Building a Generic Methodological Framework for a Sustainability Tool Tailored for Architect-Designers

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ABSTRACT

Success in sustainable building depends on a number of factors. Within the competency of project participants, it is crucial that architect-designers have the knowledge and ability to adopt the issues of sustainable building into their designs. An approach on the way towards sustainable architectural designs is to apply methods and tools. These tools aim to act as a bridge, an interface between scientific proven knowledge and the daily practice of architect-designers. Although the use of sustainability tools by design teams is increasing, the present state of contemporary designs regarding the full scope of sustainability indicates a gap, an inadequacy of existing tools.

The target of this research is to build a generic methodological framework for a sustainability tool specifically tailored for architect-designers. First, a literature study identifies specificities of determining factors, resulting in supposed criteria for aimed tool. Second, a review on existing kinds of sustainability tools is carried out. Synthesized issues are pointed out and the assumed inadequacy is verified. Third, an outlook is proposed. Based on identified criteria and issues, a presumed promising concept for aimed tool is delimitated and a set of starting points for the further development are selected. Finally, a proposition for the generic methodological framework is formulated.

The result of this exploratory study is a confirmation of the hypothesis that prevailing up front kinds of sustainability tools are inadequate for architect-designers. Suggested generic methodological framework is seen as a possibility for the development of an operational sustainability tool specifically tailored for architect-designers.

INTRODUCTION

The demand and urge for sustainable development has been increasing the last decades. Due to the multi-dimensional complexibility of the concept of sustainable development in combination with the complexibility of the building sector, the gradation of multidisciplinarity and the size of project teams are expanded. In response, the need for well-understood planning and design processes of sustainable built environments has also been increased (Abdalla et al., 2011).

On the top of critical success factors for delivering a sustainable project is the competency of project participants (Bakar et al.). Whatever the 'project delivery system' is, it is seen that the architect-designer fulfills a central role in the project team (Molenaar et al., 2009). As a consequence and by extension, it can be stated that the architect-designer plays a crucial role in delivering sustainable built environments.

A generic and ever expanding approach on the way towards sustainable building is to apply methods and tools. These enable the planning team to identify the effects and interactive relationships of

social, economic and ecological dimensions, and deal with these in the planning and/or construction process. (Hegger et al., 2008, p.191). Despite the huge range of tools on the market, the awareness of their existence and the increasing implementation by project teams, the built environment still indicates a gap regarding sustainability. This gives rise to the presumption of an inadequacy of existing methods and tools for sustainability. Given the earlier stated central role of the architect-designer, this inadequacy could be related to incompatibilities, and/or contradictions between the user and the method / tool.

Given a transition towards a sustainable built environment is necessary and architect-designers display a wavering approach, a specific tailored tool for architects is desirable, advisable, and could be successful. The primary objective of this paper is the development of a generic methodological framework for a sustainability tool specifically tailored for architect-designers.

In order to develop a tailored tool, the aimed user has to be known, identified and recognized. First, a literature study identifies specificities of determining factors, resulting in supposed criteria for aimed tool. Second, a review on existing kinds of sustainability tools is carried out. Synthesized issues which the aimed tool should address are outlined. Third, an outlook is proposed. Based on identified criteria and issues, a presumed promising concept for aimed tool is delimitated and a set of starting points for the further development are selected. Finally, a proposition for the generic methodological framework is formulated.

This paper adds to the knowledge of sustainability tools. By explicitly taking into account and focusing specific features of the architect-designer and the process of designing, it stresses the need for a new approach for, and development/ discussion of tools within the field of architectural designing.

This paper is derived from the first part of an ongoing doctorate dissertation on sustainable group housing projects (Janssens, ongoing). This specific research is an explorative attempt for the building of aimed generic methodological framework rather than a research with strict conclusions. The outcome is tentative and preliminary and needs further discussion and verification, both in the fields of academics and practitioners. Outcomes highly depend on conducted literature study of selected corpus of sources, and are not supposed to be salutary or the only possible ones.

DEVELOPMENT OF SUPPOSED CRITERIA FOR AIMED TOOL

Identification of influencing factors

Following aspects are believed to affect the composition of criteria: ‘the architect-designer’ as the actor, ’designing’ as the activity, ‘the built environment’ as the object and finally the aim of ‘a sustainable development’.

The object: the built environment. The built environment relates people to spaces through built forms. It ranges in scale from interiors, buildings, neighbourhoods to districts and cities, including their supporting infrastructure. It refers to a broad-ranging interdisciplinary field that addresses design, construction, management and use. The built environment could be defined as the human-made space or surroundings that provide the setting for human activity, live – work – recreate, on a day-to-day basis. It comprises an infinite variety of functions to meet the endless range of human interests and proclivities. In another sense, the built/constructed environment involves some of the most elaborate forms of artifice—varieties of materials, complex engineering, infrastructures of technical interconnection and relationships to nature. The built environment refers to a practice-oriented discipline, in which the end product is a material, spatial and cultural product of human thinking and labor, taking into account interactions among the constructed, social and natural environments.

The aim: sustainable development. The essence of sustainable development is to provide for the fundamental needs of humankind in an equitable way without doing violence to the natural systems of life on earth (Kemp & Martens, 2007). Following Our Common Future (WCED, 1987), numerous efforts were made to operationalize the concept. The most common is the triangular representation with three pillars ‘environment’, ‘society’ and ‘economy’. In some contexts these pillars come to be referred to as ‘Planet, People, Profit’ (Elkington, 1997).

Concerns for the relationship of humans to environment, natural and built, increasingly deploy the rubric of sustainable development, making it one of the fundamental concerns of contemporary times. The definition of Our Common Future has been interpreted in many ways, caused by the fact that the

vision and the description are linked to many different aspects. Some interpretations give the notion that sustainable development is a specific field or discipline, other emphasizes the dynamics emerging from different imperatives. Either way, the vision concerns complex, multi-disciplinary problems that have to be handled from both holistic and analytical approaches.

The activity: designing. Despite real differences between the end products created by designers in various domains, design can be seen as a generic activity: 'Many forms of design then, deal with both precise and vague ideas, call for systematic and chaotic thinking, need both imaginative thought and mechanical calculation' (Lawson, 2005, p.4). Nevertheless considerable revisions about design theory, several authors claim that our current understanding of design is still incomplete. This does not imply that designing is mysterious and obscure, but that it is complex (Lawson, 2005). Tjallingii (Tjallingii, 1996) states that designing is the creation of promising combinations and opportunities regarding the physical context, the use and management.

The actor: the architect-designer. The working field of the architect-designer is the built and yet to build environment, ranging in different scales and specialties. Literature is vague and apparently no one feels able to offer a succinct description that they are confident would be widely agreed upon and yet fully describe the work of all architects. Lawson (Lawson, 2004, p.1) states: 'It is quit impossible to find two people who call themselves architect and yet hardly share any of their daily tasks'. Following Lawson (2005, p. 4), the working field of the architect-designer lies near the middle of the spectrum of design activity. Design in the built environment requires both technical knowledge and expertise, as well as visual imagination.

Pinning down synthesized features of actor and activity factors

Factors of the actor (the architect-designer), and the activity (designing) are complex and heavily loaded. A commonly accepted defined framework is inexistent. However, for the purpose of this research, a self-compiled set of widely subscribed features was made, backed by selected corpus of relevant sources. Synthesized features are provided in table 1. Within the scope of this paper, providing referencing notes on displayed features is not possible. Therefore only general references are given: Cross, 2006; Lawson, 1980; Lawson, 2004; Lawson 2005; Rehal, 2002; Van Dorst, 2005.
Classified features may not be seen as strict, as there is a strong overlap in, and interdependence of, characteristics of the 'architect-designer' and 'designing'.

Table 1. Synthesized features of actor and activity.

The actor: 'the architect-designer'	The activity: 'designing'
Explicit & implicit knowledge	Exploratory & satisficing
Different levels of expertise & experience	Responsive & integrative
Complexity management	Convergent & divergent
Solution focused	Resultant, emergent & abductive
Metaphoric appreciation	Reflective (simulating) & ambiguous
	Iterative, personal & unique
	Narrative & imagery

Cross-factor reflections

Sustainable building is a combination of disciplines, a necessary package deal to prevent us from trade off effects. This complexity describes the problems of sustainable development and at the same time shows the daily practice of an urban designer or planner. The practice of finding 'promising combinations' (Tjallingii, 1996) is the common ground for sustainable transition and design. In a designerly way of thinking one combines possible solutions from disciplines which are by nature different (Van Bakel, 1995) (Cross, 2006).

In both aspects, built environment and sustainable development, there are no right or wrong answers. Actions must be decided in process of negotiation and dialogue, and the long-term perspective is central within the quest. Lundeqvist (1995) and Edén (2002) conclude that features of sustainability resemble, in general, any traditional design problem. Because the similarities between features of the

built environment and sustainability, and the architect-designers ability of dealing with complexibility and multi-disciplinarity makes him suitable to deal with the sustainability quest. Despite sustainability is often dealt by, or pushed off to, a wide range of project partners, the architect-designer can and should take up the mandate in view of sustainable successes in a designerly way. Both aspects, sustainability and the built environment, are so complex that chances for success largely depend on the knowledge, a deep understanding and experience of the architect-designer. It is important that this knowledge and experience building is supported, made possible and not prevented or penalized.

Supposed criteria a tool should comply

This final subsection provides an overview of criteria which a sustainability tool for architect-designers is supposed to comply with.

Table 2. Supposed criteria for aimed tool.

Supposed criteria	Description
Random usability	• No mandatory, design activity structuring successive process: free timing of startup, enter and use, free consultable, allowing an iterative, cyclical or linear process. • Allowing using different design approaches. • Serving an incremental and radical optimization of (yet to be) designed / built environments. • Meeting architect-designers' diversity: suitability to preferences and difference in levels of expertise.
Apprehensible communication	• Ensuring a transfer of knowledge and insights to the architect-designer (primary user of tool). • Ability to act as a discussion platform for project actors. • Providing an attractive/suitable display and representation of the content (photo, sketch, ...).
Problem framing	• Providing background information: identification, structuring and limiting of the problem. • Setting boundaries for the design problem (and solution): support the development of the brief. • Connecting partial problems, mutually and with the design process.
Solution focused moving	• Displaying principles, measures, concepts, combinability's. • Providing non- and contextualized exemplary solutions: single, multiple and/or integral oriented.
Source of knowledge and insights	• Inclusion of scientifically and practically proven knowledge. • Linking theoretical knowledge with practical relevance.
Enabling innovation	• Indicating the need and importance of verifying displayed facts and building episodic knowledge/insights • Stimulating knowledge building by designing. • Incorporation of incentives for own research.
Non-limiting	• Safeguarding creativity and unicity of design/project. • Space for interpretation, implicit knowledge/experience. • Balancing between prescription and freedom/voluntariness: open-ended / non-committal. • Indicating the non-restrictiveness of displayed substantive body of knowledge.

DETERMINATION OF ISSUES OUT OF EXISTING KINDS OF SUSTAINABILITY TOOLS

Identification and description of existing kinds of tools

As there is no strict classification of tools, for the purpose of this section, we suggest a threefold classification. Knowledge based or qualitative tools involve instruments providing guiding principles (e.g. 'Trias-model') on the one hand and guidelines (e.g. 'Practical Recommendations for Sustainable Construction' of the EU) on the other hand. Both kinds are based on proven knowledge and experiences.

Guiding principles offer a simple structure which has to lead to sustainable successes. They formulate generic recommendations, strategies, etc. Guidelines link sustainability in a direct way to decisions, but without offering a structure for the design process. Checklists, catalogues and directives often include targets, criteria and/or measures which can be considered or must be implemented to match set requirements. Performance based or quantitative tools include life-cycle impact assessment, outdoor and indoor social and environmental quality. Quantitative tools can focus on single or a limited amount of sustainability criteria or on multiple criteria. Single or limited sustainability oriented tools (e.g. EcoQuantum) are often developed for scientific research. Aspects of sustainability are clearly defined and demarcated (e.g. energy, material). Multi criteria tools (e.g. BREEAM) are focused on the use by practicing actors in the building sector, aiming to be implemented in practical real-life applications like buildings and neighbourhoods. A matrix assists designers in identifying design criteria, document proposed design performance and calculate the number of achieved credits, leading to an overall rating. Performance based tools, more in specific market oriented tools, can also include a rating system, often supplemented with a certification system and labelling. These labels are used in view of market positioning, recognition, publicity and entitling/obtaining funds, fiscal benefits, subsidies, grants etc.
Ad hoc tools are project specific developed tools. They can be qualitative or quantitative, or a combination of both. Usually these tools are initiated on the occasion of a large scale project like urban regeneration programs, and new neighbourhoods/districts (e.g. PIMWAG-system ECO-VIIKKI, Helsinki, Finland).

Analysis on prevailing strengths/weaknesses and synthesized issues

An exhaustive analysis with regard to displayed classification of existing kinds of tools is not a goal in itself. A quick suitability scan in a general perspective leading to strengths and weaknesses enables uncovering issues. Table 3 provides an overview. Consulted authors are: Abdalla et al. (2011), Gowri (2005), Janssens (2013).

Table 3. Prevailing strengths and weaknesses of existing kinds of tools and synthesized issues.

Kind of tool	Strenghts	Weaknesses
Knowledge based tools (qualitative)	• Informative • Assistance in decision making • Preserve freedom and creativity • Mapping sustainability aspects on to components, indicators, measures, etc.	• No / limited and inadequate insights in mutual relations in and between theoretical and practical aspects • Vague descriptions • Comprehensive elaborations
Performance based tools (quantitative): Multi criteria	• Presumed integrality >> • Presumed accessibility >> • Indicator for quality's >> • Measuring is knowing >>	• Limited sustainability scope • Degree of expertise required • No guarantee for successes • Dubious quantifiability of criteria / scoring / weighing • Focus on criteria / indicators • Often misused as checklist
Ad hoc tools	• Project specific tailored >>	• Shadow of exclusiveness, exceptionality which is a burden for mainstreaming
Overall	• Identification and definition of sustainability, enabling communication and negotiation	• Dubious effectiveness, efficiency, complexity reduction, up-to-dateness • Susceptible to subjectivity • Extensiveness
	Synthesized issues Preserving objectivity - Providing insights - Attention for manageability – Actual Integrality - Being inspirational	

OUTLOOK FOR A SUSTAINABILITY TOOL FOR ARCHITECT-DESIGNERS

Suitability review and delimitation of a presumed promising concept

This subsection verifies the suitability of two mainstream kinds of tools using two short quotes from literature.

'*The so-called educational tools, including guidelines, rules-of-thumb and best practices seems to be more coherent with the architectural practice, in which the construction of knowledge and decision making is strongly based on referential procedures.*' (Albuquerque, 2007)

'*However, the methods of science are perhaps surprisingly unhelpful to the designer. Modern building science techniques have generally only provided methods of predicting how well a design solution will work. They are simply tools of evaluation and give no help at all with synthesis. Daylight protractors, heat loss or solar gain calculations do not tell the architect how to design the window but simply how to assess the performance of an already designed window.*' (Lawson, 2005)

Design tools are a somewhat controversial subject for architect-designers. Many architects dislike talking about their work process in terms of methods or tools, because it suggests a repetitiveness that is contradictory to creativity. It must be obvious that the specificity of architects, their design methodology and the complexity of designing is so individual that it is impossible to discover an existing or develop a tailored 'tool' which satisfies all. *'Designing is far too complex a phenomenon to be describable by a simple diagram.*' … '*The word "design" is applied to an extraordinarily wide range of activity include at one extreme something that could also be called "engineering" and at another something that could also be called "art".*' … '*Design is a highly personal and multi-dimensional process.*' (Lawson, 2004)

Delimitation of a presumed promising concept

Weaknesses of existing kinds of tools, synthesized issues and previous suitability review gives rise to the development of an innovative concept for aim framework.

- Focus on pre-design and early design considerations and later design inspiration
- Physical – spatial approach instead of a constructive technical approach
- Knowledge based instead of performance based
- Design supporting instead of design process structuring
- Solution focused instead of problem focused
- Knowledge building instead of full exhaustive and limitative display

Selection of a set of starting points for the further development

A description of the complete set of starting points is not possible within the limited length of the paper. As these starting points represents the basis of the further development of presumed promising concept, they will be discussed and documented in depth during the oral presentation. By way of illustration, two important starting points are outlined in this sub section.

General model of high level creative strategies in design. Three key aspects appear to be common in the creative strategies exercised by designers (Cross, 2006). First, taking a broad 'system approach' to the problem. Rather than accepting narrow problem criteria, often set by the client or e.g. regulations, aiming for high-level problem goals. Second, 'framing' the problem in a distinctive and sometimes rather personal way, stimulating and pre-structuring the emergence of design concepts. Third, designing from 'first principles'. Designers either explicitly or implicitly rely upon 'first principles' in both the origination of their concepts and in the detailed development of those concepts.

The phenomenology of concepts. Ramirez (2000) finds it appropriate to operate with three kinds of concepts: ideological, diffuse and compact concepts. The ideological concept hides and idealizes preferred ideas, notions and situations which are desired and may be realistic. Typical political rhetoric is very often dominated by ideological concepts, such as freedom, sustainability, quality, equality and so forth. Diffuse concepts are somewhat ambiguous and often need to be connected to a particular context, situation or experience to be understood. Diffuse concepts refer to phenomena that really exist but are

difficult to precisely describe through definitions. Compact concepts are used in science where the studied object is the concrete material world and where unambiguous, well-defined definitions and context independence are the central characteristics. While the built environment is interdisciplinary, all three kinds of concepts are necessary in de design process, whereas a specific order is relevant. Rehal (2002) states: 'In the earlier stages of the process, it is mostly diffuse and ideological concepts that are in focus. When the artefact begins to take shape, the thought process transgresses from diffuse concepts to more compact ones.' This way, concepts are used appropriate to the design stage. Complexity and subjective matters (such as aesthetics, culture, artefacts) which ought to be negotiated during the design process, are kept open as long as possible. The further compact concepts are used or developed, the more the design is ready.

Preliminary proposition for aimed tool

Taking into account the outcomes of explorative study, a process of reasoning, synthesizing and a continued evaluative leap (trial & error) to supposed criteria, results in a preliminary proposition. A knowledge structure is believed to be suitable for aimed generic methodological framework. This design supporting structure can be implemented in a cyclical or linear process of design, for random referencing, backgrounding, inspiration, ideation, and/or for selecting final solutions in whole or in part. The actual deployment of the structure depends on the preferences and level of expertise of the user.

A full description of the proposed knowledge structure is not possible within the limited length of this paper. A detailed and illustrated discussion will be the focus of the oral presentation.

The general outline of the framework approaches a gradation from theory to practice, and from problem to solution.The framework consists of implicit and explicit elements, preceded by a backgrounding and followed by a synthesizing part. Implicit elements are incorporated in the structure and content, while explicit elements are recognizable and distinctive parts as such. Implicit elements are: best real-life practice backed, cross structure referencing, suitable representation techniques, database of knowledge, building of episodic knowledge, transcending the specific, no value judgement, non exhaustive display, combinability's, satisfying and optimizing. Explicit elements are given in figure 1.

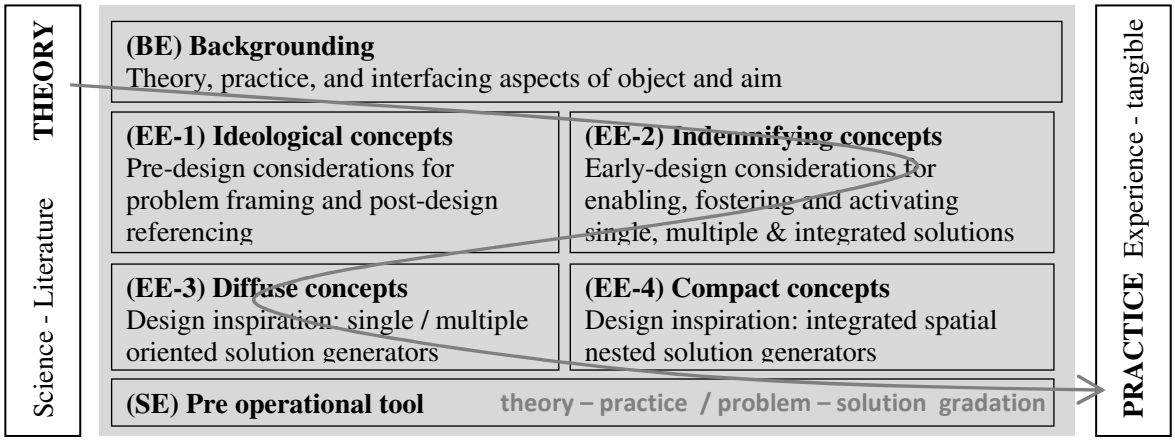

Figure 1 Explicit elements of preliminary proposed generic methodological framework.

FINALIZING REMARKS

Developing a tool, within the sustainability quest for the built environment specifically tailored for architect-designers, is an innovative but complex task. Tentative building and display of proposed framework in this paper must be seen as an incentive for discussion and further research. Experts in this field and related aspects are well placed for verification, adjusting and a further development.

The perspectives at short term are twofold. First, this research will be supplemented with a verification. Preliminary outcomes are to be presented to a selection of practicing architect-designers after which they will be asked to provide feedback. Second, in order to test the feasibility of aimed

content of the tool, a specific substantive body of knowledge will be investigated and integrated in the framework. Both perspectives enable an evaluative loop of verification and adjustments, leading to improvements. During this process it is important to constantly safeguard developed and adjusted criteria, and to prevent relapsing in issues of current sustainability tools.

The preliminary result of this exploratory study is a confirmation of the hypothesis that prevailing up front kinds of sustainability tools are inadequate for architect-designers. Suggested generic methodological framework is seen as a possibility for the development of an operational sustainability tool specifically tailored for architect-designers.

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