific, firm-specific and individual worker characteristics

into a spatial econometrics equation of QoL and QoBE determination. The results of this analysis would be a Euro value of WTP for marginal amounts of green open space. The data could also be used to determine the spatial multiplier and to conduct a GWR to analyse the spatial variations.

It is obvious that these detailed requirements cannot easily be met. Thus, the first thing to do is to check whether official (survey) data are available for research that meets the above criteria. The second point that arises is the Europe-wide compatibility of input. Because the results for all projects that are evaluated in VALUE should be comparable between nations, a common base of data collection has to be developed. The administrative division of land uses, for example, can differ between European countries and will have to be adjusted properly. Therefore, consideration has been given to the use of a combination of Urban Audit data and CORINE land cover information in the VALUE project (for further discussion of the practicability of this combined approach see Section 4.3).

2.2.4 Alternative Approach: Students' Survey

(Pierre Guilliams and Jean-Marie Halleux)

One of the conclusions of the CSI project (Creating a Setting for Investment, INTERREG IIIB, 2002-2008) was that, for deprived areas, changes of image have to take place at the city/region scale in order to reverse existing trends and create further economic development. But can landscape quality/green infrastructure change the image and break the vicious circle where the poor image results in out-migration? This is the question we will try to answer in this section.

Although there is limited scientific support for the view, the majority of public authorities agree that cities wanting to attract high technology enterprises or skilled

workers have to promote their socio-cultural and natural assets and the QoL in general (Naud/Tremblay, 2006, p. 57). The attractiveness of city-regions for skilled workers is a factor that is officially regarded as being of increasing importance. "A skilled workforce is a critical feature of competitive cities" (Parkinson et al., 2004, p. 16). The importance of the factor varies between different types of cities and regions. However, it is particularly significant in regions that have a poor image (Accaputo et al., 2006, p. 16).

Florida's theses about what he calls 'the creative class' are particularly relevant.

> "Firms in knowledge-based industries are less concerned with traditional factors, such as land costs, tax rates, or governments' incentives. Such firms report that they steer their location decisions to attract and retain talent. Places with large available talent-pools reduce the costs associated with search and recruitment of talent. This is more significant in highly competitive and innovative industries where speed to market is a critical success factor" (Florida, 2002b, p. 751).

Consequently, European as well as American and Australian cities have multiplied initiatives to be considered 'creative cities' in order to attract investors and workforces (Roy-Valex, 2006, p.326). Florida suggests that the preferred destinations of the creative class are those that are 'hospitable' (offering ease of integration into the region) and that culture and environmental quality are important 'soft' location factors (Florida, 2002a and 2002c).

Interviews of office occupiers in Wallonia by Segefa-ULg within the scope of the CSI project (2008) confirmed this assumption. The interview of McKinsey & Company illustrates the importance of green infrastructures in attracting the most skilled workforces.

> *"Landscape quality is very important for the attractiveness of the top students just graduated. These latest will have the choice between different consultancy companies offering them a high income and other financial advantages. To be the one chosen by them, 'soft' location factors like the working environment can make the difference".*

In order to explore the question of the link between the retention of skilled labour and landscape quality, an innovative approach would be to elicit the expectations of skilled students about the working environment by means of surveys.

The benefits of the students' surveys are threefold:

1. They are a population that is easy to reach;
2. A large number of responses can be expected;
3. The comparability of results in the different partners' regions would be very high.

2.3 Conclusions

(Simone Allin and John Henneberry)

Evaluation at the site scale

At the site scale, the concept and application of CBA is well established for describing and measuring the economic impact of projects, investments and policies in the environmental sector. Consequently, it can be seen as an important and substantial aid for decision-making, but never as a substitute (Gilpin, 2002, p. 189).

However, the overarching framework of CBA has its specific weaknesses. These, for example, refer to dealing with synergistic effects and with difficulties of capturing non-monetary or non-tangible values. In addition, the small scale of the VALUE investments and their potentially very limited impact on the urban economy represents a particular challenge when applying evaluation methods. This fact especially holds true for methods that are normally used to investigate and to assess macro-economic effects. However some of the weaknesses can be addressed by means of complementary and alternative valuation techniques (that is, RPTs or SPTs). Implemented with methodological rigour, these offer a wide range of possible and consistent combinations. Thus, they are adaptable to the specific purpose of any study.

Evaluation at the city/region scale

At the city/region scale, there also exists a wide range of concepts and approaches to describe and measure economic growth, including traditional (supply-side or demand oriented) techniques as well as alternative methods. The latter focus on cumulative effects and the self-perpetuating nature of growth processes (Armstrong/Taylor, 2000, p. 117).

Referring to the economic valuation of green infrastructure investments at the city/region scale, the following main issues have to be considered from a conceptual and operational point of view:

- distinction between short-term and long-term impacts of green infrastructure investments on the regional/urban economy and choice of the appropriate models;
- adequate capturing of synergistic effects regarding other sectors of the economy or the economic system as a whole;
- accurate examination of the potentials of alternative approaches (for example, the investigation of ‘quality of life’ or ‘liveability’), in particular in the context of environmental and qualitative aspects;
- consideration of further dependencies amongst regions and cities as a consequence of world-wide networking and consideration of influence/impact of overall socio-economic trends;
- problems in conducting the studies, referring to factors such as scale of investments, data availability, time and costs; and
- difficulties regarding communication and information exchange with authorities, businesses and stakeholders at the city/region level.

An overall approach to the valuation of green infrastructure

Based on the assumption (and partial empirical evidence) that green infrastructure investments have a macro-economic impact within an urban economy, the multipliers for these projects calculated as part of an input-output analysis may complement the use of CBA to value related indirect costs and benefits. However, and as already stressed above, the small scale of the VALUE green investments will limit the significance of their economic impact and, thus, of expected results.

Beyond the appraisal of the internal economic impacts of green infrastructure investments, the review of existing evaluation techniques highlights the need for a further investigation of their external economic effects. This relates especially to their potential contributions to the QoL and QoBE of a city/region. Further to this, contemporary approaches do not seem to be satisfactorily comprehensive and appropriate. Thus, they have to be further refined and developed to meet the purposes and specific research needs of the VALUE project. This may be achieved, for example, by means of an integration of measures of qualities and quantities of urban green and open spaces. A students' survey focusing on their requirements and preferences for the future working environment might be an alternative approach that could provide additional evidence in an efficient way.

A final consideration is the way that site and city/region level evaluations may best be integrated. These two types/levels of techniques have different conceptual bases. At the site level, the core measure is net benefit derived from gross costs and benefits arising from an investment. At the city/region level, the main indicator is growth (measured in GDP/GVA terms) where more is considered to be better (than less); and where the distinction between gross costs and benefits is, at least, unclear. In addition, size (of turnover) is conflated with competitiveness. However, this turnover might also be generated by non-competitive activities. Operational issues also arise from differences in approach; for example, equating the outputs/outcomes of a site level investment with a capital injection into an urban or regional economy is problematic.

Chapter 3 will build on the key findings of this chapter to provide an up-to-date overview of the general characteristics and the current state of the particular VALUE green infrastructure strategies and investments. It will also identify their expected economic benefits and relate these to the core research questions.

3. Overview of VALUE Investments: Main Objectives and Expected Benefits at the Site Scale and the City/Region Scale

(Simone Allin and John Henneberry)

This chapter provides an overview of the current state of selected VALUE investments in the six European partners' cities. It highlights the main characteristics of each investment at the site scale (that is, general description, main objectives and related indicators). In particular, it gives information about the specific context of the investment and illustrates its character by means of photographs, design plans or maps. In addition, for each partner's city/region the main characteristics of existing green infrastructure strategies, policies and plans are described, focusing again on the main objectives and core policies.

Finally, the chapter identifies the expected economic benefits of each green infrastructure investment at the site scale and for each green infrastructure strategy or plan at the city/region scale. This provides the basis for the decision on appropriate economic valuation techniques for application to the particular VALUE investments that is addressed in Chapter 4.

3.1 Sheffield – 'The Wicker/Nursery Street'

(Simone Allin and John Henneberry)

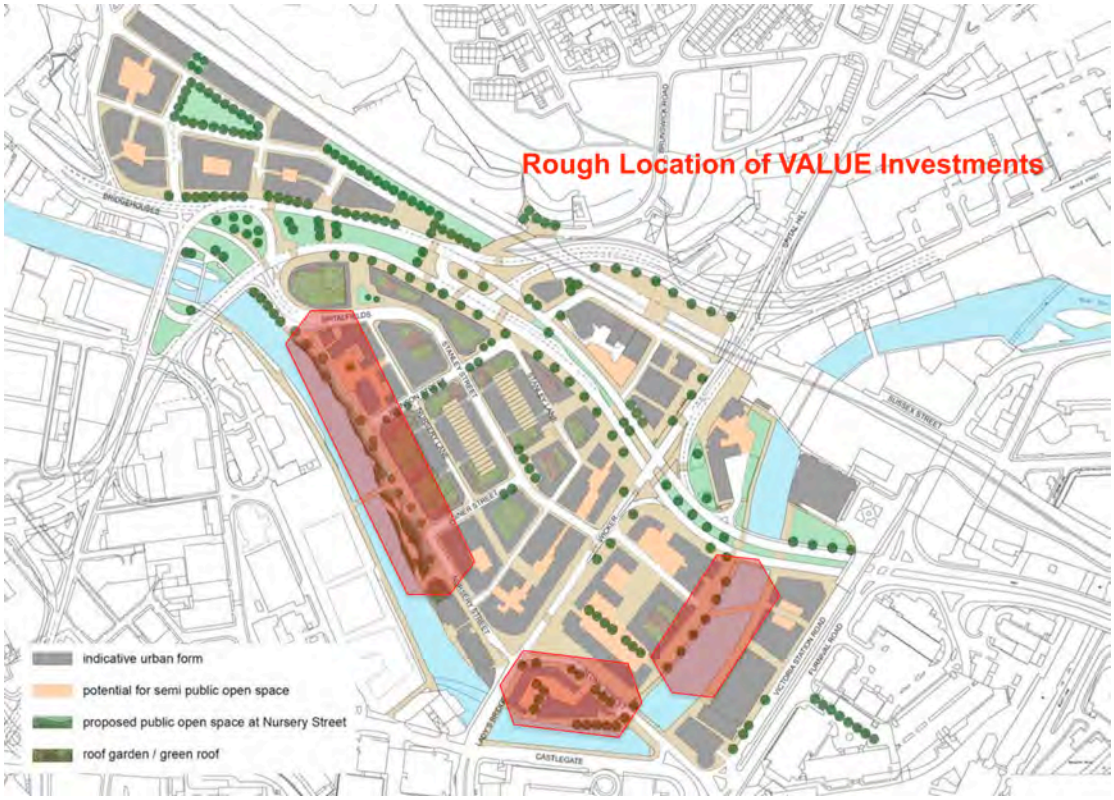
General description of the investment at the site scale (II)

South Yorkshire Forest Partnership (SYFP) and Sheffield City Council (SCC) are planning strategic investments in urban green infrastructure and public open space improvements at The Wicker/Nursery Street. The area is on the northern edge of Sheffield's city centre and adjacent to the River Don. The larger Wicker riverside neighbourhood has been identified as a new office and mixed uses area in the *Sheffield City Centre Masterplan Review (2008)*. Particular actions are related to improved access, greening and landscape quality and include a public urban pocket park adjacent to the banks of the River Don, traffic calming, pavement widening, improved bus facilities, tree planting, on-street parking, seating, riverside walks, a new footbridge, public art and street furniture uplift in general. To date, a feasibility study of the planned investments has been completed and Sheffield City Council/City Centre Team has provided an urban design proposal/masterplan as well as complimentary documents mainly focusing on specific environmental, ecological and hydrological issues related to The Wicker/Nursery Street Riverside.

Furthermore, the investments in Sheffield are strongly related to the issue of flood prevention. In June 2007, the area was subject to extensive flooding with many properties suffering substantial damage. In order to alleviate future flooding problems, the area requires a strategy that will address the current situation in a comprehensive manner. Urban design proposals related to the City's flooding study aim at integrating the complexity of these requirements and propose accordant solutions.

So far, current problems regarding the implementation process mainly refer to delays experienced in one of the starting phases (Phase 3) of the scheme because of the time taken to bring together an appropriate funding package and resolve programming issues.

Figure 5: Urban Design Masterplan for The Wicker/Nursery Street Riverside Area (SCC, 2007/2008)



Main objectives and related indicators at the site scale (II)

The overall aim of the VALUE investment in Sheffield is to create and support a safer, more secure public realm, and to provide sustainable transport routes and river walkways joining the associated residential areas and employment centres. Furthermore, the investment focuses on the establishment of sustainable cooperative working between a range of bodies to identify shared benefits and to deliver durable improvements.

Expected (economic) benefits and beneficiaries – core research issues within VALUE

It is anticipated that deprived communities and businesses in the city centre will benefit from the above-mentioned investments in green infrastructure improvements. Furthermore, the potential benefits of the investments are likely to be extended to visitors of the adjacent central hotel zone. Core research questions are as follows:

- Who exactly will benefit from the planned investments, how and to what extent?

- What are the individual users' or non-users' expectations and preferences regarding the particulars of the planned investment (especially referring to the design characteristics of the riverfront pocket park)?
- Thus, how and where should the future investments be targeted in order to maximise environmental, social and economic benefits?
- What potential economic impact can be associated with the planned green infrastructure investments regarding the current value of residential and commercial premises in The Wicker neighbourhood?

Main objectives of Green Infrastructure strategies and plans at the city/region scale (I)

Sheffield City Council is currently developing an ambitious long-term strategy for the future use and management of the city's green and open spaces called 'Sheffield's Great Outdoors, 2010 – 2030' (Sheffield City Council, 2009b). The focus of the strategy, related topics and particular actions is on four key themes: people (that is, Health & activity, education, diversity, safety), places (that is, safe access, design, heritage, economic values), environment and sustainability (that is, climate, wildlife, connections) and quality management (that is, leadership, partnerships, standards, skills, funding) (Sheffield City Council, 2009a). The overall aim is to manage and to make the very best use of Sheffield's green space assets in order to maximise their benefits to the city both now and in the future (Sheffield City Council, 2009b). The strategy outlines a plan to meet local people's needs and requirements in relation to green and open spaces. It aims to deliver mainly environmental benefits by means of raising the overall quality of green and open spaces throughout the city (Sheffield City Council, 2009b). The draft of the strategy was presented to the City Council's Cabinet meeting in June 2009. Approval was then given for further consultation on its contents, seeking final approval later in 2009 (Sheffield City Council, 2009b).

Referring to the economic values of green and open spaces in Sheffield's city/region, the draft of the strategy highlights the need for cities to be attractive to business, investment and employees. To achieve these targets, cities as the centres of economic growth need to have high quality environments as well as high quality urban design (Sheffield City Council, 2009a, p. 29). In this regard, green spaces are characterised as having potential for productive land use and income generation (for example, in the contexts of agriculture, forestry, estate management, recreation and tourism). Related policy statements within the draft strategy read as follows (Sheffield City Council, 2009a, p. 29):

- PL E1. Promote high quality green and open space as being at the heart of both Sheffield's thriving communities and its business offer.
- PL E2. Encourage business opportunities in the 'active tourism' and 'outdoor recreation' sectors, within Sheffield's green and open spaces.
- PL E3. Encourage business opportunities with respect to productive and sustainable land use – forestry, moorland estates, agriculture, waterways and renewable energy.

Further to the ‘Great Outdoors’ strategy, Sheffield City Council has recently developed a ‘Core Strategy’ (adopted in March 2009) as part of the statutory Local Development Framework.

The Core Strategy provides an overall spatial strategy and – for the period to 2026 – sets out the overall vision for the city, the relationships between the areas within it and how different factors come together in each area (Sheffield City Council, 2009c, p. 1). Besides core topics of urban development such as settlement patterns, housing, employment and economic development, transport and education, this spatial strategy also includes a section on ‘Green Corridors and Countryside’ focusing on the protection and long-term development of green assets in the city/region.

According to this, a network of green corridors, parks, recreational areas and green spaces will be preserved and enhanced within and close to the urban areas, including strategic links along the main river valleys. These will serve a range of purposes including movement of wildlife in the city, leisure and recreation, and walking and cycling. The City’s green infrastructure network is also expected to connect with the surrounding countryside. Most of the countryside will remain protected as Green Belt to support urban and rural objectives. Furthermore, the environmental features of the spatial strategy are closely linked to objectives for health and well-being, sustainable transport, sustainable use of natural resources, prizing the green environment and a city with character, especially in terms of urban heritage and design (Sheffield City Council, 2009c, pp. 27-28, pp. 127-132).

Consequently, they aim at providing for opportunities, well-being, and quality-of-life for all through protecting and enhancing the quantity and quality of open space and its connection to riversides in the city centre (Sheffield City Council, 2009c, pp. 87-92).

Last but not least, Sheffield’s green infrastructure is part of a global environment and, thus, responses to climate change, conscious utilisation of natural resources and sustainable design of developments, the use of renewable energy and carbon reduction, the protection and improvement of air quality, and flood risk management are further key and strategic issues at the city/region scale (Sheffield City Council, 2009c, pp. 113-121).

3.2 Manchester – ‘Oxford Road Corridor’

(Simone Allin, John Henneberry and Pete Stringer)

General description of the investment at the site scale (II)

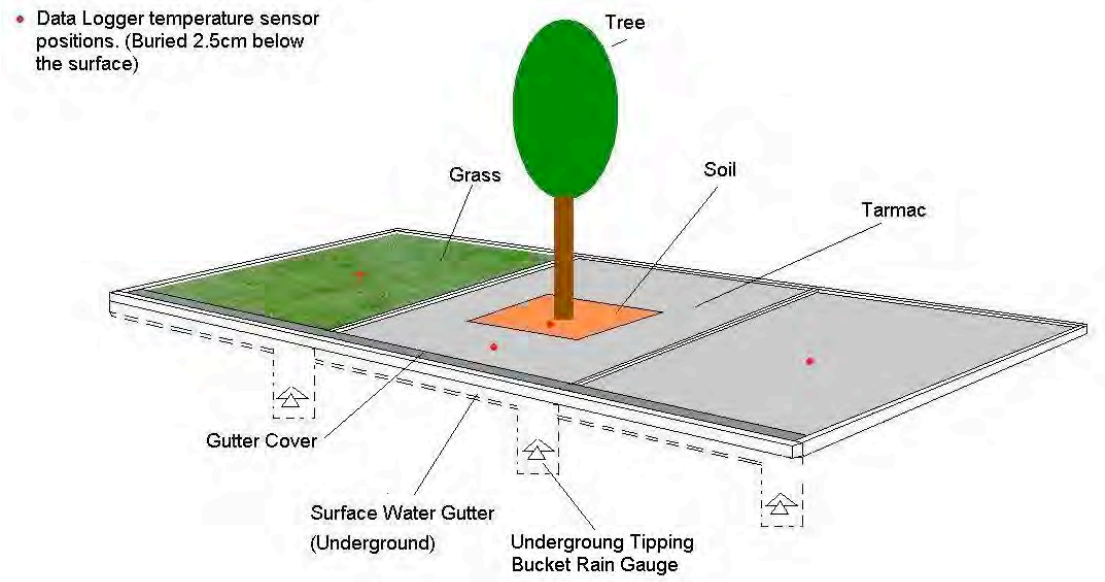
Community Forest North West (CFNW)/Red Rose Forest and Manchester City Council (MCC) are targeting green infrastructure investments along the Oxford Road Corridor in Manchester, which is one of the major transport routes into the city centre from the South. In addition, the Oxford Road Corridor provides direct access to the campuses of the University of Manchester and Manchester Metropolitan University. Particular actions are related to the planting of trees on pavements and open spaces. The planned investments are closely associated with the strategic dissemination of environmental quality information through signage in order to monitor climatic variables (that is, ground surface temperature, rainwater runoff, and capture of PM10 particulates). So far, Experimental Monitoring Plots (so-called ‘i-trees’) are targeted on six strategic locations in the Oxford Road Corridor. The plots comprise different

surface types such as trees, grass and tarmac. The supervision of the Experimental Monitoring Plots (mainly referring to tasks such as data collection and analyses) will be carried out by a PhD student from the University of Manchester and pupils from the Manchester Academy.

Also proposed is the installation of Green Roofs on buildings adjacent to the Oxford Road Corridor. The green roofs will be monitored and evaluated to determine their impact on a range of climate change variables (similar to the i-trees monitoring plots) by PhD students from the University of Manchester and the Manchester Metropolitan University. There will also be an analysis of the economic benefits of the investments (by researchers from the University of Sheffield), for example, with regard to potential energy savings from natural cooling and reductions in water discharge costs for Oxford Road Corridor businesses and residents.

So far, current problems regarding the implementation process mainly refer to (match) funding. However, CFNW have secured match funding for the i-trees experimental plots and the green roofs in the Oxford Road Corridor. In contrast to this, CFNW is still awaiting (status September 2009) confirmation of match funding for further street tree planting in the Oxford Road Corridor.

Figure 6: Experimental plots in Oxford Road Corridor (with labels and probes)



Main objectives and related indicators at the site scale (II)

The overall aim of the VALUE investment in the Manchester Oxford Road Corridor is to highlight the need for strategic green infrastructure investments on major road corridors. A complimentary goal is the determination of the impact of different urban morphology land-use surface types and green roofs on urban climatic variables. Consequently, the aim is to demonstrate how green infrastructure investments can help 'climate proof' cities and how they can support energy and financial savings through a reduced need for spending on air conditioning equipment, water discharge

systems and so on. Furthermore, it is hoped that the investment will encourage a greater 'walk to work' ethic and will ameliorate the loss of open space to urban development through the planting of trees on strategic public sites in a very dense urban built environment. Last but not least, the investment will be used where possible as a means for community engagement in deprived areas, improving social cohesion (long-term) and enhancing the image and viability of previously depressed housing market areas.

Expected (economic) benefits and beneficiaries – core research issues within VALUE

The information gathered by the above-mentioned research approaches will be used

- to help quantify what needs to be done from a green infrastructure perspective to address the projected urban heat island effect and to reduce the probability of localised pluvial flooding. These benefits will obviously have consequences on economic savings which are difficult to measure directly but could be sourced by looking at the costs of flood damage elsewhere in the UK;
- to identify the economic benefits of green roofs from a cooling perspective – that is, how green roofs provide savings through reducing the need for air conditioning and how they can make savings by holding grey water which otherwise would have to be discharged into main drainage systems thereby incurring a cost from the local water utility provider (in the Northwest, United Utilities); and
- to elicit the economic benefit of prolonging or extending the life of the existing roof's waterproof membrane by protecting it from climatic extremes.

In conclusion, expected economic benefits mainly focus on the potentials of natural cooling and reducing surface water runoff, and the provision of natural signposting. Beneficiaries of the investment include students and workers resident in the area and all pedestrians and passengers travelling along the Oxford Road Corridor. Core research questions refer to the users' and non-users' (for example, future students and employees of the University of Manchester, local enterprises/businesses, pedestrians and passengers) expectations and preferences regarding the particulars of the planned investment. How do these groups of people and individuals view the quality of their living and working environment in general and the importance of green infrastructure in the Oxford Road Corridor in particular? What is the economic benefit of the green infrastructure investments in Manchester? Can the investments (based on a series of alternative scenarios), for example, provide real cost savings in terms of building cooling costs during the summer, eradicating/reducing levels of disruption caused by pluvial flooding, reducing surface water discharge costs and improving work force efficiency by reducing sickness days resulting from respiratory related illness and stress? And, finally, how can climate proofing make urban areas more attractive to investment and/or provide significant savings to businesses?

Main objectives of Green Infrastructure strategies and plans at the city/region scale (I)

Based on the Manchester Community Strategy's aims for the period 2006 – 2015, one objective is to make Manchester the greenest city in Britain ('Green City' programme/objective, Manchester City Council, 2009). To achieve that aim, the current emphasis of green policies at the city/region scale is on themes such as energy

use and CO_2 emissions, air quality, waste, and sustainable development in general. Consequently, Manchester's interpretation of the overall UK sustainable development strategy focuses on a range of environmental strategies at the city level, which, in addition, are embedded in cross-boundary approaches within the wider city/region. Over the next few years, Manchester aims to continue the improvement of its local and global environmental performance. Furthermore, the city's strategy is to concentrate on the contribution of the achievements in the environmental sector to sustainable economic growth in the wider city-region. This economic success in Manchester is mainly defined by a larger population "who are wealthier, living longer, happier and healthier lives in diverse, stable and cohesive communities." (Manchester Green City Team, 2009)

In addition, a series of site/area specific green infrastructure plans and strategies exists for Greater Manchester (the city/region) and for the North West region as a whole. The green infrastructure plans for Greater Manchester, for example, comprise:

- Green Space Strategy for Central Manchester (Draft),
- Wigan Green Heart,
- Croal-Irwell Regional Park,
- Irwell City Park,
- Manchester and Salford Tree Audits,
- Greater Manchester Green Roof Programme Feasibility Study,
- Trafford Forest Plan,
- Heywood Green Infrastructure Plan,
- Christie's Hospital Green Infrastructure Plan, and – last but not least –
- the 'i-trees' Feasibility Study for the Oxford Road Corridor Manchester.

The emphasis of these – rather partial – green infrastructure plans in the Manchester city-region is mainly on the improvement of urban green infrastructure networks or systems and particular green spaces and parks in urban areas. The related targets will be achieved by, for example, the planting of trees and/or the substantial enhancement of urban forests. Additional topics relate to climate change issues such as its mitigation by means of the installation of green roofs or alternative land use surfaces in dense urban environments (see, for example, the 'i-tree' plots in the Oxford Road Corridor).

Further to this, a number of green infrastructure strategies, reports and action plans exist focusing on the greater North West region. Their current emphasis is mainly on general and particular climate change related issues. These, for example, cover the role of green infrastructure regarding mitigation and adaption to climate change, and the synergies of green infrastructure and hydrology in a changing climate. In addition, they concentrate on the role of green infrastructure and its climate change mitigation and adaption functions relating to the short-term sustainable economic development in the region. In this regard, green infrastructure assets are, for example, judged as being critical to enabling investment in the North West region. Further research on this issue is being carried out by investigating investment pinch points across the region. The term 'pinch point' has been interpreted as a place where significant

investment is expected to occur over the next three to five years, yet where there are issues (the pinch) that green infrastructure can help to solve. Consequently, each pinch constitutes a risk to the success of a project or investment.

Furthermore, overall guidance and planning documents relate to the preparation and development of statutory planning strategies at the regional scale (Regional Spatial Strategy) and green infrastructure plans as parts of Local Development Frameworks at the local scale. Regional spatial and economic strategies currently focus on the further development of the economic benefit of the region's natural environment (as part of the overall 'quality of life' in the region) through the better alignment of environmental activities and economic gain, the promotion and delivery of multi-purpose networks of green space (key words are accessibility and connectivity), and the integration of green infrastructure within existing and new development, particularly within major development and regeneration schemes. Within this context, a pressing need for the collaboration of organisations to develop planning and delivery of green infrastructure has been identified in the North West region (key words are funding impediments, organisational cultures, policy frameworks, strategic opportunities and delivery mechanisms).

3.3 Bruges – 'Green Cycle Belt'

(Nel Ghyselinck and Frank Stubbe)

General description of the investment at the site scale (II)

The ambition of the project is to create a cycling belt around Bruges that connects the green areas surrounding the city. The aim is to establish linkages between the city and its surrounding villages in order to improve the overall quality of life in the city/region. Thus, the green belt is meant to become an important recreational and functional cycling axis around Bruges. Currently the belt is not complete: several links are missing and need to be created. The particular actions of the project aim to realise these missing green links.

The VALUE case study is a part of the master plan of the land development project 'Green Cycle Belt Bruges'. The VALUE case study is located in Assebroek and focuses on the missing link between two former train trails, currently in use by cyclists. The aim is to create a path between the two old railway tracks. One went between Bruges and Oedelem, the other one between Bruges and Sijsele. At the same time, the surrounding area is to be improved by other green investments. For example, these include landscape recovery along the cycling path, the creation of wetlands to help biodiversity and the construction of a 'health footpath' that connects the hospital AZ Sint-Lucas Bruges with the green belt.

So far, the planning phase is complete. Obtaining the approval of the Flemish Government is the next important step. Further stages of the project development process (for example, buying the land, drawing the technical plans, implementing the investments on site) depend on this approval.

Figure 7: Assebroek

Main objectives and related indicators at the site scale (II)

Specific objectives of the link in Assebroek are to

- convince the 1200 employers, 85 doctors and daily visitors to come to the AZ Sint-Lucas hospital by bike and reduce car use;
- enable the patients to go for a walk in the nearby natural area; and
- make a pleasant recreational area for nearby villages.

Another important objective of the VALUE case study is to develop an economic evaluation model to calculate the economic return of the green investments in Assebroek. This will show the importance of providing the missing link in Assebroek and of improving the surrounding area.

Expected (economic) benefits and beneficiaries – core research issues within VALUE

The biggest expected economic benefit focuses on the reduced use of cars. By creating this missing link, it is hoped that the number of commuters using their bikes to go to work (for example, at AZ Sint-Lucas hospital and people who live in Assebroek and work in Bruges) will increase. Other objectives of the planned investments in green infrastructure in the area surrounding the missing link are:

- to increase recreational cycling because of the improved landscape quality;

- to attract new people for leisure activities;
- to help increase biodiversity by creating wetlands and offer birds and plants more chances;
- to get people outside into the open air and to increase their levels of physical activity, which has a positive influence on the physical and mental heath; and, in total,
- to create a higher overall quality of life.

Main objectives of Green Infrastructure strategies and plans at the city/region scale (I)

In the neighbourhood of Bruges, VLM together with a number of partners have initiated a project aiming at the improvement of the QoL in the city/region. One major sub-goal is to protect green infrastructure and to build it into the urban space. In order to achieve this, VLM has made a master plan 'Green Cycling Belt'. It will be developed with the instrument of land development in collaboration with local and regional authorities, citizen groups, neighbourhood committees, leisure unions and several private companies.

The ambition of this green belt project is to make the city centre and its surroundings more attractive as a place to live, to work, to go out for a ride or a walk, and, hence, more interesting for investors. Such a green belt will bring a lot of benefits for citizens, firms, farmers and tourists in and around Bruges. Each citizen can use this green belt for bicycle commuting, for recreation, to walk, to go to the centre, or to go to the beach on bicycle through the polders.

The main objectives of the project are:

- to develop a green belt around the city;
- to link the disconnected green islands; and
- to connect the green built-up area to the centre of the city.

These objectives are realised by creating the missing links in the network of cycling trails around Bruges and investing in green infrastructure. The investments aim at creating a framework that will convince the citizens of Bruges to reduce car use. The ambition is to promote bicycle commuter traffic that is healthy for employees and for the surroundings.

Another important objective is to develop a framework to evaluate the cost-benefits of green investments. This can be achieved by developing a methodology for measuring the economic impact of the improvement of the environment. The cost-benefit model will convince the investors and key-decision makers (politicians) to make these green investments for the future with hard evidence, facts and figures. The CBA will show that investing in a green belt around a city can contribute to competitive benefits. This will have a great impact on the attraction of the city (for private investors, citizens of Bruges and tourists). Small green investments can create a healthy added-value for the citizens and the ambition is to show this by means of concrete figures.

The purpose of these green investments is to create pecuniary advantages for firms and employers. A part of these advantages will be reinvested in green investments in the green belt. This represents a very innovative approach in the region of Flanders. It is a new policy to develop alternatives to travelling on congested roads. It will attract

people for leisure activities, more sustainable traffic and new investors. The ambition is to attract visitors to the wider environment of the city region.

3.4 Verviers – 'Vesdre River Greenway'

(Pierre Guilliams and Jean-Marie Halleux)

General description of the investment at the site scale (II)

Verviers' VALUE investment focuses on linking deprived economic areas located in the eastern part of the city with the city centre by improving the landscape quality of the River Vesdre's banks.

The project includes the construction of a continuous and secure green path (foot/cycle path) along the River Vesdre. This project incorporates the needs and wishes of local stakeholders through collaborative planning approaches (for example, community engagement campaign, establishment of strategic partnerships). Particular actions are related to green pedestrian/cycle infrastructure and greening works (bank-side safety works, footpath and recreational infrastructure, landscape and planning along the route). The route is subdivided into three sections along the left bank of the River Vesdre. Each section receives different kinds of works to increase the accessibility and security of the banks and also to integrate the river into the urban landscape (for example, observation pontoons, ramps).

So far, funding problems have prevented the realisation of the three sections, which reduces the social, environmental and economic impact of the project. The budget constraints forced SPI+ and the city of Verviers to prioritise investment in those parts of the initial project that will make the most efficient use of available resources. Recently, this unsatisfactory situation has led to a request to the Walloon Region for extra funding. This potential funding may have a significant effect on the impact of the VALUE investment and, as a consequence, the determination of the works will be made only after the response of the Minister is known.

Main objectives and related indicators at the site scale (II)

In addition of the general enhancement of the landscape quality of the River Vesdre, the investment has several aims. On the one hand, it will increase the accessibility of Verviers' blue/green network, more particularly the accessibility of the River Vesdre, which is historically hidden behind the backyards or blind walls of houses. It will also increase the accessibility of the Marie Henriette Park. On the other hand, the investment will link the residential city centre with commercial/industrial areas, which are located in the eastern part of the city.

Figure 8: Location of the VALUE investment in Verviers

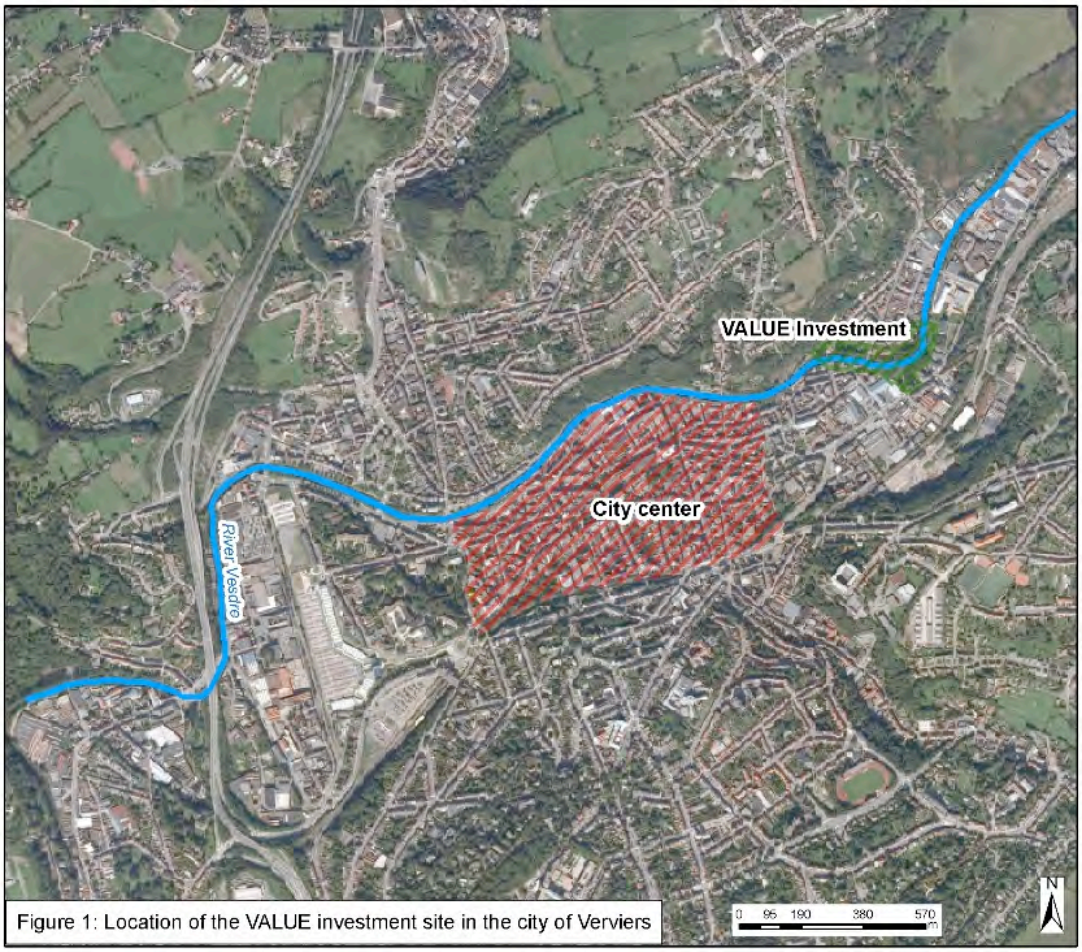


Figure 1: Location of the VALUE investment site in the city of Verviers

Expected (economic) benefits and beneficiaries – core research issues within VALUE

The local communities will directly benefit from an attractive and popular 'greenway'. The project includes three sections and has several ambitious economic objectives. On the one hand, by connecting to the eastern economic quarter, it should encourage sustainable transport (walking, bicycling) between Verviers' city centre and outlying economic poles. At the same time, it should improve the reputation of the training centres and encourage building renovations or even brown field regeneration. On the other hand, for the local residents, in addition to the green amenities, the reconditioning of the Marie Henriette Park should also help to prevent damage and anti-social behaviour that have occurred more and more frequently in the park.

Through SPTs including local communities' surveys (residents, employees, employers) based on computer modified images, this case study will make it possible to evaluate the economic impact of an ambitious greenway project along the River Vesdre.

Main objectives of Green Infrastructure strategies and plans at the city/region scale (I)

At a smaller scale, the VALUE investment has the aim to be part of the development scheme of the River Vesdre, established by the STU (Technical Service of Environment, Urbanism and Land Planning) of the city and reviewing the development of the river's banks (see below, Figure 9). From a historic perspective, the river was polluted and the local population saw it as a negative element of the environment. However today, the development scheme tries to integrate the River Vesdre into the urban landscape, so that local communities can make use of it. The development of this 'greenway' also aims at encouraging alternative transportation systems, and at linking economic poles in deprived eastern areas with the city centre.

Figure 9: Official Development Scheme of the River Vesdre

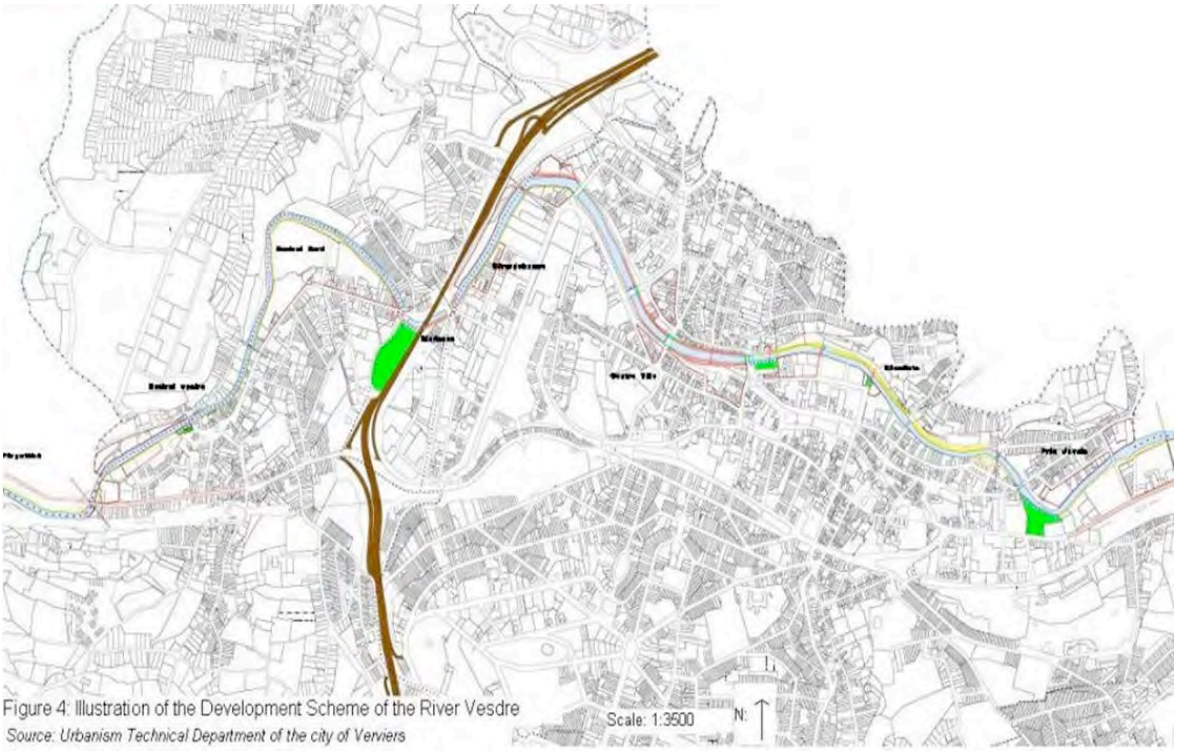


Figure 4: Illustration of the Development Scheme of the River Vesdre
Source: Urbanism Technical Department of the city of Verviers

3.5 Stuttgart – ('Online Route Planner' &) 'Greenway Enhancements'

(Karsten Rusche)

General description of the investment at the site scale (II)

'Verband Region Stuttgart' (VRS, including a number of counties and municipalities) together with its sub-partner 'Verkehrs- und Tarifverbund Stuttgart GmbH' (VVS) are the two key players in relation to the planned green infrastructure investments in the Stuttgart city/region. These investments have two elements.

- Firstly, a web-based bicycle route planner and an accordant improvement strategy were implemented in order to enhance the use of green infrastructure within a densely populated area. Particular actions of the investments refer to the implementation of 'routes' in the online route planner. This includes, for

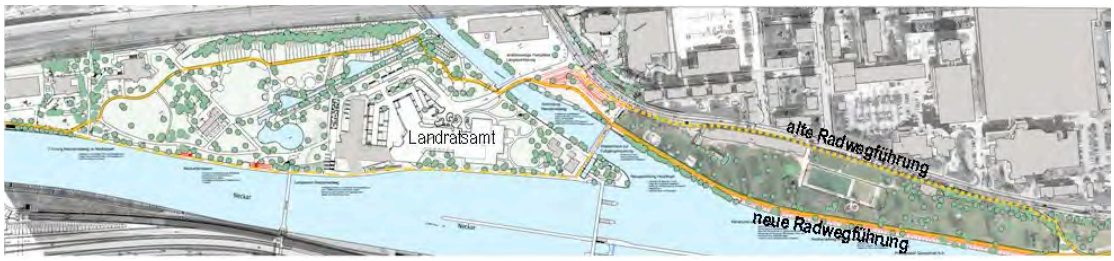
example, stopover points and a tool to improve the connection with the public transport system (that is, the possibility to transport bicycles on public buses). Furthermore, the development of links to other web-based services – such as a route planner for local trains and information on leisure/tourist activities within the region – is planned.

- Secondly, the emphasis of the investments in the Stuttgart city/region is on the improvement of essential linkages between green spaces of employment and residential areas. Currently, these so-called 'development axes' along the Neckar, the Rems and the Fils valleys represent essential links within the Stuttgart city/region (especially for commuters). Particular actions of the investments are related to improvements of the Neckar valley bike track and adjacent green spaces within Esslingen and the City of Nürtingen. For example, it is planned to widen existing green spaces and to install so-called 'stopping off areas' for picnics. In Nürtingen, the installation of a short bike track is planned. The main partners of this second part of the investments are the planning departments of the municipalities of Esslingen and Nürtingen.

So far, the development of the online route planner is on schedule, and the specific tools are under construction. For example, the sub-partner VVS is collecting data about existing and planned bicycle trails (to be completed by Spring/Summer 2010). In the meanwhile, information on progress will be published online and by stages. This refers, for example, to one milestone of the project, which is the publication of the routing for the County of Esslingen that is due to be completed by the end of 2009.

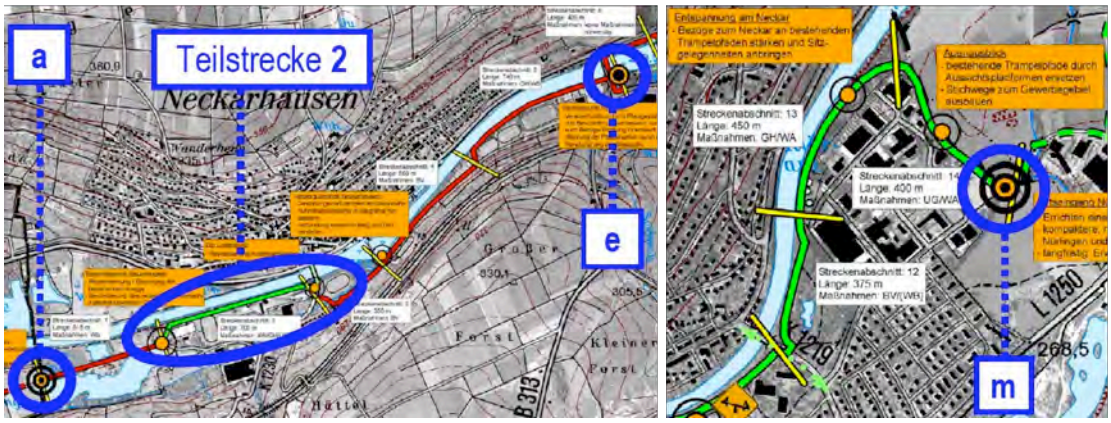
Regarding the current status of the bicycle trail in Esslingen, progress is on schedule, and planning almost completed. Tender specifications are about to be elaborated, and tendering process is finished. The 'ground-breaking ceremony' was held in October 2009.

Figure 10: Esslingen – Existing ('alte') and new ('neue') bike routes



The Nürtingen bicycle trail is on schedule as well. However, it is still in the planning stage and tendering is supposed to be finished by Spring 2010. This will be followed by the actual construction period.

Figure 11: Nürtingen – Bicycle trail concept



Main objectives and related indicators at the site scale (II)

The green infrastructure investments in the Stuttgart city/region generally aim at increasing the number of biking commuters. Thus, they focus on investments along the development axes to maximise benefits and efficiency. Both parts of the investments are targeted to reduce motorised traffic and to strengthen regional recreation and tourism. Overall, the investments are designed to contribute to a greater awareness of sustainable transport options at the regional level. Consequently, the key beneficiaries include bikers and commuters within the Stuttgart city/region, the population and visitors of the city/region, and the other VALUE project partners.

Expected (economic) benefits and beneficiaries – core research issues within VALUE

Green infrastructure in densely populated regions is generally underestimated with regard to its role as a significant location factor for high-skilled knowledge workers. This is oftentimes due to a lack of information about its value. Thus, economically strong regions still lose green spaces as a consequence of further housing or commercial/industrial developments. The VALUE investments in the Stuttgart city/region are regarded as a key element in making and keeping the metropolitan region more competitive and attractive for working and investment. Expected direct use values are related to topics such as recreation and leisure, tourism, health and well-being. Further to this, the investments are targeted at encouraging economic growth, future investments and supporting labour productivity. Last but not least, they will contribute to the city/region's quality of place and its overall reputation as a 'green area'.

Main objectives of Green Infrastructure strategies and plans at the city/region scale (I)

The main objective of the green infrastructure investments at the city/region scale is to enhance the overall economic attractiveness of the Stuttgart city/region. As successful agglomerations are in need of a broad basis of human capital the availability of a set of regional amenities is seen as an important location factor. All investments support the goal to make the region more 'green' in terms of easier access to green spaces and other green infrastructure. This raises the public awareness

of the unique natural setting of the Stuttgart region green valleys. Summarising, Stuttgart's increased attractiveness as a place to live will attract a high skilled labour force and their families. Consequently, the enhancement of the overall green infrastructure system combines easier access (for technically open-minded people) via the online route planner with a more attractive and complete green infrastructure to improve the overall connectivity and, thus, the competitiveness of the Stuttgart city/region as a whole.

3.6 Amersfoort – 'Euterpeplein' and 'Randerbroek'

(Derk Jan Stobbelaar)

Euterpeplein

General description of the investment at the site scale (II)

Euterpeplein is a triangular area in a rather old neighbourhood of the city of Amersfoort. It was previously used as an open-air car parking area, surrounded by trees. The adjacent area contains shops and houses. It is a busy area, with a lot of traffic movements. The municipality of Amersfoort classified the current spatial quality as too low. It developed a plan to improve the spatial quality by investing in green infrastructure.

The investment was done in a participatory trajectory, following the Green Credit Tool method. This is a method that the city of Amersfoort is testing on small scale restructuring sites. The University of Applied Sciences Van Hall Larenstein (part of the Wageningen University and Research Centre) is supervising the investments and the application of the Tool, mainly by literature study, case study and interviews.

Figure 12: Euterpeplein: Green structure after (left picture) and before (right picture) restructuring

Main objectives and related indicators at the site scale (II)

The overall aim of the investment is to increase the spatial quality by interactive planning. Amersfoort Local Municipality had a vision to renew the quality of the green spaces within the urban areas, to enhance the outcomes as stated above. Accordingly, the Amersfoort Local Municipality developed the Green Credit Tool, as described in the document 'Groene Saldo Regeling' (Amersfoort Municipality, 2007).

It is based on the green compensation method (Alkmaar, 2005) and became the point of departure of all spatial planning and developments within the neighbourhoods. The Green Credit Tool was introduced as the method to realise this green vision and to maintain the liveability of cities where spatial developments took place.

A two-fold goal can be reached by means of the Green Credit Tool. Firstly, an analysis is made of the existing green infrastructure and how it is perceived by users and other stakeholders. This enables the municipality to understand the value of green areas as viewed by the local community and users, and to understand how it could be improved in future planning. Secondly, through this method there is active communication with the stakeholders regarding green space planning and stakeholders are therefore more familiar with the redevelopment plans and future planning. This two-fold goal was also used to guide the research aims and objectives.

The core aim of the Green Credit Tool is to enhance and maintain the green totality and quality of the area before and after development takes place. The focus is on public green spaces. In these terms, quantity is also regarded as a quality. Decrease in quantity should thus be compensated. Four aspects of the quality and quantity of green are measured: user quality, perception, cultural quality and managerial quality. Loss of quality or quantity of green should be compensated in the same realm. The Green Credit Tool is furthermore used to get a better insight into decision-making in green spatial planning processes. It is a useful way to get an overview of the different interests and stakeholders and thus also a useful communication tool.

Expected (economic) benefits and beneficiaries – core research issues within VALUE

Potential (economic) benefits focus on the above mentioned quality aspects: user quality, perception, cultural quality and managerial quality. These all contribute to the economy of the city because of its attractiveness for companies (see below) and inhabitants. The improvements are directed to inhabitants (of the neighbourhood) and of visitors of the area, mainly because of the available shops. Specific improvements relate to the accessibility of the square. The perceptions should be that it is greener, has a more understandable lay-out and is better maintained.

Randerbroek

General description of the investment at the site scale (II)

Park Randerbroek is a small green area with an English landscape theme. It is a very important green space in Amersfoort. It is surrounded by Bisschopsweg (north side), Heiligenbergerweg (east side), Rubenslaan and Ringweg Dorrestijn (west side) and the provincial road A28 (south side) (see Figure 13, below). It can be characterised by different plants and trees, as well as by high use volumes. The current management of the park is not optimal, especially in terms of accessibility and recreational value. The City of Amersfoort has investigated the possibility of replacing the hospital situated within this area, as this would create more green space potential (Lagenberg, 2009, p. 5).

Figure 13: Randerbroek: Vision of Park Randerbroek (Amersfoort, 2009)

Main objectives and related indicators at the site scale (II)

The municipality identified certain objectives in renewing Park Randerbroek, including the use, management and renewal itself. They proposed to relocate the hospital (situated in Gasthuislaan) and the tennis courts (in Metgensbleek). They also needed to incorporate the current renewal plans of the Sportfondsenbad (swimming pool) and additional sport facilities.

In 2007, the following goals were decided in terms of Park Randerbroek:

- Renewal of original characteristics of the park;
- Adjustment of the tree system according to original park layout of Van Lunteren;
- Renewal and upgrading of walkways throughout the park;
- Making the water system more visible;
- Removal of elements that do not fit into the original park plan;
- New access;
- Creating social safety; and
- Creating a management plan.

The City of Amersfoort had a vision of renewing the quality of the green spaces within the urban area, of enhancing the value of these spaces and determining the

economic value of green spaces. The concept of Value Added Planning was introduced to address these objectives. The focus is on the added benefits of green qualities within an area. They are identified by means of perceptions, social views and cultures, and economic measures. Thus, the concept is used to understand the added value of green investment, in terms of its social, economic, practical and indirect dimensions. Value Added Planning focuses on spatial planning in such a manner that tangible value adding takes place. Thus, how can the perceived values (whether social, economic or natural values) be translated into tangible increases in economic value?

This was tested at three levels:

- Methodology to capture/understand green values (Theory and Methods);
- Level of stakeholder involvement and participation (Case studies and Interviews); and
- Impact on green planning (Results).

The City of Amersfoort puts great amounts of funding into green space development and, thus, needs to be able to determine the benefit of related actions. Value Added Planning is a way to determine the impact and benefit of green planning, even before the start of a development project.

Expected (economic) benefits and beneficiaries – core research issues within VALUE

Being in close proximity to open spaces does have a positive impact on property values. However, this is largely dependent on the type of open space and distance from the space (Rics, 2007, p. 4). Developable open space, such as farmland and forested land, can provide amenity effects, albeit at lower levels than permanently protected open space. The economic status of a neighbourhood is a factor in the analysis of the fiscal impacts of open space protection. Therefore opportunities to extract higher profits are likely to occur if open space is included within an environment that is attractive to purchasers (Rics, 2007, p. 7).

Cities that integrate the environment in urban planning and management benefit in many ways. Such cities prove more liveable, more equitable, and more inviting to investors. Their citizens are healthier, and fewer working days are lost to environment-related illnesses. Urban space and infrastructure respond better to public needs (Liveable Cities, 2007, p. 66). This is why urban green space makes economic sense, as illustrated, for example, by the Evergreen Project. Within the scope of this project, case studies have demonstrated how the protection of green spaces can result in signification savings and enhanced revenues, and how they can be a driving force behind community revitalisation (Evergreen, 2009, p. 1).

Main objectives of Green Infrastructure strategies and plans at the city/region scale (I)

The municipality of Amersfoort is, like many Dutch municipalities, confronted with a general problem concerning the planning of green infrastructure. Decision-making takes place within a broad framework of actors and stakeholders and several targets have to be reached and objectives to be met. It is not always possible for

municipalities to take their green qualities into account and to integrate them into spatial planning. In order to be able to stimulate the economy of Amersfoort, it is important that the existing positive development processes in the city continue in the future. This means that a high pressure on building sites is to be expected, while at the same time quality of life and sustainable growth have to be ensured (Commissie Van Ek, 2009; p. 9).

At the national level, the Netherlands has made extensive policy concerning nature and green space. This has been incorporated in ministerial policy documents such as those on the National Ecological Network. An attempt is now made to interconnect green spaces and ecological zones. Consequently, green corridors could come into existence admitting nature to take its natural forms. The Dutch tendency to fragment natural areas into smaller and oftentimes isolated patches is countered through this policy. This is a national policy, which affects lower levels of policy making, such as the provincial and municipal scale. Thus, through these kinds of policies nature conservation, creation and connectivity are stimulated at a municipal level. However, at the local level the municipality is confronted with many other demands, requests and objectives when it comes to spatial planning. Besides natural values, spatial planning has to take into account housing demands, infrastructure facilities, business development and so on. Within this setting, green space has to compete with other spatial uses.

Besides this, in the economic vision of the city of Amersfoort until 2030 (Commissie van Ek, 2009, p. 12) it is stated that for the future economic growth of the city of Amersfoort it will be of major importance to avoid any contradictions between economy and ecology, well-being and welfare, population growth and environmental pressure. Instead, economic, social and ecological capital should become more interconnected. The biggest challenge is to build and strengthen a more sustainable society. The city of Amersfoort aims to take a leading role in the Netherlands in this respect (Commissie van Ek, 2009, p. 12). In this context, it is important to understand the possible values (whether economic, social or environmental) of green investment in the city-centre, and to seek means by which the multiple stakeholders in planning can come up with solutions for green space which are beneficial to all.

3.7 Conclusions

(Simone Allin and John Henneberry)

The various green investments in the VALUE partners' cities exhibit a range of different characteristics. They vary in scale and nature and in their specific objectives. They play contrasting roles in wider, city/region green strategies, which also differ greatly. In order to consider the most appropriate ways to value these investments, a categorization that allows a comparison of their qualities is needed. The starting point is the broad definition of green infrastructure provided by Natural England (2008).

"Green Infrastructure is the region's life support system – the network of natural environmental components and green and blue spaces that lies within and between […] cities, towns and villages which provides multiple social, economic and environmental benefits." (Natural England, 2008). The selected VALUE green infrastructure projects and investments can be matched against this broad definition. They represent more or less important elements of their cities' and regions' green

infrastructure systems and networks. They are expected to deliver particular mixes of social, economic and environmental benefits (the general and economic benefits and values of urban green infrastructure are discussed in more detail in Section 4.1).

We can then move to a more precise classification of urban green infrastructure and its characteristics, using the 'Grey-Green Continuum' identified by Davies et al. (2006). The position of the VALUE investments in this continuum is shown in Figure 14.

Figure 14: The six VALUE investments within the Grey-Green Continuum

It is evident that the VALUE green infrastructure investments fall within a certain range of types of urban green infrastructure. These are more (capital) intensive and more formal than greener or greyer types of investment. They fall within the categories of urban parks and gardens (Amersfoort), cycle routes (Bruges and Stuttgart), channelled rivers and waterways (Verviers and Sheffield) and road verges in combination with street trees (Manchester). Thus, they represent a reasonably diverse, mid-continuum portfolio, covering both fairly 'green' urban environments such as parks, gardens and cycle routes as well as rather 'grey' and clearly man-made urban environments such as channelled rivers and road verges – generally linked with overall transportation networks.

The characteristics of the selected green investments, thus defined, will affect the choice of the technique(s) used to value them (at site (II) and city/region (II) levels). Another factor will also have a major effect on the valuations. Since the completion of the final application document of the VALUE project in April 2008, the green infrastructure strategies and investments in the six VALUE partners' cities have been further developed and specified. However, almost all of the actual green infrastructure investments in partners' cities – regardless of their scale – are still in the planning and preparation stage. Thus, the evaluation exercises that will be undertaken in WP 4 will mainly be based on ex-ante appraisal.

4. Development of an Evaluation Framework – Identification of Optimum Evaluation Techniques at the Site Scale and the City/Region Scale

(Simone Allin and John Henneberry)

This chapter develops the methodological approach to the economic valuation of green infrastructure investments within the VALUE project – both at the site scale and the city/region scale. The design of the evaluation framework is based on the main outcomes of the review of existing evaluation techniques for economic appraisal of green infrastructure investments (see Chapter 2) and the characteristics and expected economic benefits of each of the VALUE investments as described in Chapter 3.

In this regard, the present chapter identifies and matches optimum evaluation techniques to each of the VALUE partners' cities and regions and their particular green infrastructure investments. Referring to the evaluation of investments at the site scale, a complementary set of techniques embedded in the overall context of CBA is applied. At the city/region scale, one common and consistent approach is used for evaluating all green infrastructure strategies. This approach will enable the valuation results to be compared to each other, the transnational dimension of the VALUE project.

The first section presents an overview of the general and particular benefits of urban green infrastructure – mainly referring to the work of CABE (2005), Greenspace Scotland (2008), Natural England (2008) and Timmermans et al. (2009).

4.1 General and Particular Economic Benefits of Urban Green Infrastructure

(Simone Allin and John Henneberry)

Natural England (2008) define green infrastructure as "the region's life support system – the network of natural environmental components and green and blue spaces that lies within and between […] cities, towns and villages which provides multiple social, economic and environmental benefits." Thus, a subsequent (and broad) concept of green infrastructure can encompass (Natural England, 2008, p. 6):

- Managed and natural green areas in rural and urban environments, including woodlands (and wetlands), gardens, formal parks, green corridors (for example, bridleways, railway and road verges and cycle paths, street trees, waterways, and open countryside);
- strategic connections of open green spaces through planning and policy;
- the understanding that an area's green infrastructure should provide many benefits for people living in and visiting an area; and
- the importance of ecosystem services within green infrastructure, to provide the required functions and quality.

Against this background, urban green infrastructure may display a variety of general environmental, social and economic benefits. The City of Amersfoort together with the University of Applied Sciences Van Hall Larenstein (associated with the University of Wageningen, the Netherlands) have determined the qualities or values

of (urban) green infrastructure in one comprehensive matrix (Timmermans et al., 2009). They refer to a total of five categories, namely user quality, perceptive quality, natural quality, cultural quality and managerial quality as values broadly connected with urban green infrastructure. Further to this, they identify specific differences related to the contexts of these values depending on examinations at the city, the neighbourhood, the quarter and the block scale (Timmermans et al., 2009).

Another major literature review of recent and current research related to the links between green space and a range of QoL issues (Greenspace Scotland, 2008) highlights the following main areas where green spaces and green infrastructure unfold their specific benefits within an urban economy:

- health and well-being;
- social and community values;
- economic value/impact;
- environmental value; and
- planning and design.

Referring to the context of health and well-being, recent research findings indicate increasing evidence for positive associations between green space and both physical and mental health (Greenspace Scotland, 2008, p. 28). Examples of these effects of green spaces and infrastructure – initially predominantly *socio*-economic – are as follows. Good quality and a sufficient quantity of accessible open green spaces can contribute to health improvements and health care in relation to physical activity, stress reduction and other restorative effects (Greenspace Scotland, 2008, pp. 14ff.). The provision of new or improved recreational space or greener streets also encourages a greater 'walk to work' ethic amongst the population. Referring to the potential economic benefits or values of green infrastructure, good quality urban green spaces and infrastructure can add value to surrounding property (both commercial and residential). Consequently, it can increase tax yield to maintain public services. In addition, green infrastructure can contribute to the attraction of tourists and visitors, encourage employment and inward investments to an urban area, and – last but not least – help to create or further to develop a favourable image of a particular place (CABE, 2005).

Summarising, the main economic values or qualities of urban green spaces or infrastructure fall into three (broad and partially overlapping) categories (ECOTEC, 2008, pp. 14ff.):

- direct use benefits such as products from the particular piece of land, recreation and leisure benefits (for example, entrance fees for sports facilities), land and biodiversity benefits, tourism, health and well-being benefits, flood alleviation and management benefits, climate change adaptation and mitigation benefits;
- indirect use or spill-over benefits such as economic growth, business activity and investments, land and property values, labour productivity, public safety, tourism, health and well-being benefits, flood alleviation and management benefits, climate change adaptation and mitigation benefits; and

- non-use or symbolic values (generally without any behavioural trail) such as 'quality of place' associated with potentials of job creation and the development and support of local pride and image building.

4.2 Matching of Evaluation Techniques to the Characteristics of the VALUE Investments at the Site Scale

The descriptions of the selected investments in the VALUE partners' cities (presented in Chapter 3) included their objectives and expected economic benefits. They cover most of the direct, indirect and non-use benefits identified by ECOTEC (2008). In this section, for each of the investments in turn, we summarise its particular economic benefits. Then a recommendation is made about the evaluation techniques that might most appropriately be applied to it at the site scale. The recommendations are based on the list of potential economic benefits and on the capacities and strengths of the various evaluation techniques (analysed in Chapter 2).

4.2.1 Sheffield – 'The Wicker/Nursery Street'

(Simone Allin and John Henneberry)

The potential economic benefits of the green infrastructure investments in Sheffield's The Wicker/Nursery Street area may be summarised as follows:

- Socio-economic benefits in terms of community engagement in a deprived community and a higher level of 'quality of (urban) life' (that is, living and working environment) in The Wicker/Nursery Street for various groups of beneficiaries (that is, residents, employees, local businesses, pedestrians, visitors (especially to the adjacent central hotel zone)); and
- Socio-economic benefits in terms of a higher, locality-based attractiveness to further investments and, thus, a generally better 'quality of business environment' in The Wicker/Nursery Street neighbourhood for various groups of beneficiaries (that is, local businesses, employees, students/future graduates, visitors/salesmen).

<u>Suggested optimum evaluation technique(s) at the site scale (II):</u>

The main evaluation technique matching the specific characteristics of the planned green infrastructure investments in Sheffield's The Wicker/Nursery Street area is a SP survey. This will focus on the users' and non-users' expectations and preferences regarding the design alternatives and, thus, the perceptive details of the planned green infrastructure investments in The Wicker/Nursery Street area (that is, pocket park, footbridge, general greening improvements in public space).

Due to the specific requirement to elicit rankings or ratings for individual attributes (or alternatives) of the good in question, CM is suggested as the preferred SPT. Within this context, the application of a 'Choice Experiment' (covering – at least – one future design alternative and the status quo) using advanced 3D visualisations of the on-site situation is regarded as the most promising and practicable approach. The aim of this survey is to elicit people's perceptions of the effect of the anticipated greening projects on the quality and attractiveness of the neighbourhood; and,

consequently, upon people's future willingness-to-pay for commercial or residential premises.

Finally, the practicability of using advanced 3D visualisations to illustrate the alternative scenarios in Sheffield will be compared with the focus on more basic 2D visualisations within the Manchester case study (see following Subsection 4.2.2).

4.2.2 Manchester – 'Oxford Road Corridor'

(Simone Allin and John Henneberry)

The potential economic benefits of the green infrastructure investments in the Manchester, Oxford Road Corridor may be summarised as follows:

- Overall economic savings as a consequence of generally reduced urban heat island effects (especially during summer periods);
- Economic savings due to a reduction in the probability of localised pluvial flooding (by means of a balanced mixture of various land use types aiming at reducing overall surface water runoff);
- Provision of further significant economic savings (for example, to local businesses) from a cooling perspective (for example, in terms of a reduction of the need for air conditioning) and from increased grey water retention by green roofs and surfaces;
- Socio-economic benefits in terms of community engagement and a higher level of 'quality of (urban) life' (that is, living and working environment) in the Oxford Road Corridor for various groups of beneficiaries (that is, passengers, pedestrians, employees, students, visitors);
- Socio-economic benefits in terms of a higher, locality-based attractiveness to further investments and, thus, a generally better 'quality of business environment' in the Oxford Road Corridor for various groups of beneficiaries (that is, local businesses, two universities, employees, students/future graduates); and
- Socio-economic benefits in terms of improved health standards and work force efficiency by reducing sickness days resulting from respiratory related illnesses and stress.

<u>Suggested optimum evaluation technique(s) at the site scale (II):</u>

The main approach to economic valuation of the green infrastructure investments in Manchester's Oxford Road Corridor concentrates on the following two methods. Firstly, a comparative project-based CBA (potentially confirmed by the results of a complementary Benefit Transfer Analysis) will focus on an ex-ante estimation of building and infrastructure costs and benefits with and without the particular green infrastructure investments. Thus, the main research question to be answered is whether and to what extent the planned street trees, alternative land use surfaces and green roofs in the Oxford Road Corridor contribute to potential energy and money savings for local residents and businesses (and the City Council).

Secondly, a SP survey will focus on users' and non-users' expectations and preferences regarding the design alternatives and, thus, the perceptive/visual details of the planned green infrastructure investments in the Oxford Road Corridor. This survey will also cover questions related to the impact of the planned green investments on house and property prices. Because of the specific requirement to elicit rankings or ratings for individual attributes (or alternatives) of the good in question, CM is suggested as the preferred SPT. Within this context, the application of a 'Choice Experiment' (covering – at least – two future design alternatives and the status quo) using existing 2D visualisations of the on-site situation is regarded as the most promising and practicable approach. The aim of this survey is to elicit people's perceptions of the effect of the anticipated greening projects on the quality and attractiveness of the Oxford Road Corridor; and, consequently, upon people's future willingness-to-pay for commercial or residential premises there. The survey will also extend another conducted by PhD students of the University of Manchester. Their focus of research is on the general importance of green infrastructure in the Oxford Road Corridor. Finally, the use and practicability of basic 2D visualisations to illustrate the alternative scenarios in Manchester will be compared with the use of more advanced 3D visualisations within the Sheffield case study.

This main approach to economic valuation of the green infrastructure investments in Manchester's Oxford Road Corridor will be accompanied by a general analysis of the effectiveness of the so-called 'Green IT Now' software as a tool for encouraging residents to support tree planting projects on the streets where they live.

4.2.3 Bruges – 'Green Cycle Belt'

(Nel Ghyselinck, Frank Stubbe, Bert Vermeire and Ann Verspecht)

The potential economic benefits of the green infrastructure investments in Bruges may be summarised as follows.

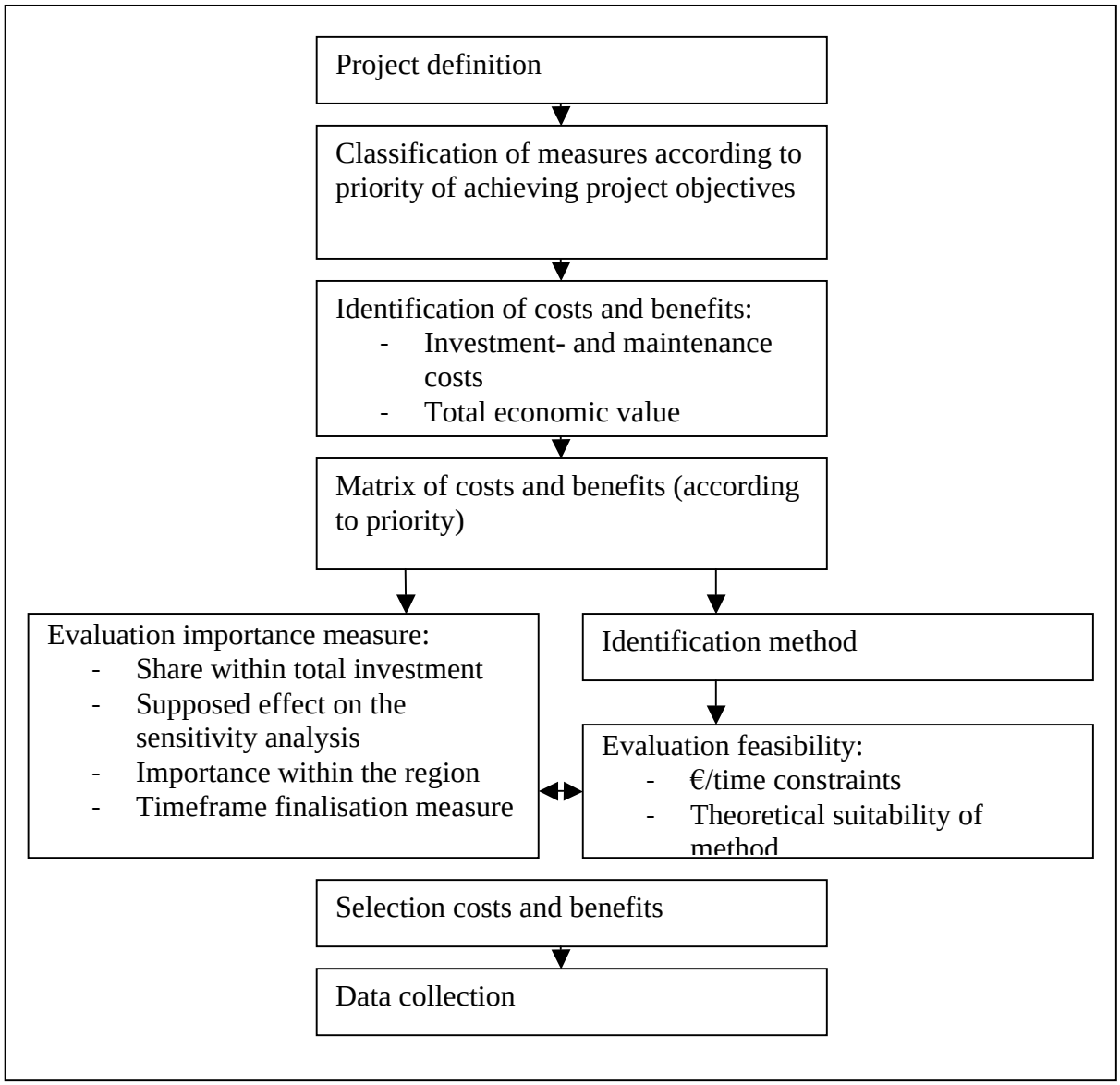
- Socio-economic benefits in terms of sustainable transport: increase in commuting by cycle between the city and the surrounding areas of Bruges, decrease in car use, positive influence on health. Beneficiaries are commuting cyclists, for example, employees and school children.
- Socio-economic benefits in terms of 'quality of life': creating a higher landscape quality, more recreational infrastructure and biodiversity. Beneficiaries are recreational cyclists, tourists, inhabitants.
- Socio-economic benefits in terms of economic dynamism: attracting new inhabitants and investors to the surrounding areas of Bruges. This will increase the value of the surrounding land and make the politicians aware of the economic importance of green investments.

<u>Suggested optimum evaluation technique(s) at the site scale (II):</u>

With regard to the project of the green belt, there is a variety of measures and actions to be taken into account. It is theoretically possible to calculate the added value of each measure by using a range of methods from the 'toolkit' of CBA. However, in practise, there are constraints of time and money. A more efficient way to determine the added value is by grouping the measures and matching them to the priorities of the

project. Consequently, prioritising and grouping of particular investments can support the determination of which measure makes the biggest contribution to the total result.

Figure 15: Implementation of CBA in the VALUE project



The approach to CBA within VALUE is characterised by stepwise narrowing of the focus from a general model of economic valuation to the specific context of the project. This implies that important choices will be made. These are, for example, the prioritisation of measures according to the achievement of the project's objectives. The choices have to be supported by the overall model and, furthermore, have an impact on the end result of the evaluation. Consequently, it is crucial to justify this by referral to the objectives or evaluation targets of the project, taking into account the stakeholders' interests.

The main priority is the completion of the green cycling belt around Bruges. Important green investments, which contribute to this priority, are the creation of the

missing links. The second priority is the creation of a higher quality of life in the areas surrounding the missing links. This, for example, can be achieved by creating a higher landscape or nature quality. Planting of trees and creating wetlands address this priority as well. Picnic places and information panel contribute to the third priority of the project. These are investments that do not belong to the first or second category and have a limited but not negligible contribution to the project.

Once we determined the category and priority of the green investments, and thereby the contribution to the total economic added value, we have to determine the cost and benefits related to the investment and chose the method to value them. In the VALUE case study the measures with the most added value to the project will be the investments in the missing links and the investments related to the improvement of the quality of live in the surrounding area.

The suggested evaluation techniques matching the specific characteristics of the planned green infrastructure investments in the VALUE case study in Assebroek will be mainly:

- Monitoring through a ‘bikers counting experiment'. The aim of the green belt is to create an important recreational and functional cycling axis where – besides landscape quality – safety also has a high priority. Thus, in some cases, new safer green links are created parallel to the old ones. By measuring the decrease in number of cyclists on the old paths and the increase of cyclists on the new paths, it is possible to make an evaluation of the added value of the green link. The cyclists are counted with a measuring device.
- HPM and benefit transfer. Various studies show that prices of houses are the result of a lot of features including the quality of life and green investments. By applying the HPM, it is possible to calculate the impact of specific green investments on house prices. In order to conduct such a study, it is necessary to have sufficient data on house prices (by transactions) in the immediate surrounding of the investment. In some cases, this can be a problem. If there is not enough accurate data, the technique of benefit transfer can help. In this case, it is very important to find a similar case where figures of added value are known. At this point, we are negotiating to get a database of housing transactions from the Federal Government and are searching for useful studies.

4.2.4 Verviers – ‘Vesdre River Greenway’

(Pierre Guilliams and Jean-Marie Halleux)

The potential economic benefits of the green infrastructure investments (‘green way’ along the river banks) in Verviers may be summarised as follows:

- Socio-economic benefits in terms of quality of life (living and working environments) for various groups of beneficiaries (inhabitants, employees, strollers);
- Socio-economic benefits in terms of change in transport modes between the city-centre and its eastern part for various groups of beneficiaries (inhabitants, employees): increase of bicycling and walking and decrease of driving, having various impacts in terms of environment, car traffic, health and so on; and

- Socio-economic benefits in terms of economic dynamism increasing the attractiveness to further investments and the quality of business environments along the river banks leading to the renewal of the neighbourhood and the regeneration of its brown fields.

It should be noted that these benefits are not limited to the site scale (II) but may also be considered at the city/region scale (I).

Suggested optimum evaluation technique(s) at the site scale (II):

The suggested evaluation technique matching the specific characteristics of the planned green infrastructure investments in Verviers is a SP survey. This will include interviews of local communities (that is, residents, employees, employers) and various groups of beneficiaries. The application of the HPM was initially considered. However, this would require a metropolitan context (to produce sufficient data) to be statistically relevant, which cannot be provided by the Verviers investment (small neighbourhoods concerned, small urban context). In addition, the physical character of the greenway (a long, linear feature linking widespread sites) makes any economic evaluation based on real estate prices difficult.

Amongst the techniques covered by the SP method, the CVM is preferred for the identification of the value of a good in its entirety (DTLR, 2002, pp. 30ff.). Even if it is more expensive and time consuming, the preferred survey method will be face-to-face interviews. Thus, the greenway project will be presented to the interviewees through computer-modified images carried out by the SEGEFA – ULg (University of Liege). Based on the modified images, the interviewees will be asked about different issues: global amenity, frequency of use (by strollers, bicyclers, workers), impact on the neighbourhood and so on. Finally, for each scenario, potential beneficiaries interviewed will be asked about their willingness-to-pay.

The SEGEFA-ULg (University of Liege) will then undertake a CBA by treating the results and putting forward the benefits (economically speaking and in terms of usefulness) of the greenway in comparison with its cost.

4.2.5 Stuttgart – (‘Online Route planner’ &) ‘Greenway Enhancements’

(Karsten Rusche)

The potential economic benefits of the green infrastructure investments in Stuttgart may be summarised as follows.

- Direct use values: recreation and leisure, tourism, health and well-being.
- Indirect use values: economic growth and investment, labour productivity, tourism, health and well-being.
- Non-use values: quality of place, reputation as a ‘green area’.

This list represents the objectives of the Stuttgart investments. Based on this order of impacts of green infrastructure investments it can be stated that more or less all of them will occur on the local and on the city/regional scale.

Suggested optimum evaluation technique(s) at the site scale (II):

The suggested evaluation techniques matching the specific characteristics of the planned green infrastructure investments in Stuttgart read as follows.

At the site scale an approach that relies on SPTs seems most appropriate. This is because the investments are quite small scale and, thus, will probably only reach a small user group. In addition, the particular green infrastructure changes will presumably not have a measurable impact on surrounding house prices. Consequently, the use of RPTs is not very promising. For example, referring to investment A (route planer), the rising 'virtual' accessibility of green infrastructure cannot be measured by using price variables. Summarising, the Stuttgart projects will be evaluated by SPTs (that is, CM, eventually combined with visualisations).

With regard to the online route planer, a complementary set of usability valuations can be applied. An online users/bikers counting exercise is planned and further alternative (online) feedback systems can be used in order to assess the impact and acceptance of the project by potential user groups.

4.2.6 Amersfoort – 'Euterpeplein' and 'Randerbroek'

(Derk Jan Stobbelaar)

The potential economic benefits of the green infrastructure investments in Amersfoort may be summarised as follows.

- Socio-economic savings by improving the user quality of the square; the square becomes more easy to use by visitors and buyers (higher accessibility and functionality).
- Socio-economic savings by increasing the perceived quality of the square (through visual and spatial experiences); a nicer place results from improved liveability, and thus possibly adding to the economy.
- The same counts for the cultural quality and managerial quality; both adding to the liveability of the place.
- Randerbroek: return flow of money from green investments back to the investor (municipality) via the increase in house prices.

Suggested optimum evaluation technique(s) at the site scale (II):

In order to understand the value of green within the city and to reinforce green zones, Amersfoort is testing three tools that can be used in urban spatial planning. These three tools are the Workbench method, Value Added Planning and the Green Credit method. The tools all have a different level of stakeholder involvement.

The suggested evaluation techniques matching the specific characteristics of the planned green infrastructure investments in the City of Amersfoort read as follows.

Euterpeplein

As described in this report (see Section 3.6), within the case study 'Euterpeplein' we will focus on the Green Credit Tool, which can be used to understand the value and qualities of public green space. The Green Credit Tool introduces a different perspective to green spaces that can add value to urban environments and thus create economic spin-offs. The Green Credit Tool is also a communication tool and incorporates public opinions, meaningful stakeholder involvement and enhances social responsibility and awareness. This tool can contribute to the planning of sustainable urban green spaces.

In the Green Credit Tool, values of public green space have a pivotal role. The values used in the Green Credit Tool ('Groene Saldo Regeling', Gemeente Amersfoort, 2007) are mainly qualitative values identified by inhabitants of redevelopment areas. Furthermore, values defined by experts are also incorporated in the Green Credit Tool. These values are categorised as follows: user value, perception, historical value and managerial value. Here we discuss the possibility to translate these qualitative values into more tangible economical data.

The Dutch Ministry of Agriculture, Nature and Fishery did research on how to make Societal Cost Benefit Analyses (SCBA) for the valuation of nature, water, soil and landscape. These cost benefit analyses can be used to quantify the benefits of nature, water, soil and landscape and express these in monetary terms. These benefits or costs can arise or be downgraded by redesign of the landscape, for instance through infrastructure projects, housing, water control and hydraulics projects (Witteveen en Bos, 2006). In order to see if the qualitative values mentioned in the Green Credit Tool can be translated into monetary data we will use the calculations made in the above-mentioned report on SCBA. In Table 1 below, the values identified in the SCBA calculations of Witteveen en Bos (relating to nature, water, soil type and landscape) have been linked to the categories used in the Green Credit Tool (user quality, perception, nature, culture and managerial quality).

Since the Green Credit Tool is used for public green space in small-scale urban redevelopments and not applied to bigger spatial scales, it is important to identify which categories and values could be applicable. The calculations made in the report of Witteveen en Bos (2006) are mostly based on larger spatial scales, the impact of an infrastructural programme on a nature reserve is for instance calculated. The question therefore will be to what extent it will be possible to apply these data to dense urban areas, where one development often is replaced by the other, and where the value of the land is very different from less densely populated areas.

Table 1: Linkages between SCBA Values and Categories of the Green Credit Tool

Indicators in the Green Credit Tool: scale and quality aspects	Nature	Water	Soil type	Landscape
User quality (accessibility, functionality, for instance playfields etc)	Recreation values: Exploitation possibilities Day recreation/ longer recreation	Recreation on the water Sailing/boating possibilities Exploitation possibilities due to presence of waters	Recreation: allotment gardens	Exploitation of cityscape/ townscape
Perception (visual and spatial experience/perception)	Satisfaction due to living in the green Recreational experience: Presence of green, silence, connectivity	Satisfaction of living near the water Perception of water recreation	Satisfaction due to living on clean soil	Perception of archaeological monuments. Recreational perception of green, silence, connectivity. Satisfaction of living (due to green and open space). Experience value of cityscape/townscapes
Natural quality (water, ecology)	Clean air Harvest of nature products (wood/food-crops etc) Protection against climate change	Protection against flooding of rivers Protection against water damage Protection against climate change	Protection against regional flooding	Protection against plagues and diseases
Cultural quality (cultural history, architectonical value)				Recreational values: archaeology and historical architecture
Managerial quality (state of maintenance)		Contribution to nature conservation		

Randerbroek

The concept of Value Added Planning will be applied to the 'Randerbroek' case study. As already described in this report, it has been developed to ensure sustainable economic development. The concept is based on the assumption that adequate, qualitative planning will ensure added value (in terms of social aspects, environmental aspects and economic aspects) in the future. Adequate, qualitative planning includes a holistic approach to development, focusing on detailed aspects that will enhance the good perceptions of a place, create visual attractive spaces and ensure sustainable developments with economic benefits. The Value Added Planning method is a new concept and still needs to be refined. It was already implemented in some case studies in Amersfoort. Thus, it has been tested and evaluated by specialists and students with an urban planning, environmental, developmental and architectural background.

The Green Credit Tool enhances this approach of Value Added Planning in terms of the following economic spin-offs.

Direct income for municipalities:

- Increased property tax revenue from the increase of property values due to proximity to Park Randerbroek; and
- Increased sales tax revenue as a result of spending by tourists who visit primarily because of the uniqueness of Park Randerbroek (beyond the tax receipts, these factors also bolster the collective wealth of residents through property appreciation and tourism revenue).

Direct income for residents:

- Increase in house prices; and

- ‘Uplift’ of the area as a whole.

Direct savings for residents:

- Residents’ use of the city’s free parkland and free (or low-cost) recreation opportunities, which saves them from having to purchase these items in the marketplace;
- The health benefit – savings in medical costs – due to the beneficial aspects of exercise in the parks; and
- The community cohesion benefit of people banding together to save and improve their neighbourhood parks. This ‘know-your-neighbour’ social capital helps ward off antisocial problems that would otherwise cost the city more in terms of police and fire protection, prisons, counselling, and rehabilitation.

Environmental savings:

- Park Randerbroek can furthermore contribute to water and air pollution reduction within Amersfoort – the retention of rainfall by the park system’s trees, bushes, and soil, thus cutting the cost of treating storm water, and the fact that park trees and shrubs absorb a variety of air pollutants;
- Contributing to sustainable development approaches – limiting future mitigation costs; and
- Protecting natural landscape and cultural history.

4.3 Description of Evaluation Approach Matching the Characteristics of the VALUE Green Infrastructure Strategies at the City/Region Scale

In this section of the chapter an approach to the evaluation of the city/regional impact of green infrastructure is developed. Compared with the site level evaluations, greater emphasis is given to the comparability of the results – while still acknowledging the differences in national and city/regional circumstances. The latter are partially reflected in the varying objectives of the green infrastructure strategies of the VALUE partners’ cities, which are summarised in the next sub-section (4.3.1). In the subsequent sub-sections evaluation techniques are indentified that will elicit both the impact of green investments on their cities’ wider economies (termed ‘internal’ economic effects) and the impact of such investments on cities’ quality of life and competitiveness (termed ‘external’ economic effects).

4.3.1 Summary of Objectives of the VALUE Green Infrastructure Strategies and Plans

(Simone Allin and John Henneberry)

The existing green infrastructure strategies and plans in the six VALUE partners’ cities and regions focus on the key issues listed below. These are linked with potential economic benefits at the city/region scale resulting from the implementation of the related strategies and plans. The latter include the individual VALUE green infrastructure investments as described in this report (see especially in Chapter 3).

- Sheffield: urban attractiveness to businesses; attracting investment and employees to live in Sheffield; provision of high quality environments and high quality urban design; close connection of green open space and the riversides in the city centre; understanding of urban green infrastructure as part of a global environment (climate change mitigation).
- Manchester: overall improvement of local and global environmental performance; contribution of achievements in the environmental sector to sustainable economic growth in the wider city/region; pro-active approach to climate change mitigation; further development of economic benefit of the region's natural environment (QoL) through the better alignment of environmental activities and economic gain; integration of green infrastructure strategies within major new development and regeneration schemes.
- Bruges: improvement of quality and connectivity of environment/green infrastructure in the city/region; fostering of collaboration between local and regional authorities, key decision-makers and stakeholders; urban attractiveness to businesses/investors and residents/visitors; promotion of alternative and sustainable transportation systems (bike commuting).
- Verviers: comprehensive integration of the River Vesdre valley into the urban landscape and environment; development of a 'greenway' aiming to encourage alternative transportation modes/routes; establishment of sustainable linkages between suburban economic poles with the city centre; encouragement of the regeneration of deprived suburban/rural areas.
- Stuttgart: improvement of quality of place and regional reputation through targeted green infrastructure investments; improvement of the city/region's attractiveness as a place to live; attracting highly skilled labour forces and their families; improvement of accessibility of green spaces and green infrastructure in general (tourism).
- Amersfoort: stimulation of sustainable economic development; long-term connection of economic, social and ecological capital/values; understanding the establishment of a more sustainable society as one of the biggest challenges for the city and its future development; furthering of connectivity of traditionally fragmented Dutch green spaces by means of building sustainable green corridors and networks.

This list of themes illustrates the range of key issues, which are currently tackled by the existing green infrastructure strategies and plans in the six VALUE partners' cities and regions. It displays an emphasis on the (more or less) strategic view of the benefits of high quality, accessible and well-connected green infrastructure systems. Generally, they represent a means of promoting overall urban attractiveness for both businesses (future investments) and their employees as well as for individual local residents and visitors to the particular cities and regions. In addition, this focus implies a further consideration of institutional and political frameworks. It also relates to the need to involve stakeholders in important local and regional decision-making processes. Last but not least, the green strategies and plans generally address the need for overall ecological improvements. Thus, they highlight the way that climate change raises challenges crucial to current and future urban environments.

4.3.2 Suggested optimum evaluation technique(s) at the city/region scale (I)

(Simone Allin and John Henneberry)

With regard to the evaluation of green infrastructure strategies, plans and systems within the VALUE project at the city/region scale, one common approach will be applied to all partners' cities and regions. According to the key issues highlighted in the previous Subsection 4.3.1, this approach has to cover the listed main areas of interest at this scale. Furthermore, it is designed to address the need to evaluate the impacts within the urban economies themselves and in relation to the VALUE cities' and regions' general competitiveness in comparison with other city/regions in North-West Europe.

Even more than the evaluation exercises at the site scale (see Section 4.2 of this report), the evaluation framework at the city/region scale is significantly constrained by the characteristics and contents of the VALUE green infrastructure strategies, plans and investments (for example, the small scale of the investments), general data availability, feasibility of study and, thus, time/staff resource limits within the VALUE project. Two techniques are suggested. Together they represent a reasonable, feasible and promising approach to economic appraisal at the city/region scale by combining existing and novel information and knowledge in an innovative and efficient manner.

Evaluation of Internal Economic Effects: (Partial) Implementation of Input-Output Analysis in Combination with Multiplier Analysis

(Simone Allin, Nel Ghyselinck, John Henneberry, Frank Stubbe, Bert Vermeire and Ann Verspecht)

Input-output analysis and modelling have been used extensively in empirical economic analysis. Within the last decade, the approach has also been applied to environmental analysis. Input-output models manipulate data in both physical and monetary units. They aim to capture the direct as well as the indirect environmental impacts of alternative products or processes on the basis of the explicit representation of physical stocks and flows of energy and materials, measured in physical units, through an entire economic system (Duchin/Steenge, 2007).

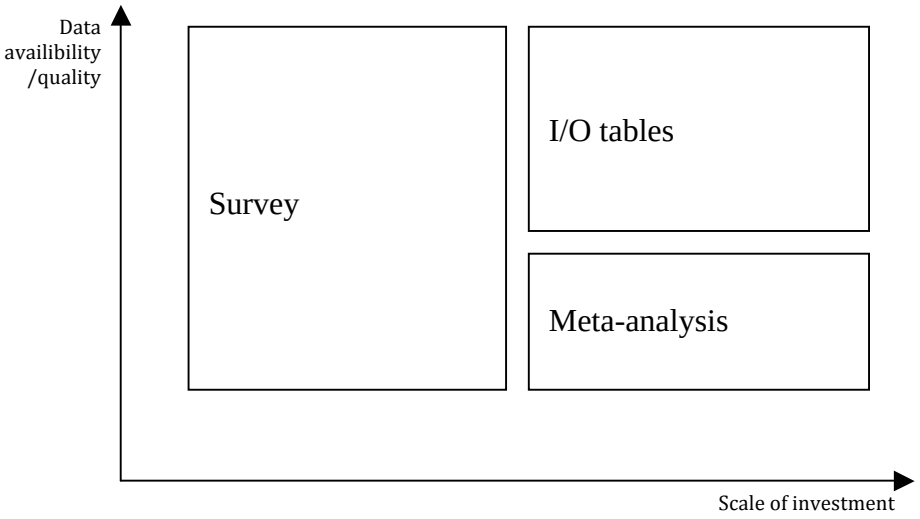
Multiplier Analysis represents an easily applicable instrument to analyse the impact of shifts in final demand on total output or total factor use (see sub-section 2.2.2). Furthermore, the derivation of multipliers from input-output tables is broadly modelled and standardised in many countries. Because of its popularity, even environmental data are included nowadays. However, the question remains whether the particular characteristics of the selected VALUE green investments are such as to allow a robust estimation of their downstream multiplier effects. Two issues are significant in this regard.

First, green infrastructure may be classified under various economic sectors in (national or regional) input-output tables. Consequently, it is very difficult to assign specific values to particular economic sectors and to obtain relevant statistical data at an appropriate level of disaggregation. This problem is exacerbated by the second issue: the small scale of the VALUE investments. Even the apparently straightforward categorisation of the construction of a bike track as part of the overall construction sector displays huge sector-related variation.

Consequently, a specific 'decision framework' to guide the design and implementation of a partial, but consistent multiplier analysis of the internal economic effects of the VALUE investments has been developed (Vermeire et al., 2010) and is described in Figure 16. The diagram positions the main methods for estimating local multipliers in relation to the main criteria on which a choice between the methods should be based. Ideally, multiplier analysis should be undertaken through the use of input-output tables. However, whether this is possible or not depends on two main factors.

- Data availability/quality: input-output tables need to reflect appropriate sectors of the local economy preferably at a highly disaggregated level.
- Scale of investment: ideally, the investment should relate to the same area as the data provided by the input-output tables, so that the dynamics within the tables are representative of the specific investment and its region. In practice, this often is not the case because input-output tables usually cover national or regional economies, while many investments have only local or sub-regional effects.

Figure 16: Overview of Methods of (Local) Multiplier Analysis



The interaction of the two criteria determines the choice of the most appropriate method(s) for undertaking multiplier analysis. This may be illustrated as follows.

- Plentiful, high quality data and large-scale investments allow analysis based on input-output tables.
- A large or medium scale investment in combination with low quality data requires some form of meta-analysis ('benefit transfer') that investigates relationships observed in earlier research with comparable characteristics and transfers their results to the present investment (Arnqvist/Wooster, 1995; Osenberg et al, 1999).

- In the case of a small-scale investment, a survey of a limited number of rounds of expenditure within the local economy can establish an overview of the costs incurred within a project. The further indirect effects of the investment can also be measured by means of a survey. If the conduct of a survey is not possible, a tailored combination of input-output table analysis and meta-analysis may be attempted.

Given the relatively modest scale of the VALUE investments, it is suggested that a survey-based approach to analysing their internal economic effects be adopted. One version of such an approach has been developed by the New Economics Foundation (NEF/The Countryside Agency, 2002). It provides "local decision-makers with a simple tool to evaluate local economic multipliers and evaluate a region's performance over time" (Tyson, 2005, p.14). The 'Local Multiplier 3 (LM3)' was designed to measure the impact of local spending in rural communities (NEF/The Countryside Agency, 2002, p. 2). However, it has also been piloted in urban areas, including Sheffield. Despite potential problems relating to data confidentiality and the difficulty of assessing the internal economic impact of small-scale investments, this approach could provide an indication of related money flows in the affected local economies.

The LM3 starts with an initial income and then measures how that income is spent. As people and organisations spend money differently, their expenditures have to be calculated accordingly. First, the spending of organisations is measured. Second, the spending of people and organisations receiving money from the first group of organisations are measured. The LM3 covers three rounds of expenditure. The organisations' initial income is Round 1. Round 2 is how much the organisations spend locally. Round 3 is how much of that local spending is then re-spent by the organisations' local staff and suppliers in the local area. If the money from all three rounds is added together, and divided by the initial income, the result is the local multiplier for three rounds (the 'LM3'). It is important to stress that the LM3 tool is an indicator. It does not provide exact measurements but does give a general sense of how a local economy is working and how its sectors are affected by a particular investment or expenditure (NEF/The Countryside Agency, 2002, p. 20).

Evaluation of External Economic Impacts: Combined Use of European 'Urban Audit' and 'CORINE' Datasets for (Partial) 'Quality of Life' Analyses

(Karsten Rusche)

An assessment of the impact of green infrastructure investment at the city/region scale requires a broad data set that contains a huge variety of environmental, economic and other information at that scale.

The Urban Audit – Characteristics

At first glance, the 'Urban Audit' dataset seems very promising in this context. It is an attempt by the DG Region to collect a broad set of accessible data for the urban characteristics of European cities. Thus, after a pilot phase, the currently available data relate to about 380 European cities that have collected information on a range of

topics (see Figure 17) and cover an interesting mix of hard and soft characteristics of European cities. Because the Urban Audit is the only database that offers Europe-wide coverage and because it focuses on urban data, it is the most promising available data source for this aspect of the VALUE project.

However, there are some significant drawbacks to its use. There is limited information on the commercial sector in the Urban Audit. Consequently, the assessment of the VALUE projects will have to focus on the QoL rather than on the QoBE. However, another problem remains: additional analyses to determine the quality of green infrastructure in urban areas will be required to augment the Urban Audit information.

Figure 17: Extract of Structure of the Urban Audit Statistics (taken from European Commission: Urban Audit Methodological Handbook)

Table 1: Structure of the Urban Audit Statistics

1. Demography	
	1.1 Population
	1.2 Nationality
	1.3 Household structure
2. Social aspects	
	2.1 Housing
	2.2 Health
	2.3 Crime
3. Economic aspects	
	3.1 Labour market
	3.2 Economic activity
	3.3 Income disparities and poverty
4. Civic involvement	
	4.1 Civic involvement
	4.2 Local administration
5. Training and education	
	5.1 Education and training provision
	5.2 Educational qualifications
6. Environment	
	6.1 Climate / geography
	6.2 Air quality and noise
	6.3 Water
	6.4 Waste management
	6.5 Land use
	6.6 Energy use
7. Travel & Transport	
	7.1 Travel patterns
8. Information society	
	8.1 Users & infrastructure
	8.2 Local e-Government
	8.3 ICT sector
9.Culture and recreation	
	9.1 Culture and recreation
	9.2 Tourism

Most of the VALUE partners' cities are included in the Urban Audit - Stuttgart, Manchester, Sheffield and Bruges – but Amersfoort and Verviers are not. However, the definition of QoL relies on a regression analysis. As 10 other Dutch cities and six Belgian cities are part of the Urban Audit, the impact on Amersfoort and Verviers can be deduced by using the results for the cities of the Netherlands and Belgium (by using a country dummy) in combination with the city data of Amersfoort and Verviers. Making projections on out-of-sample data is one of the standard procedures that come with regression analyses.

How well does Urban Audit data meet the requirements of an analysis of QoL? Information on at least house prices, income levels and amenity is needed. The housing variables seem to be centred on reasonable value levels and also have few outliers. In contrast, the green infrastructure indicators exhibit some odd distributions. In some cities the recorded proportion of green space approaches 100 per cent. Clearly, this is not an urban level of green space and does not match the data range suggested by Eurostat (see Urban Audit Methodological Handbook). Consequently,

there must be some serious reservations about the reliability of green infrastructure data in the Urban Audit.

How to extend the measurement of green open space using CORINE

There is a way to overcome this problem. CORINE land cover data may be used to construct some measures of green infrastructure that refer to its quantity and quality. The CORINE data covers many land use types for the whole of Europe. In addition, the Urban Audit and CORINE data are both available in GIS. Consequently, they can be combined for integrated analysis.

The indicators of green infrastructure quality and quantity developed for VALUE should cover: the amount of green infrastructure, both absolute and proportionate (for example, hectares of open space; hectares per inhabitant); the character of the green infrastructure, using measures of diversity and fragmentation (described in sub-section 2.2.3); and the accessibility of green infrastructure. The latter might be indicated by the variable 'population within 15 mins walking distance' of green infrastructure or 'the settlement area within 300 meters of the perimeter of green infrastructure' (summed over the whole city/region area).

In order to add to the Urban Audit and CORINE data sets, it is suggested that VALUE makes use of further publicly available European data. On the one hand, knowledge about the small-scale geography of green open places can be enhanced by information about 'green urban areas within urban morphological zones' from the European Environment Agency. Here, the resolution of particular shapes of green spaces is much higher than the one in CORINE. On the other hand, information about standard city data is enriched with Eurostat's regional statistics at the NUTS-3 level. This statistical level is roughly comparable to the city level. It mainly covers information about the gross domestic product, which is better identified on a regional (NUTS) level than just at the city scale. This is because people tend to live in suburbs, but their income is measured in the city centre.

Conclusions

The conclusions on the Urban Audit are twofold.

- It is a 'second-best' source but it is the only available data set suitable for the purpose of a RP analysis at the regional scale. The Urban Audit includes a great variety of data on different themes on the level of European cities. It also covers functional areas around cities so that delineation problems can be minimised. The quality of data from cities in Northwest Europe is high. Consequently, the regression analyses can draw on data from more than 100 cities. With the ongoing further development of the Urban Audit, it will also become possible to use panel data techniques to widen the database.
- Urban Audit data on green infrastructure is less reliable. In addition, it is not available for many cities – at least compared to more 'standard' data. So, there remains a need for an additional approach to encode qualities and quantities of green infrastructure. Joint usage of the Urban Audit and the CORINE data seems very promising in that case. Many of the VALUE projects focus on increasing the accessibility rather than the amount of green infrastructure. The integration of GIS techniques with Urban Audit and CORINE data seems the

most pragmatic and efficient way to pursue the regression analysis. This will then be used for the city/region level assessment of green infrastructure changes.

Only QoL can be assessed with the data that is available. And even in the QoL context, the approach will have to be simplified because there are no data on wages or spending structures in the Urban Audit database. One possible alternative would be to ask the VALUE practice partners to collect the missing national data inputs to recalculate the QoL regression results, although this may have significant resource implications. The 'third-best' approach would then be to concentrate on the effects of green infrastructure on GDP, education or population change (regressions without recalculations).

Alternative/Complementary students' survey

(Pierre Guilliams and Jean-Marie Halleux)

As already briefly mentioned in Subsection 2.2.4, alternative students' surveys focusing on future working environment preferences in the VALUE cities and regions could assist in gathering more information on the contribution of green infrastructure to city/regions' competitiveness in a time and resource efficient way. In order successfully to conduct the surveys, the method used might be based on online surveys of final year students. They would be asked about their preferred future working environment. The questionnaire would present representations of different working environments (via computer modified images) and would make it possible to assess the impact of such environments on the students' job choices and the elements of the environment preferred. The same method could be applied in all the VALUE partners' regions, producing sufficient data to provide statistically strong results and to permit international comparison.

4.4 Conclusions

(Simone Allin and John Henneberry)

The foregoing suggestions on appropriate evaluation techniques – both at the site and at the city/region scale – for application to the VALUE green infrastructure strategies and investments are based on two in-depth analyses: the comprehensive review of existing methods and approaches to economic appraisal within the context of environmental studies; and the examination of core objectives and characteristics of the particular green strategies and investments themselves. Thus, the proposed set of techniques is carefully matched with the main economic benefits expected from the VALUE investments. These benefits, together with their specific importance and relevance for further research, have been identified in consultation with the six VALUE partners' cities and regions. Furthermore, the evaluation frameworks at both the site scale and at the city/region scale are consistent and practicable in terms of methodologies and data and other resource requirements.

4.4.1 Evaluation framework at the site scale

(Simone Allin and John Henneberry)

The following table provides an overview of the suggested main and complementary evaluation techniques (both embedded in the overall CBA framework) matching the characteristics and expected economic benefits of the particular VALUE green infrastructure investments at the site scale.

Table 2: Overview of Evaluation Techniques at the Site Scale

VALUE Investment	Main evaluation technique	Complementary methods
Sheffield – The 'Wicker'/Nursery Street	SPT (Choice Modelling > Choice Experiment) *Partial CBA**	Use of advanced 3D visualisations; comparison with use of basic 2D visualisations in Manchester
Manchester – Oxford Road Corridor	Comparative, project-based CBA SPT (Choice Modelling > Choice Experiment including house price indicators) *Partial CBA**	Use of basic 2D visualisations; comparison with use of advanced 3D visualisations in Sheffield Survey on effectiveness of 'Green IT Now' software
Bruges – 'Green Cycle Belt'	Selective CBA HPM & Benefit Transfer	Bikers Counting Experiment
Verviers – Vesdre River Greenway	SPT (Contingent Valuation Method) *Partial CBA**	Further interviews with local stakeholders, communities Matrix representation of costs and benefits of development scenarios Use of computer-modified images
Stuttgart – ('Online Route Planner' &) 'Green Enhancements'	SPT (Choice Modelling > Choice Experiment) *Partial CBA**	Further analysis of online tool in terms of its acceptance and user frequency: online bikers counting exercise Potential use of visualisations
Amersfoort – 'Euterpeplein' and 'Randerbroek'	Social CBA *Partial CBA**	Green Credit Tool and Value Added Planning

**Note: With exception of the evaluation technique to be applied to the Bruges case study (that is, CBA), all other main evaluation techniques focus primarily on the measurement of values and preferences. Consequently, the actual assessment of costs of the investments in Sheffield, Manchester, Verviers, Stuttgart and Amersfoort will be undertaken as part of the proposed survey-based multiplier analysis at the city/region scale (see Subsection 4.3.2).*

4.4.2 Evaluation framework at the city/region scale

(Simone Allin and John Henneberry)

At the city/region scale the suggested evaluation framework has two parts. The internal economic effects of green infrastructure investments within an urban economy will be assessed by means of a survey-based multiplier analysis, combined with the use of input-output tables and/or meta-analysis where appropriate and practicable. The external economic impact on city-regions' competitiveness relative to other cities and regions in North-West Europe will be addressed by the application of a (partial) 'Quality of Life' analysis. The latter will concentrate mainly on the use of existing secondary data drawn from the Urban Audit and CORINE databases. If resources permit, these analyses will be supplemented with surveys of students' preferences for future working environments.

Both approaches to evaluation at the city/region scale require some further, but modest, primary data collection by the VALUE partners' cities and regions themselves. In this regard, the related VALUE research partners will provide the VALUE cities and regions with technical support and advice.

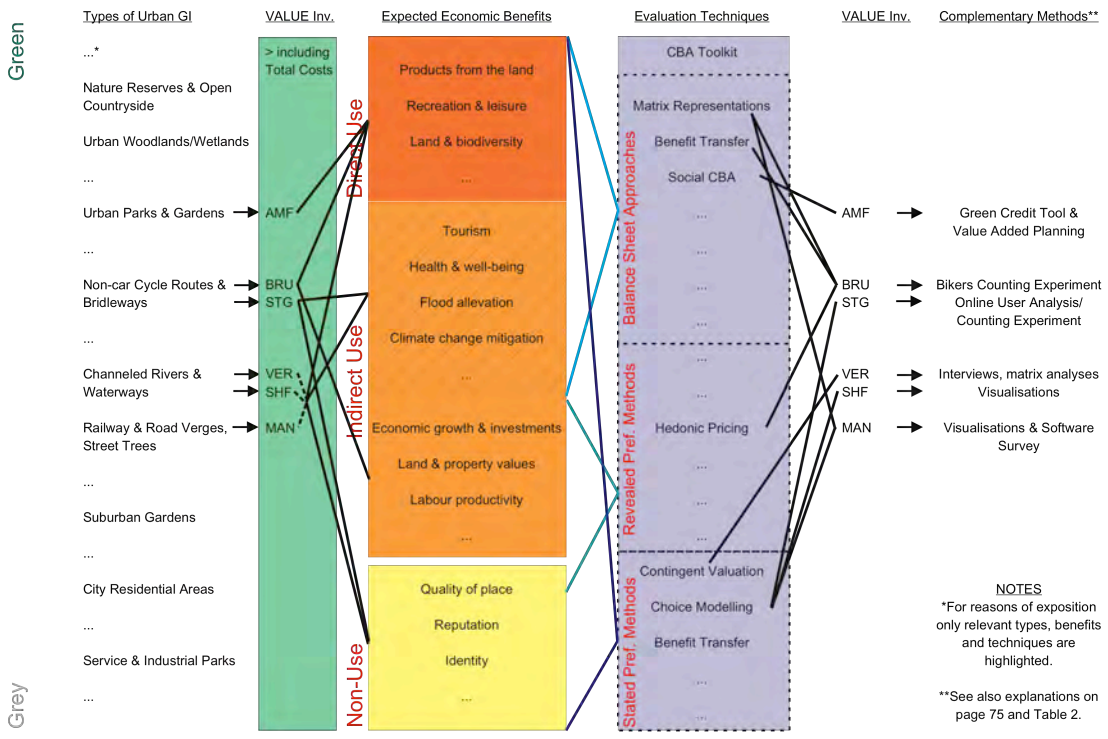
5. Conclusions

(Simone Allin and John Henneberry)

The overall aim of this report was to present the main outcomes of the baseline analysis of existing economic valuation tools for application to green infrastructure investments. Evaluation techniques and their current applications relevant to appraisals at the site scale and at the city/region scale have been reviewed as part of the core research tasks related to Action 1.2 of the VALUE project. Following these objectives and based on the related findings, the report outlines a two-part draft evaluation framework tailored to the characteristics of the particular VALUE green infrastructure strategies and investments in the six partners' cities and regions.

The development of the evaluation framework at the site scale can be summarised as follows (see Figure 18). The first steps were: the identification of the different types of planned urban green spaces; the classification of the VALUE green infrastructure investments to these types; and the linking of their main characteristics with the expected economic benefits. In this process, the total (social) costs – such as capital expenditure, labour and management costs, operating and maintenance costs, research, design and development costs, opportunity costs, compensations and rehabilitation costs – needed to produce the specific green good were considered implicitly (see Gilpin, 1999, p. 177).

Figure 18: Summary of the Evaluation Framework at the Site Scale



It became obvious that all the VALUE green investments are relatively small in scale, but are targeted at a broad and similar range of economic benefits. Consequently, in the second step, a strategic decision was made to focus on the most important characteristics and objectives of each investment. The suitability and capacity of the reviewed evaluation techniques were then compared with these key aspects of the investments to determine the most suitable match. Further to this, the VALUE partners' cities and regions – together with their academic partners – developed a range of complementary approaches, which were designed to fit with further research issues particular to their investments and to their specific national and local contexts.

One remarkable thing about this diagram is that the 'greener' VALUE investments (that is, those in Amersfoort, Bruges and Stuttgart) generally seem to be much more focused in terms of their 'main topic' and their expected economic impacts (mainly direct and indirect use values). Thus, they are more likely to choose from the more specific evaluation techniques such as matrix representations of costs and benefits or the Green Credit Tool. The more 'grey' the VALUE investments are (that is, those in Verviers, Sheffield and Manchester) and, thus, the more they are embedded in complex urban environments with a variety of urban development issues to be integrated and considered, the more diverse they appear in terms of their objectives and related (intangible) economic impacts. Within these case studies a distinctive choice of more flexible evaluation approaches such as SPTs can be indentified.

The development and design of a common evaluation approach at the city/region scale had to pay special attention to the constraints (for example, data availability and project resources) mentioned in the previous chapters (see Section 4.3 in particular). The suggested approach to the economic appraisal of the VALUE green infrastructure strategies, plans and investments at the city/region scale is partial but feasible and efficient. It addresses the key issues and core research questions at this scale, as highlighted by the VALUE partners. Special regard was paid to the general problem of the small size of the VALUE green infrastructure investments and the consequently rather limited impact that they will have on the overall urban economy. Therefore, the proposed approach may serve as a prototype for future assessments and help other cities and regions that need to address similar questions when targeting their green investments.

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