DEVELOPING AN URBAN SUSTAINABILITY ASSESSMENT PROTOCOL REFLECTING THE PROJECT LIFECYCLE

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Recent years have witnessed a recognised shift in the manner that sustainability assessment requires to be considered within building projects. In evolving away from its sole consideration as a technically based exercise, recognition has emerged of its role as contributing to a wider subjectively based approach to decision-making, that aids in the promotion of sustainability through stakeholder engagement, mediation and critically as a stimulus for learning. In order for practitioners to engage and aid the delivery of such an approach, sustainability assessment requires to be viewed as a process which is applied throughout the project lifecycle. The role of sustainability assessment across the lifecycle is addressed, in order to reflect the variations observed in the assessment tools applicable and the profile of the stakeholders involved. A cross- mapping exercise of established interpretations of the project lifecycle was conducted including the RIBA Plan of Work 1999 and 2007, Process Protocol, Building Design Management Process, the OGC Gateway Project Process and the HOK Integrated Design Process. A range of interpretations of sustainable design processes were surveyed and analysis was conducted to explore their relationships and implications for developing an Urban Sustainability Assessment Protocol. The emerging protocol is based around an adaptation of the RIBA Plan of Work 2007 which has been verified with a range of practitioners through a series of interviews. Across the protocol it emerged that each of the outlined activities related in their function to five generic phases for managing sustainability assessment across the project lifecycle i.e. scoping, sustainability planning, assessing, monitoring and auditing.

Keywords: communication, education, lifecycle, project management, sustainability.

INTRODUCTION

Sustainability assessment is recognised as a 'process to identify, predict and evaluate the potential impacts of a range of initiatives and their alternatives on the sustainable development of society' (Therivel *et al.* 1992). The nature of its evolution in relation to the built environment has been the subject of much debate over the past decade. Increasingly assessment is perceived as a necessary tool for understanding the social, economic and environmental consequences associated with the way we design, build,

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operate, maintain and ultimately dispose of buildings and their support systems (El-Haram *et al.* 2007). Despite this, the lack of a common framework and language with which to consider and assess sustainability has restricted the ability of practitioners to successfully interact with it through assessment (Deakin *et al.* 2002). This combined with the absence of a truly integrated assessment tool that is sufficiently inclusive, holistic, multidimensional and capable of addressing the integrated nature of sustainability, is argued to have resulted in the absence of a useable approach for practitioners to aid in its delivery within current building projects (Brandon *et al.* 1997). This is coupled with concern over the lack of integration between current assessment practice and the decision-making processes at all stages of the lifecycle and scales of urban development (Lee 2005). Kaatz *et al.* (2006) advances this by arguing that only when sustainability is integrated with the building process, and not purely as an element of it, can both the concept and its implications begin to be understood.

Walton *et al.* (2005) in a review of 675 assessment tools identified significant variation in the nature of their applicability and function, and in the profile of the stakeholders involved over the course of the project lifecycle. Pahl-Wostl (2002) argues that predominantly these tools are applied in a reactive manner, focusing simply on understanding and quantifying the flow of resources intended to be used within the project. Recent awareness has emerged that such an approach is inadequate to support the predominantly subjective nature of the decision-making processes surrounding sustainability in the built environment (Pahl-Wostl 2002). In order to engage with this dimension, assessment requires to emerge as a tool for promoting communication and learning about sustainability across the building process (Kaatz *et al.* 2006), in a manner that uses factual knowledge to guide decision-making and not to constrain it (Wilkins 2003). This would provide the opportunity to proactively instil sustainability into the processes and practices of the project, and allow the various stakeholders to engage and contribute to its direction.

Such an approach undoubtedly represents a considerable shift for practitioners, and it is important to aid their understanding of its implications if the desired integration of sustainability with the building process is to be delivered. In order to achieve practitioner recognition, there is a need to consider the role of sustainability assessment in relation to each stage of the project lifecycle. By allowing practitioners to relate the activities of the assessment to the practices associated with their own roles, a greater understanding can be generated and potential buy in achieved. It is anticipated through this, that the activities of assessment can be applied to guide the decisions and practices of the project and enable practitioners to be proactive in their approach to sustainability. In advocating this, the assessment must be viewed as a process to inject sustainability into the project, in a manner that provides the opportunity for practitioners to effectively engage with the wider stakeholders in a meaningful way.

This paper presents the methodology and findings of a mapping exercise that set out to identify the activities and deliverables of sustainability assessment reflective of each stage of the project lifecycle. Similar work was conducted by Khalfan *et al.* (2002) in the development of the Sustainability Process Protocol Framework. Although acknowledging points of assessment, Khalfan *et al.*'s work primarily focused on sustainability management within the project lifecycle, and a need has been identified to establish a detailed protocol specific for sustainability assessment. Discussions with practitioners supported such an approach as sustainability is viewed increasingly

as a concept that needs both consideration and management throughout the different lifecycle stages of the project. This paper represents an output from the EPSRC sponsored SUE-MoT (Sustainable Urban Environment – Metrics, Models and Toolkits) research consortium comprising Dundee, Glasgow Caledonian, Loughborough and St Andrews Universities.

RESEARCH METHODOLOGY

Instead of reinventing the wheel, it was felt that a mapping exercise of both established and emerging interpretations would provide a sufficient basis from which to identify the key activities and deliverables associated with sustainability assessment across the project lifecycle. Recent years have seen the emergence of a variety of interpretations of the lifecycle itself, and of the consideration of sustainability in relation to it. A review of this nature aims to provide an overview of the approaches to sustainability taken by the various project teams contributing to its lifecycle (i.e. project planning and design, construction, facilities management and demolition). Traditionally sustainability is viewed and considered by each of these teams from their own perspective, therefore failing to establish a generic overview across the project lifecycle. Two phases of mapping aim to view these in relation to each other, and to identify an understanding of the individual activities and deliverables relating to sustainability assessment across the lifecycle of the project. For the purposes of ensuring an unbiased output from the analysis, a grounded theory approach (Glaser and Straus 1967) was adopted to ensure that the findings emerged specifically from the mapping exercise and were not influenced by any preconceptions held by the researchers.

The first phase involved the identification of a suitable interpretation of the stages of the project lifecycle around which to structure the emerging protocol. Those considered were the Royal Institute of British Architects (RIBA) Plan of Work (RIBA 1999 2007), Process Protocol (Aouad *et al.* 1998), Building Design Management (Gray and Hughes 2001), Office of Government Commerce Gateway Project Process (OGC 2007) and the HOK Integrated Design Process (Mendler *et al.* 2005). These were cross mapped to expose their commonalities and differences. A requirement of this exercise was to identify and adopt an interpretation of the project lifecycle that was both relevant and familiar to practitioners. Consideration of the various interpretations revealed that the RIBA Plan of Work 2007 provided the most recognisable interpretation, and this was supported by practitioners representing each of the project teams involved across the lifecycle during a series of interviews (Twelve in total). As a result, the stages of the RIBA plan of work 2007 became the spine of the mapping exercise with the other interpretations placed in relation to it.

The completed map was evaluated against similar work conducted by Hughes (2001), which acknowledged the established nature of the RIBA Plan of Work, the sufficiency of its level of detail and its broad familiarity with practitioners. Hughes's (2001) work precedes the launch of the RIBA's plan of work 2007, and criticised the traditional absence of many management issues relating to the entire lifecycle of a project, a concern that was shared during this research prior to the launch of the 2007 version. It was felt that the latest version makes some attempt to acknowledge the contrasting management roles within project teams reflective of the increasing variation in procurement routes. Examples of this can be seen in the improved consideration of activities related to project planning and post- practical completion, when comparison is drawn with the 1999 version. In addition, the language used in the 1999 version

was felt to solely reflect an interpretation of the project lifecycle from the perspective of the traditional role of the architect. For the purpose of the mapping exercise, the 2007 version was judged to sufficiently reflect a more complete interpretation of the project lifecycle and the evolving role of the architect. However, during interviews a need was identified to also reflect the OGC Gateway stages (2007) in the presentation of the final protocol. This identification was supported through its inclusion as a point of reference against the reclassified stages displayed in the RIBA Plan of Work 2007. As a result, a decision was taken to visually represent the emerging protocol around the same structure as the RIBA Plan of Work 2007, so that practitioners can then relate the activities of the protocol directly with those outlined in the plan of work.

The second phase involved the addition to the map of a range of interpretations of the sustainable design process (with some including construction and operation stages) and analysis was conducted to consider their relationships and implications for the development of the protocol. Those included are presented in Table 1.

Table 1: Sustainable design processes included in mapping exercise

Sustainable design processes	Actvities sustainability assessment observed during Appraisal and Design Brief RIBA work stages
Minnesota Sustainable Design Guide: Environmentally Responsive Design Process (University of Minnesota, 1999)	Develop green vision Established project goals and green design criteria Set priorities Review laws and standards
Sustainable Building Technical Manual- green guide (Ossa et al., 1996)	Local government information Define sustainability site criteria
The HOK Guidebook to Sustainable Design (Mendler et al., 2005)	Identify sustainable goals Identify unique client needs Unique opportunities for project/ client Analyse RFP for sustainable opportunities
Dundee City Council's Sustainable Design Checklist (Dundee City Council, 2003)	Compliance with planning policy regulations Adequate assessment of environmental impact Consideration of planning policy and regulations
Sustainable Settlements: a guide for planners, designers and developers (Barton et al., 1995)	Not applicable at this stage
Low Energy Design Guidelines: Low Energy Design Timeline (US Federal Energy Management Programme, 2001)	Not applicable at this stage
Putting a Price on Sustainability: Sustainability Issues to Consider During the Lifetime of a Building (BRE and Cyril Sweet, 2005)	Feasibility: consider location, scope for renewables, set targets, consider tool
Improving the Quality of Life in Large Distressed Urban Areas: Integrating Assessment into the Regeneration Process (LUDA, 2007)	Visioning
Framework for Sustainable Construction Procurement (OGC, 2007)	Identify major risks and issues relating to sustainability and access compliance with current sustainability policy or issues
VivaCity 2020: where sustainability is embedded into the process (Boyko et al., 2005)	Creating teams, appraising the situation and forming goals

Those cited in Table 1 were deemed to be representative of the emerging guidance presently available to help practitioners consider sustainability across the lifecycle of a project. It is necessary that together they provide coverage of the entire project lifecycle and reflect the sustainability considerations and activities of assessment related to the projects preparation, design, pre- construction, construction, use (RIBA stages) and demolition. Each represents an approach to sustainability that is understood from the perspective of the various project teams and reflects the distinct phases of the lifecycle it aims to represent. Each was placed on an XL spreadsheet structured around a spine of the stages of the RIBA plan of work 2007 and supported by the other interpretations previously discussed. Table 1 illustrates an example of this for the Appraisal and Design Brief stages of the RIBA. This allowed the sustainability considerations to be understood in relation to the activities and decisions associated with each individual stage, but also to view them in relation the overall project lifecycle. For each stage of the RIBA plan of works 2007, a generic set of activities and deliverables of assessment were developed from the cross map. This represented an attempt to rationalise the language used by the various practitioners during the different phases of the project lifecycle and to provide a generic interpretation.

Consideration of the cross map revealed that the role of assessment varies across the different stages of the project lifecycle, and reflects the contrasting nature of the support required from assessment during each stage. The cross map revealed that during the early stages of the project, a need exists to identify the sustainability considerations that require to be incorporated in its development, and to develop a means of ensuring its delivery over the course of the project lifecycle. The application of assessment 'tools' across the rest of the project lifecycle, was identified to reflect where appropriate a variety of functions aimed at aiding decision making by either guiding the development of the design or predicting, monitoring and auditing its performance in the delivery of sustainability. This provides a means by which an approach to applying sustainability tools for assessment can be considered and understood across the project lifecycle. The interpretations displayed in the cross map provided coverage of the traditional activities associated with each of the stages of a project, and illustrated how sustainability is being considered and its assessment incorporated. The cross mapping exercise provides the basis for the development of a protocol that can be considered by practitioners around an interpretation of the project lifecycle that all practitioners understand.

URBAN SUSTAINABILITY ASSESSMENT PROTOCOL

Appendix 1 presents the Urban Sustainability Assessment Protocol (USAP) emerging from the mapping exercise, illustrating the activities and deliverables relevant for each stage of the RIBA Plan of Work 2007 and OGC Gateway (2007). Across the protocol it emerged that each of the outlined activities related in their function to five generic assessment phases i.e. scoping, planning, assessing, monitoring and auditing; identified as necessary to manage sustainability assessment through the project lifecycle as shown in Figure 1. Appendix 1 highlights the iterative nature of the activities across the project lifecycle. The findings demonstrate sustainability assessment as a consideration that requires to be managed across the development project lifecycle even if this is not yet realised in practice. In presenting a protocol around a recognisable interpretation of the project lifecycle, it is anticipated that this will aid in the education and encouragement of its adoption in practice.

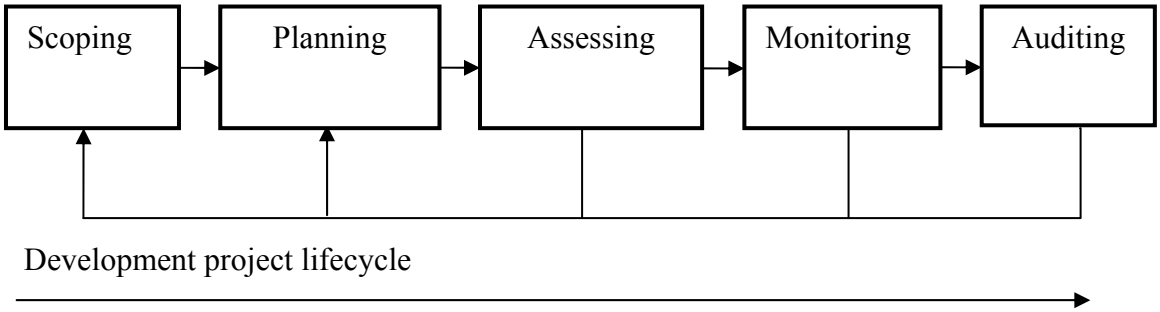

Figure 1: Phases of sustainability assessment and the project lifecycle

The scoping phase comprises activities related to establishing a sustainability vision, identifying sustainability issues, and setting sustainability goals and targets that are reflective of the context of the project. The USAP identified these activities as taking place during the preparation stages of the RIBA, a point of the project lifecycle that is associated with defining and setting the objectives for the project, increasingly through the engagement of the stakeholders. This is the point where many decisions are taken that to a certain extent are irreversible later in the lifecycle. By integrating the scoping activities at this point, it is anticipated that the context will be proactively

defined for the remaining phases of the assessment and thus inform the decisions and processes implemented throughout the remainder of the project. In viewing these activities as part of the projects wider definition, the scoping phase aims to ensure that stakeholders are engaged in the consideration of the direction of projects sustainability objectives, and that their values are expressed in the goals and targets around which the assessment is defined.

If a proactive approach to sustainability is to be delivered, activities of planning are necessary to ensure that the sustainability goals and targets set are appropriately assessed, monitored and audited at relevant points during the project lifecycle. In the early stages planning ensures that the appropriate tools are selected and any issues associated with the application of the tool accounted for. Across the remainder of the lifecycle, the role of planning is iterative by nature and involved in the management of the implementation of the assessment; and in relation to the evolving nature of the project to evaluate and refine the sustainability goals and targets. The USAP displays the role of assessing; monitoring and auditing sustainability relevant to each stage of the RIBA Plan of Work. It is necessary to understand the variation in these roles over the different stages, as this has implications on the function, and nature of tool or technique applied. The USAP is structured to ensure over the project lifecycle that the outcomes of individual tools (whether assessing, monitoring or auditing) are fed back through planning to the evaluation of the sustainability goals and targets defined in the early stages of the project. This feedback is necessary if the assessment is to inform the decisions and processes of the project, whether by allowing adjustments to be made to ensure the sustainability goals and targets are met in practice or to re-evaluate their appropriateness.

A series of interviews were conducted with practitioners representative of each of the project teams involved during the project lifecycle in order to validate the emerging USAP from the mapping exercise. Twelve interviews in total were conducted with client representatives, members of the design team, construction team, those involved in facilitates management and those conducting the assessment. Their input was valuable in aiding the development of a language within the USAP that reflects practice at each stage.

The research team was conscious of the dangers of imposing a preconceived structure on to the emerging USAP. Given the established nature of Khalfan *et al.*'s (2002) Sustainability Process Protocol Framework and its Sustainability Management Activities Zones (SMAZ), care was taken to avoid its inclusion and influence during the mapping exercise, especially during the process of distilling the individual activities. This approach provided the benefit of allowing the SMAZ to be used for the purposes of validating the emerging USAP. A comparison of the two is displayed in Table 2. This illustrates the strong similarity between the alignments of the identified points of assessment. However, it was noted that in recent years the current evolution in the understanding of the project lifecycle and its relationship with sustainability has provided the opportunity within this research to go further and provide a USAP that is specific for sustainability assessment.

Table 2: A comparison of the activities of the USAP vs. SMAZ (Khalfan et al. 2002)

RIBA phases	Urban Sustainability Assessment Protocol	SMAZ C- Sand
Appraisal	Develop a sustainability vision for the project	Prepare Sustainability Mission Statement for the Project
	Identify major issues relating to sustainability	Scope Sustainability Issues
	Set sustainability priorities based on context	Prepare Sustainability Matrix for the Project
	Establish and define sustainability goals, targets and KPI's	Prepare Sustainability Plan
	Demonstrate compliance with current sustainability initiatives	
Design Brief	Review sustainability issues, goals, targets and KPI's	
	Develop and implement procedures to monitor and record sustainable targets	
	Identify the certification and testing measures for sustainability assessment required	
	Review all existing sustainability directives and policies to ensure compliance	
Concept	Re- evaluate sustainability targets required to meet project goals	Revise Sustainability plan
	Create a plan to achieve sustainable goals, coordinate with project work plan	Undertake Sustainability Pre- Assessment of Outline Conceptual Design
	Assess need for a preliminary sustainability assessment	
Design Development	Implement sustainability action plan in the schematic design	
	Implement preliminary sustainability assessment to guide the design	
Technical Design	Continue to evaluate sustainability action plan in the technical design	Undertake Sustainability Assessment of Full Conceptual Design
	Monitor and ensure that sustainability objectives and targets are maintained	Revise Sustainability Plan
	Conduct detailed sustainability assessment of the design	
Production Information	Ensure information produced includes sustainability action plan, and sustainability goals and targets	Monitor Production Information Against Sustainability Plan
		Revise Sustainability Plan
Tender Documentation	Ensure tender documentation includes sustainability action plan, sustainability goals and targets, and relevant sustainability documentation	
Tender Action	Assess ability of tender to comply with sustainability goals and targets	
	Monitor compliance with sustainability goals, targets and KPI's	
Mobilisation	Evaluate sustainability action plan associated with mobilisation stage	
	Monitor implementation and compliance with sustainability goals and targets for mobilisation	
Construction to Practical	Evaluate sustainability action plan during construction	Monitor Construction Against Sustainability Plan
	Assess sustainability of completed building	
Completion	Monitor implementation and compliance with sustainability goals, targets and KPI's	
	Audit implementation and compliance with sustainability goals, targets and KPI's	
Post practical Completion	Implement systems to monitor sustainability performance during occupation and post- occupancy	Monitor Construction against Sustainability Plan
	Assess sustainability performance of the building	Compile Post- Construction Review Against Sustainability Targets
	Monitor sustainability performance during occupancy against targets and KPI's	
	Audit sustainability performance during occupancy targets and KPI's	

FUTURE RESEARCH

At present, research is under way to validate the emerging USAP against a series of active projects which are considering sustainability and its assessment. The case studies have been selected to represent a variety of sectors (housing, schools, hospital, commercial and office) and procurement routes in order to test how the findings relate to practice. Since the emerging protocol is representative of generic practice, a useful comparison will be drawn between this and the practical reality encountered. As a result, this will provide the opportunity not only to validate the work for its accuracy across different sectors and procurement routes, but also to allow conclusions to be drawn regarding the barriers encountered to achieving it.

CONCLUSIONS

Presented are the findings of a mapping exercise aimed at developing an Urban Sustainability Assessment Protocol (USAP) that outlines the assessment activities and the relevant deliverables for each stage of the project lifecycle. The paper provides the background to the methods adopted during this exercise, its development and validation. The USAP aims to act as an aid for practitioners when considering the management of sustainability and its assessment across the project lifecycle in a manner that is proactive and integrated within the building process.

In structuring the USAP around a familiar interpretation of the project lifecycle it is hoped that practitioners will be able to consider the suggested approach to assessment in a manner they can understand and relate to their own role. The iterative nature of the activities associated with the phases of assessment emerging in the research, illustrates an approach that advocates a proactive role for sustainability assessment

that attempts to satisfy calls for a greater degree of integration with the decisions and practices of the building process.

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Appendix 1

Urban Sustainability Assessment Protocol

RIBA work stages 2007			Activities	Phase of assessment	Deliverables	OGC gateways
Preparation	A	Appraisal	•Develop a sustainability vision of the project •Identify major issues relating to sustainability •Set sustainability priorities based on context •Establish and define sustainability goals, targets and KPI's •Demonstrate compliance with current sustainability initiatives	•Scoping •Scoping •Scoping •Scoping •Scoping	•Sustainability vision statement •Statement of sustainability issues •Initial list of sustainability priorities •List of sustainability goals and targets •Demonstrated compliance with sustainability policies and KPI's	Business justification
	B	Design brief	•Review sustainability issues, goals, targets and KPI's •Develop and implement procedures to monitor and record sustainable targets •Identify the certification and testing measures for sustainability assessment required •Review all existing sustainability directives and policies to ensure compliance	•Scoping •Planning •Planning •Planning	•Initial list of sustainability targets for the project •Initial sustainability action plan	Procurement strategy
Design	C	Concept	•Re- evaluate sustainability targets required to meet project goals •Create a plan to achieve sustainability goals, coordinate with project work plan •Assess need for a preliminary sustainability assessment	•Scoping •Planning •Assessing	•Reviewed list of sustainable goals and targets •Sustainability action plan	Design brief and concept approval
	D	Design development	•Implement sustainability action plan in the schematic design •Implement preliminary sustainability assessment to guide the design	•Planning •Assessing	•Preliminary sustainability assessment to modify the design if necessary	
	E	Technical design	•Implement sustainability action plan in the technical design •Monitor and ensure that sustainability goals and targets are maintained •Conduct detailed sustainability assessment of the design	•Planning •Monitoring •Assessing	•Detailed sustainability assessment	Detailed design approval
Pre- construction	F	Production information	•Ensure information produced includes sustainability action plan, and sustainability goals and targets	•Planning	•Compliance of production information with sustainability goals and targets	
	G	Tender documentation	•Ensure tender documentation includes sustainability assessment plan, sustainability goals and targets, and relevant sustainability documentation	•Planning	•Compliance of tender document with sustainability goals and targets	
	H	Tender action	•Assess ability of the tender to comply with sustainability goals and targets •Monitor compliance with sustainability goals, targets and KPI's	•Assessing •Monitoring	•Compliance of tender action with sustainability goals and targets	Investment decision
Construction	J	Mobilisation	•Evaluate sustainability action plan associated with mobilisation stage •Monitor implementation and compliance with sustainability goals and targets for mobilisation	•Planning •Monitoring	•Compliance of mobilisation with sustainability goals and targets	
	K	Construction to practical completion	•Evaluate sustainability action plan during construction •Assess sustainability of completed building •Monitoring implementation and compliance with sustainability goals, targets and KPI's •Audit implementation and compliance with sustainability goals, targets and KPI's	•Planning •Assessing •Monitoring •Auditing	•Sustainability performance report of construction process, demonstrating compliance with sustainability goals, targets and KPI's •Sustainability performance report for the completed building	Readiness for service
Use	L	Post practical completion	•Implement systems to monitor sustainability performance during occupation and post- occupation •Assess sustainability performance of the building •Monitor sustainability performance during occupancy against targets and KPI's •Audit sustainability performance during occupancy against targets and KPI's	•Planning •Assessing •Monitoring •Auditing	•Sustainability manual for occupancy •Sustainability performance report, demonstrating compliance during occupancy of the sustainability targets and KPI's	Benefits evaluation