

SHAPING DECISIONS AND PROCESSES FOR MORE SUSTAINABLE URBAN ENVIRONMENTS

Christopher Boyko¹ & Rachel Cooper²

¹B48 County South, ImaginationLancaster, Lancaster University, Lancaster, United Kingdom
LA1 4YW, c.boyko@lancaster.ac.uk, +44 01524 532339

²ImaginationLancaster, Lancaster University, Lancaster, United Kingdom

Abstract

To know whether eco-cities or, indeed, any so-called sustainable urban environment, will be successful, an understanding is needed about how such places 'come into being'. Understanding how decisions have been made, who makes them and when and how they are made is crucial to ensuring that the 'right' people have been involved at 'right' time. In describing and visualizing this, we are providing a framework-in this case, an urban design decision-making process-that highlights the stakeholders as well as the tensions, tradeoffs and decisions that need to be made in the name of shaping sustainable developments. This paper presents the findings from a large-scale research project about sustainable urban design decision-making and the 24-hour city. Through in-depth, case study research in three UK cities, the work identified and visualized a new framework for the urban design decision-making process as well as making crucial connections to urban form, the urban experience and urban policy. The project is described, highlighting the multi-disciplinary team approach and the diverse areas explored within the project. The three case study cities are then discussed briefly, followed by some of the distinct, area-focused results as well as some the integrated findings. In particular, the improved urban design process will be explained along with a description of some of the tools and techniques developed for urban design decision-makers.

Keywords

Urban design, decision-making, process, multi-disciplinary.

1. Introduction

Creating new eco-cities are difficult enough ventures to plan and execute from a sustainability perspective, as developments in China (Dongtan), Abu Dhabi (Masdar City)

and South Korea (New Songdo City) can attest. When decision-makers want to apply sustainability principles to *existing* urban environments in an effort to make them eco-cities, it becomes even more complex. The myriad of decision-makers and stakeholders (e.g., local authority planners, private sector architects, residents, financiers, social housing organizations), the different issues and interests (e.g., profit, improved quality of life, iconic design, NIMBYism), the scale of the development (e.g., building, street, neighborhood, city) and the tradeoffs to be made can severely complicate the creation of a sustainable eco-city. However, knowing more about the *process* involved and the kinds of issues that are important for decision-makers and stakeholders will likely improve sustainable decision-making for urban environments.

This paper outlines a large-scale research project, called *VivaCity2020*, that addresses sustainability and the process for urban design decision-making. The project is first described, with information presented about the multi-disciplinary team and the research areas studied. The three case study cities are then discussed briefly, followed by the integrated findings that the team developed in the final 2 years of the project. These findings fall under four themes: the urban experience, urban policy, urban form and urban process. Regarding the last theme, the process is discussed in detail, highlighting each stage and the tools and resources that may be used in making decisions. This process improves on what has been learned in theory and in practice, thus providing decision-makers with an opportunity to making more truly sustainable urban design decisions.

2 The VivaCity2020 project

VivaCity2020 was a UK Engineering and Physical Sciences Research Council (EPSRC) project that began in 2003 and finished in 2008. It belonged to the first phase of the EPSRC's £38 million Sustainable Urban Environments (SUE) programme, which was—and is—interested in investigating different ways of improving the quality of life for UK citizens, supporting sustainable development within the UK economy and meeting the needs of those in the industry, commercial and service sectors (EPSRC, 2010). SUE1 was divided into four clusters: urban and built environment; waste, water and land management; transport and; metrics, knowledge management and decision-making. *VivaCity2020* was part of the urban and built environment cluster and received £2.75m to conduct research over 5 years.

The principle aim of the *VivaCity2020* project was to develop practical tools and resources to support urban design professionals with sustainable decision-making. To achieve this aim, it was necessary to understand the process used in making decisions about urban design and development projects (Cook, 1980), as doing so can help to minimise mistakes being

repeated (Kagioglou *et al.*, 1998; Rowley, 1994). Concurrently, key urban sustainability issues were investigated in an effort to uncover more detailed information about important phenomena, but also to discover the daily trade-offs that decision-makers make at strategic and operational levels about and between these issues. These findings could then be fed into the process and an improved urban design process created with prompts for more sustainable decision-making at each stage of the process. The end product is a toolkit of resources that may be used to navigate urban sustainability issues and consider sustainability in a user-centred, holistic manner.

2.1 The team

The project was led by a consortium of five universities—Lancaster University, the University of Salford, University College London, London Metropolitan University and the University of Sheffield. In addition to the core team, over 100 partner and collaborating organizations from the public and private sectors were involved, such as local authorities, planning consultants, design institutions and other universities. Each of the Work Packages (see below) that comprised the project also had experts from a variety of fields and professions (e.g., design, architecture, planning, criminology, information and computer technology (ICT), engineers) who provided guidance on a diversity of issues, including deliverables, methods, case study locations and so forth. Finally, *VivaCity2020* had a steering committee who met twice a year with senior members of the core team to support and direct the research from an overarching perspective, ensuring that the project stayed on course.

2.2 The Work Packages

VivaCity2020 explored eight specific urban sustainability issues in separate, yet overlapping, research areas called *Work Packages* (WPs). Researchers in each WP examined their specific urban sustainability issue in great depth, using case studies in three UK cities (see below). In addition to individual WPs, the team also spent time working *across* WPs to ensure a more joined-up approach (see Rosenfield, 1992, for a discussion of working across disciplines). This involved sharing information (e.g., documents, interviewing the same people together), conducting case studies at the same time and place when feasible, assisting other researchers in collecting data and synthesizing the collected information to understand where tensions and tradeoffs occurred between the WPs.

2.2.1 Urban design decision-making

To enable more sustainable decision-making in urban design, a decision-making process must be mapped that indicates who is making decisions, when and how they are making decisions and what issues are important to them in making those decisions. This WP first presented an urban design process, based on a review of the relevant literature. Next, three case studies of the urban design process in-practice were undertaken to understand how decision-making was done today, in the 'real world'. From this knowledge, an improved process for urban design decision-making was created.

2.2.2 Generation and evolution of land use diversity (two WPs were involved in this sustainability issue)

At the moment, there is a critical gap in understanding how the mix of land uses evolves in cities and how diversity can be achieved without undesirable side effects in high-density urban environments. Through three case studies, this WP investigated the spatial clustering of economic, social and residential functions in close proximity via a selection of methods, including GIS mapping of land use, the economy, movement and crime; household and business surveys and; interviews with key planning decision-makers. The aim of the case studies was to measure stakeholders' quality of life and to comprehend the rationales of decision-makers. Beyond the case studies, the WP possessed an experimental component. This involved adapting agent-based micro-simulations to discover, from a more theoretical basis, how land use diversity affects individual choice (e.g., in setting up a shop, moving through the city).

2.2.3 Secure urban environments by design

Two key questions drove this WP: how can the open and permeable residential environment required for sustainability be achieved without incurring actual or perceived increases in crime? How can facilities in city centres be designed to attract legitimate users, while at the same time minimise crime? Case studies of exemplar developments in three UK cities attempted to answer these questions by focussing on crime rates, fear of crime, the night-time economy and retail. Extensive recommendations for an improved evening and retail offer as well as lower crime rates and reduced fear of crime were presented.

2.2.4 Designing environmental quality

This WP investigated quality of life in city centres in an attempt to understand how environmental and social issues impact on residents' perceptions of the urban environment. Researchers utilised resident interviews, photographs, sound recordings of city centre environments, monitoring of thermal comfort inside and outside dwellings and monitoring of noise and air pollution in their case studies of three UK cities.

2.2.5 Community pattern book for housing

Housing is a fundamental component of any city, as is the quality of its stock. Over the years, residents' needs have changed and, with it, housing design. This WP aimed to address residential culture over the past 180 years. It also explored the relationship between the design of residential public spaces and anti-social behaviour in an effort to identify whether specific spatial characteristics could be designed out of housing areas to make them safer. Thirty residential areas, with housing built between the 1820s and the present day, in three UK cities were assessed through analytical measures (e.g., housing density, road hierarchy), space syntax tools to examine the pattern of open spaces in housing developments, photographic surveys and a liveability survey.

2.2.6 The design of away from home 'public' toilets in city centres

In UK city centres, public toilets that anyone can access are a rarity. Over the years, many have been closed down, yet there is a need to supply this important convenience to users of urban environments. The question that this WP attempted to answer was: how can high-quality, accessible public amenities be provided that are cost-effective and inclusive? Through extensive interviews and street surveys, researchers developed personas to help architects, designers and toilet providers in offering improved public toilets to cater for everyone's needs. In addition, a guide was created that illustrated a truly accessible and inclusive public toilet.

3 The case studies

Case studies were viewed as the best approach to understanding sustainable urban environments, as they allowed researchers to investigate contemporary phenomena (i.e., urban design, sustainability) within a real-life context (Yin, 2003). Due to the multi-disciplinary nature of the project, a variety of research methods were used by the team,

including observations, questionnaires, surveys, ethnographies, atmospheric data collection and agent-based micro-simulations. Different researchers used different methods, with some adopting new methods from other researchers and/or working with other researchers to better understand the methods they used (e.g., two social scientists and an environmental scientist learned about each other's methods to study environmental quality and devised a new method—the 'walkabout'—to enhance the quality of the information collected).

The case studies were conducted in the same UK cities—London, Manchester and Sheffield—with attempts to undertake research on common sites within those cities—Manchester/Salford city centre, Sheffield city centre and Clerkenwell, London (see Figure 1). This enabled the team to share knowledge and interact as a group. The cities and sites were chosen specifically because of their large, high-density populations, 24-hour environment feel and host of issues that pertained to sustainability and quality of life (e.g., noise, crime, pollution and public convenience access).



Figure 1. Map of the UK with the three case study cities: Manchester/Salford, Sheffield city centre and Clerkenwell, London. Note: UK map provided by Anonymous101, via Google images; photo of Manchester/Salford provided by Pimlico Badger, via Flickr; photos of Sheffield and London are the authors' own.

3.1 Clerkenwell, London

London is the largest city in England, located in the south-east of the country. It is the country's political, financial and media centre and a major global tourist destination. As one area within Central London, Clerkenwell is steeped in monastic, brewing and artistic history. The present-day built environment, however, is influenced more by the reconstruction of

historic buildings and infrastructure during the 18th century. Clerkenwell was modernized during Victorian times, with new workshops and formal factories that would eventually be taken over by office workers in the 1980s and 1990s wanting to experience loft living. This phenomenon has continued into the 21st century, with many redundant industrial buildings being converted into offices and flats (English Heritage, n.d.).

3.2 Sheffield city centre (particularly the Devonshire Quarter)

Sheffield is the fourth largest urbanized area in England, located in the north-east part of the country. It has strong ties with steel and coal mining and was devastated when these industries collapsed in the 1970s and 1980s. However, the city has been slowly recovering over the years, finding new ways to sustain itself (e.g., through the development of the out-of-town shopping centre, Meadowhall; the new Supertram; the hosting of the World University Games in 1991 and; an increase in city centre living).

The Devonshire Quarter is a mixed-use 'urban village' in Sheffield city centre. Initially, the land was agricultural before being transformed in the 19th century into a high-density neighborhood of houses, shops, factories, workshops pubs and churches. Between the 1920s and 1970s, the area was cleared and did not see significant improvement until the 1990s and 2000s (CABE, n.d.; Sheffield City Council, 2001, 2004). Since then, new housing developments, independent shops and restaurants have flourished and the local authority has tried to link the new retail and housing with the surrounding night-time economy (Sheffield City Council, 2001).

3.3 Manchester/Salford

Manchester and Salford are located in Greater Manchester in the northwest of England. The area comprises about 115km² and is home to approximately 2.5 million residents. In addition, 19 of the 50 most deprived areas nationally may be found within Greater Manchester (DCLG, 2008). Although Salford has consistently encountered population losses since the 1990s and a higher proportion of economic instability (Report of the Leader of the Council, 29 September 2004), Manchester has grown, economically, and is seen very favorably among businesses.

4 Findings

In the final 2 years of the project, the team focused on integrating the findings from each of the WP case studies (due to space constraints, those findings are detailed elsewhere). This allowed for cross-cutting themes to emerge that elucidated some of the tradeoffs that

decision-makers and stakeholders need to consider if they wish to make more sustainable urban design decisions. The themes are: urban experience, urban policy, urban form and urban process.

4.1 Urban experience

How users of the urban environment experience spaces and places is crucial to creating more sustainable cities. Researchers studying this aspect of the project examined all aspects of users' sensory experiences. In terms of sound, residents stated that they preferred a variety of sounds—as well as its volume and frequency—although many of them stated that the availability of tranquil spaces was an important quality of life issue. For taste, residents turned to food. Discussion of the diversity, affordability and quality of food abound, which led to residents' feelings about interaction: that is, some groups (e.g., ethnic, age) did not interact with other groups, and this could be found in the type of food establishments they frequented. Related to taste was the sense of smell. Local food outlets were found to make significant olfactory impressions, with residents wishing to have improved ventilation systems to prevent stronger food smells wafting into their dwellings. Other smells, such as vomit and urine, also pervaded, lending a feeling that public conveniences were not provided for, not maintained and, in some cases, not accessible to those with urinary and other problems.

Regarding touch, residents and others talked about a number of issues that concerned them: including personal safety, the condition of pavements, the positioning of street furniture and 'door-step' problems (e.g., litter, graffiti, fly-tipping). All of these are things that people experience, come into contact with or 'touch' in their everyday lives. Finally, sight was important in that people liked to see an area's architectural heritage, whether the buildings and fabric were older or more contemporary. Moreover, researchers found that older housing stock in cities was better at adapting to different ways of living versus newer stock, which was seen as more difficult to change and tended to favor a certain demographic over others (e.g., single person v. family).

4.2 Urban policy

Through extensive investigation of current policy on a variety of issues (e.g., planning, regeneration, quality of life), two issues emerged: the importance and influence of density and of mixed-use in the urban environment. Current UK Government policies have not clearly conceptualized either issues, making it difficult for the public and private sectors to

effectively address any problems that arise. In regards to mixed-use, questions exist about its viability:

- What factors comprise successful mixed-use?
- What degree of mix qualifies as mixed-use?
- What tools and guidance are needed to assess mixed-use?
- At what scale does mixed-use work?
- What are people's amenity needs and standards?

Research has found that mixed-use is often only dual use—taking the form of residential and business—and that social housing forms a small part of the residential component of residential mixed-use. However, mixing uses should not be socially or economically engineered, but rather allowed to form organically. Furthermore, horizontal mixed-use at the scale of streets and neighborhoods appears to work better than vertical mixed-use at the scale of high-rise buildings.

In terms of amenity needs and standards, residents actively consider the type of dwelling they wish to buy or rent as well as dwelling size, layout, location, security, access to transport links and an area's vitality. The highest priorities are given to proximity of the dwelling to the city centre and accessibility. These factors become obscured, however, because of the uncertainty over who pays for the amenities and standards (i.e., private or public sector) and the lack of a planning use class for mixed-use. Thus, no guidance, investment category or working definition for successful and sustainable mixed-use exists, meaning that effective integration and separation of land use remains dubious.

4.3 Urban form

The physical form of urban environments impacts the self-organization of cities. For example, shop owners tend to migrate to locations which are already movement-rich. This may prompt additional movement, which could attract other, more diverse uses. From this clustering of uses, centers and sub-centers evolve, which may interact with one another. This cycle of multiplier effects is how cities create an essential form, with a dominant network of centers and sub-centers set within a residential backdrop. Through agent-based modeling, researchers tried to understand these dynamics. From their work, it was found that the most diverse streets in reality were often the less-favored sites in the simulation, prompting researchers to explore other ideas about vitality in urban environments (e.g., can successful diversity sometimes be the result of economically-marginal locations?).

In addition, case studies about crime suggested that urban form may affect perceived and actual crime rates. For example, through the analysis of urban street networks, researchers

discovered that crime decreases with increased ground-level housing density. Dwelling type also influences crime, with purpose-built flats and terrace houses having lower crime rates than converted flats. In terms of burglary, there appears to be a relative diffusion across the city. In contact, robbery tends to be focused more on the patterns of linked centers and on the streets intersecting with high streets.

4.4 Urban process

Researchers were able to identify an urban design process from the literature that illustrated how people make decisions. However, this process did not provide any information about making sustainability decisions, did not show who was making decisions and did not list any tools and resources used in urban design decision-making. From the three case studies, it was found that most decision-makers did not follow an explicit urban design process, nor did they think about sustainability holistically (i.e., in terms of the social, environmental and economic dimensions of sustainability). Furthermore, having historical, contextual knowledge of a place is key to making successful urban design decisions and that decision-makers can be both explicit (e.g., local authority planning officer) and tacit (e.g., local residents group). From this information, an improved process was created that showed the importance of considering sustainability at each stage (see Figure 2).

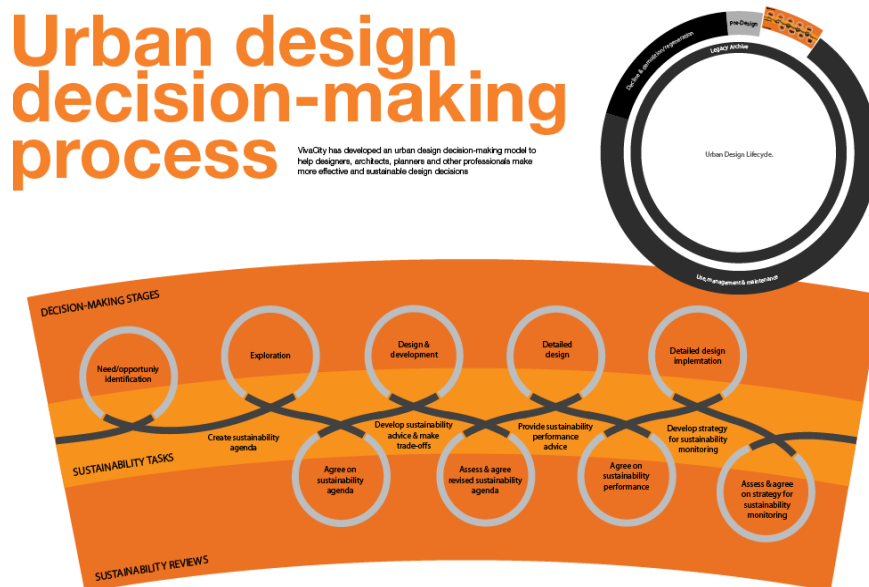


Figure 2. The improved urban design decision-making process. Source: VivaCity2020.

4.4.1 The improved urban design process in greater detail

The following stages were created from knowledge about the urban design process in the literature and the urban design processes from the case studies (see Cooper & Boyko, 2009):

- *Stage 0: Need/ Opportunity Identification.* In Stage 0, an individual or team (e.g., land owner) identifies a need (e.g., more green space) or an opportunity (e.g., new family homes) for an urban design project. A potential location for the project as well as partnership working also is identified. It is important for the individual or team to consider the social, environmental and economic dimensions of sustainability at this early stage when making decisions about the project because critical issues and tradeoffs will already begin to emerge.
- *Stage 1: Exploration.* In Stage 1, a Development Team is formed to explore the urban design project from a variety of angles (e.g., design, context, finances) and develop the project further. A Project Sustainability Group also is formed, consisting of people who will likely be involved through the lifetime of the project (e.g., developers, investors, residents). A Group leader will be appointed who has the appropriate skills for the position. It will be the leader's responsibility to ensure that new expertise is added to the team when necessary. In some cases, the Group may be small, only one or two people, when the project is small or the need/opportunity from Stage 0 is still being investigated. The main task of the Group leader is to guarantee that sustainability is considered throughout the process. As part of this stage, both sets of teams will take the outputs from Stage 0 and begin to formalize them into a Sustainability Agenda. It is essential that the basic tenets of sustainability are understood and that the teams work together to create a viable project and a Sustainability Agenda.
- *Sustainability Tasks.* Between Stage 0 and the first Sustainability Review (see below), the Project Sustainability Group—with the help of the Development Team in some cases—creates a Sustainability Agenda based on knowledge, experience, information and past decisions. The Agenda contains a ranked list of sustainability issues that the Group sees as important and will carry through to Stages 2 (Design and Development) and 3 (Detailed Design) of the project. It sets in writing how the teams understand the sustainability issues and the rankings. This Agenda should be re-assessed throughout the process to ensure that existing and new sustainability issues are considered and ranked accordingly.
- *Sustainability Review.* Before the Development Team begins designing and developing their ideas for the project, they must agree on the Sustainability Agenda

with the Project Sustainability Group. By doing this, it gives both teams an opportunity to consider the sustainability issue rankings and to negotiate any tradeoffs on the issues.

- *Stage 2: Design & Development.* In Stage 2, the actions of the Development Team correspond to stages/phases in construction management and architectural processes (e.g., Phase 4, Outline Conceptual Design, of the Process Protocol; Stage C of the RIBA Plan of Work). During this time, the Development Team begins designing their plan and considering design and development issues pertaining to sustainability.
- *Sustainability Tasks.* Between the first and second Sustainability Reviews, the two teams will generate Sustainability Advice as part of pre-planning application meetings. Doing so gives both teams an opportunity to give and seek advice about the sustainability of the project, and discuss sustainability tradeoffs. The tradeoff discussions may lead to a re-ranking of sustainability issues and a revised Sustainability Agenda, to be presented at the second Sustainability Review.
- *Sustainability Review.* The Project Sustainability Group will discuss tradeoffs and agree the re-ranking of the Sustainability Agenda with the Development Team. This allows both teams to be involved in the process and understand what sustainability issues are being considered in the project. The Project Sustainability Group also will examine and agree the Development Team's preliminary designs.
- *Stage 3: Detailed Design.* In Stage 3, the actions of the Development Team correspond to stages/phases in construction management and architectural processes, (e.g., Phase 5, Full Conceptual Design, of the Process Protocol; Stages D and E of the RIBA Plan of Work). During the time, the Development Team progresses in more detail with their designs, demonstrating a greater understanding of design issues pertaining to sustainability.
- *Sustainability Tasks.* Between the second and third Sustainability Reviews, the two teams will seek and provide Sustainability Performance Advice as part of pre-planning application meetings. This task will give both teams a chance to share information and knowledge about the proposed design and its potential performance in terms of sustainability before the formal performance assessment at the third Sustainability Review.
- *Sustainability Review.* Once the Development Team has created a detailed design for the project and discussed sustainability performance with the Project Sustainability Group, the designs will be evaluated against the Sustainability Agenda

by the latter. Agreement between the detailed design and the Sustainability Agenda allows a “go-no go” decision for submission of a planning application. Disagreement suggests that the two teams will have to look at the Sustainability Advice given previously and will have negotiate further sustainability tradeoffs.

- *Stage 4: Detailed Design Implementation.* In Stage 4, the actions of the Development team correspond to stages/phases in construction management and architectural processes (e.g., Phase 6, Coordinated Design, Procurement and Full Financial Authority, of the Process Protocol; Stages F through L of the RIBA Plan of Work). Pending planning permission, the project will begin construction.
- *Sustainability Tasks.* Once the project is built, both teams will agree on a Strategy for Sustainability Monitoring, which outlines management and maintenance plans for the site and the surrounding context in the short- and long-term. The strategy should incorporate a budget, timeline and a list of stakeholders who will manage and maintain the project over its lifetime.
- *Sustainability Review.* The two teams will review and assess the Strategy for Sustainability Monitoring, using the Project Sustainability Reviews to guide assessment. This assessment offers a formal benchmark against which future urban design decisions can be compared and evaluated.

As part of discussions about sustainability, findings from the urban experience, urban policy and urban form themes can be incorporated at different stages of process. Moreover, decision-makers can be prompted to consider these issues through the use of various tools and resources, created or sourced during the *VivaCity2020* project (see Table 1). Finally, the improved process shows that two types of decision-making teams—the Project Sustainability Group and the Development Team—are needed to deliver more sustainable urban design and development projects, and that these groups may change over the course of a project, depending on needs, skills and experiences.

Table 1: Tools and resources to be used throughout the urban design process.

Stages of the improved urban design process	Tool or resource to be used at/between urban design process stages
Between Stages 0 and 2	<ul style="list-style-type: none"> • Bibliographic review of mixed-use: organized by theme; includes books, web site, journals and conferences • Environmental quality case studies: explains innovative, qualitative and quantitative methods for capturing environmental quality in London, Manchester and

	<p>Sheffield; discusses findings related to residents' experiences within city centers and measured levels of greenhouse gases</p> <ul style="list-style-type: none"> • Housing case studies: shows residential areas in three city centers—London (Clerkenwell), Manchester (Hulme) and Sheffield (Devonshire Quarter)—and the various types of housing that have been built in the UK from the 1820s until the present day • Livability postal survey: based on the Government's "livability agenda" to capture residential satisfaction in an area. It comprises 24 questions, divided into four themes: upkeep and management of public space and buildings, road traffic and transport-related issues, abandonment or non-residential use of domestic property and anti-social behavior • Night-time economy and crime case studies: explores the relevant literature in detail as well as the night-time economy and crime in London, Manchester and Sheffield • Retail and crime case studies: explores the relevant literature in detail as well as retail and crime in London, Manchester and Sheffield • Space Syntax analysis: shows the relationship between street layout and residential property value using Council Tax Bandings, locational variables, age, property size and ambient density; shows the value and formation of urban centers by exploring the Space Syntax theory of Centre Formation, comparing different high streets using graphical representation and statistical analysis • Toilet user personas: each persona is an 'archetypal user', created in collaboration with user groups in research about city centre toilet provision • *Toilet user surveys: used to indicate people's feelings about how provision meets, or fails to meet, the local community's needs • Urban design and the creative arts: using data from the
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	<p>research, two artists created videos and prints, giving an alternative insight into sustainability and the urban experience of city users and residents</p>
<p>Between Stages 2 and 3</p>	<ul style="list-style-type: none"> • Environmental quality case studies: see above • *Inclusive toilet hierarchy: identifies a hierarchy of provision in reference to away-from-home toilets; used to inform debates about the number and types of accessible toilet cubicles in any context • I-VALUL: a presentation, exploring residential burglary and street robbery and the value of personal and property security • Hulme case study: looks at the New Urbanist regeneration of Hulme, assessing whether the area has become a safer and more sustainable place to live • Open Space Strategy: quantitative data for 30 housing schemes, including figure/ground ratios of buildings and open spaces, the extent and type of non-residential uses, the public/private designation of open spaces, the local street hierarchy and the type, height, transparency and permeability of building façades and secondary boundaries (e.g., walls) • Spatial data analysis: used to map economic, social and land-use diversity in the case study areas using GIS. Can be used with Space Syntax to identify street and pedestrian routes and on-street surveys to identify pedestrian movement (data available for London and Sheffield) • Toilet user personas: see above • Toilet user surveys: see above • External tools: <ul style="list-style-type: none"> ○ Complex Built Environment Systems: a group interested in developing solutions to practical design, construction and managements problems ○ Cultural Planning Toolkit and Guidance ○ Design Against Crime: research, educational

	<p>material and policy initiatives that aim to improve design's effective in reducing crime</p> <ul style="list-style-type: none"> ○ Inclusive Design for Getting Outdoors: research consortium focussed on ways to improve the design of outdoor environments to enhance older people's quality of life ○ Live Work Network: an organisation devoted to providing information on live/work units ○ Space Syntax: an organisation providing an evidence-based approach to the planning and design of cities ○ Street Design Index: uses comprehensive mapping of neighbourhoods, communities and routes to enable decision-makers to consider a wide range of urban design issues (e.g., fear of crime, surveillance, amenities, signage)
Between Stages 3 and 4	<ul style="list-style-type: none"> ● Toilet design templates: building on recommendations from a wide range of British Standards, this guide is used to help design accessible and inclusive toilets
After Stage 4 and afterward	<ul style="list-style-type: none"> ● Urban design process case studies: discussed in this paper ● Spatial data analysis: see above

5 Conclusions

Undertaking urban design and development projects in the name of creating a sustainable eco-city is not an easy task. An array of people and issues make such projects fraught with difficulties and complexities. One way to provide some clarity is to visualize a process for decision-making and use it as a guide to shape decisions. Such a process can also help formalize the issues that are important to a particular context and suggest the tools and resources needed to help make decisions.

The *VivaCity2020* project did just this by exploring sustainability in urban environments and creating a process that could help decision-makers make more sustainable urban design decisions. The multi-disciplinarity of the team as well as the connections made between theory, practice (via case studies) and the WPs allowed a toolkit—process, sustainability issues and tools—to be formulated that is flexible. Thus, not only can current and future

research on urban sustainability be incorporated into the toolkit, but it helps decision-makers to better understand cities in a more holistic manner by identifying overlaps and tradeoffs as drivers of more sustainable urban design decision-making.

References

Boyko, C. & Cooper, R. (2009). The Urban Design Decision-making Process: A New Approach. In R. Cooper, Evans, G & Boyko, C. (Eds.), *Designing Sustainable Cities* (pp. 42-50). London: Wiley-Blackwell.

CABE (n.d.) The Devonshire Quarter. Retrieved on 7 August 2008, from: <http://www.cabe.org.uk/case-studies/the-devonshire-quarter>.

Cook, R. S. (1980). *Zoning for Downtown Urban Design: How Cities Control Development*. Lexington, MA: Lexington Books.

English Heritage (n.d.) Current Project: Clerkenwell. Retrieved on 17 August 2005, from: <http://www.english-heritage.org.uk/server/show/nav.1651>.

EPSRC (2010). Introduction. Retrieved on 3 August 2010, from: www.epsrc.ac.uk/about/progs/pes/sue/Pages/Introduction.aspx.

Kagioglou, M., Cooper, R., Aouad, G., Hinks, J., Sexton, M., & Sheath, D. M. (1998). *A Generic Guide to the Design and Construction Process Protocol*. Salford: University of Salford.

Report of the Leader of the Council (2004) Submission for Urban Regeneration Company (URC) Status for Central Salford. Salford: Salford City Council.

Rosenfield, P. (1992). The Potential of Transdisciplinary Research for Sustaining and Extending Linkages between the Health and Social Sciences. *Social Science & Medicine*, 35 (11), 1343-1357.

Rowley, A. (1994). Definitions of Urban Design: The Nature and Concerns of Urban Design. *Planning Practice & Research*, 9 (3), 179-198.

Sheffield City Council (2001) Devonshire Quarter Action Plan. Sheffield: Sheffield City Council.

Sheffield City Council (2004) Sheffield city-centre urban design compendium. Sheffield: Sheffield City Council. Retrieved on 29 June 2005, from: http://sccplugins.sheffield.gov.uk/urban_design.

Yin, R. K. (2003). *Case Study Research: Design & Methods*. Thousand Oaks, CA: Sage.