



International High- Performance Built Environment Conference – A Sustainable Built
Environment Conference 2016 Series (SBE16), iHBE 2016

Co-creating urban environments to engage citizens in a low-carbon future

Aaron Davis^a, Jane Andrew^{b*}

^aUniversity of South Australia, North Terrace, Adelaide 5000, Australia

^bmatchstudio: University of South Australia, North Terrace, Adelaide 5000, Australia

Abstract

As cities try to lower their carbon footprints, the concept of transforming brownfield sites into ‘eco-precincts’ has gained substantial traction. There is not yet however, an established way of combining technological innovation with social and behaviour change. The design, and operation of an ‘eco-precinct’ requires the cooperation of a wide variety of disciplines and stakeholders. Without this cooperation, there is often a disparity between the aspirations for these precincts and the final outcomes. Co-creation is increasingly being looked-to to support precinct development in that it facilitates deeper user engagement in the design process. There a number of challenges to applying co-creative models to larger scales of development. One of which is defining the user in greenfield or brownfield development. This complexity is added to by the perceived risk to budgets and timelines due to the uncertainty associated with the feedback loops of the co-creation process, and the complex power dynamics and process challenges between various professional and non-professional actors. This paper suggests that addressing these challenges is critical in facilitating a shift from ‘consultation’ (both professional and public) being considered as a discrete event (noun), to an ongoing and iterative process (verb) that can facilitate the creation of innovative user centred low-carbon urban environments.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee iHBE 2016

Keywords: Low carbon development; co-creation; architecture; urban design; end users

* Corresponding author. Tel.: +61 08 8302 9004
E-mail address: aaron.davis@unisa.edu.au

1. Introduction

As cities try to lower their carbon footprints, the concept of transforming brownfield sites into 'eco-precincts' has gained substantial traction. There is not yet however, an established way of delivering these precincts that combines technological innovation with the social and behavior change that is necessary to ensure their successful operation.

The design and operation of an 'eco-precinct' requires the cooperation of a wide variety of disciplines and stakeholders. These stakeholders are both professional and non-professional (e.g. local governments, consultants, community groups, residents, etc.). Without this cooperation, there is often a disparity between the aspirations for these precincts and the outcomes that are achieved. The Adelaide Living Laboratory project, as a part of the Cooperative Research Centre for Low Carbon Living (CRC-LCL) and the European Network of Living Laboratories (ENoLL) is testing whether the use of a co-creation methodology, where end users, industry and researchers are able to collaborate in an iterative process, can lead to an improvement in outcomes. It is also anticipated that the participatory nature of this process will help to facilitate behaviour change alongside design innovation.

To date, the co-creation approach has been most commonly applied at the scale of individual product or service development, and not at the scale of an urban development [1]. There have been various calls in the literature, and by ENoLL itself, to test co-creation at this scale [2 - 5]; but, to date there is little evidence for its application. In 2013, Concilio et. al. tested co-creation in urban applications in Finland; however, the integration of co-creation into the processes can be argued as being enhanced consultation rather than collaboration.

This paper outlines the context in which the Adelaide Living Laboratory project is applying co-creation to urban development, describes some of the key challenges being faced, strategies for addressing these challenges, and highlights areas for further research.

2. Context

2.1. *The wicked problem of low-carbon development*

As cities try to lower their carbon footprints, the transforming of brownfield or grey field sites into medium- and high-density mixed-use precincts is increasingly cited as a significant way of reducing the carbon impact of Australian cities. However, there are multiple logistical, political, and social challenges associated with the transformation of these sites that combine to make their development a wicked problem. Like the terms creativity and innovation, the definition of a 'wicked problem' has become blurred with its adoption and use within many discourses. In 1967, Rittel's ideas were published in Churchman, defining wicked problems as 'a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing.' [6]

Urban development in general, but particularly low-carbon urban development with its added complexity is closely aligned to this definition of a wicked problem. Rittel and Webber went on to explore wicked problems in the context of urban environments, suggesting that the difficulty in dealing with urban development is that there are no right or wrong answers, only good or bad, better or worse. [7] There are a vast number of ways of understanding and addressing carbon impact, but it can be argued that the existence of the problem itself is symptomatic of a higher-order problem in the relationship between people, cities and the environment.

2.2. *Urban renewal*

In recent years, the term 'urban renewal' has become popularised as a way of describing brownfield development. A brownfield site is defined by the United States Environment Protection Agency as an "abandoned, idled, or underused industrial or commercial facility where expansion or redevelopment is complicated by real or perceived environmental contamination" [8]. Brownfield sites are often in close proximity to existing transport and other city infrastructure. This means that despite remediation costs, in Australia, the redevelopment of brownfield sites into residential areas has been shown to be more financially viable than continuing greenfield developments on urban fringes [8].

The opportunity to connect with existing city infrastructure lowers the carbon impact of these developments, but the proximity of these sites to existing development also presents an opportunity to demonstrate how cities can tackle macro-scale challenges like climate change through user-focused design interventions at the meso- and micro-urban scale. Despite the technological focus of the majority of the projects within the CRC-LCL, there is a general recognition that one-star users in a six-star building or system will only achieve a two-star outcome. This suggests that education and behaviour change are as important as technological development in reducing actual carbon impact because although technological strategies can reduce predicted and modelled impacts, it is difficult for these models to translate into reality without active user participation.

2.3. Stakeholder engagement

While in almost all urban renewal projects there is an element of community and stakeholder consultation as a part of the process, there is not as yet, an established methodology for incorporating a program of user/resident engagement that can support behaviour change necessary for low-carbon living.

The behaviour change strategies that are used in urban development are often either passive or punitive. Passive strategies include town-hall type information sessions, pamphlets, and posters, while punitive measures punish poor behaviour typically through increased financial costs. Both of these strategies typically rely on the deployment of further resources after the design and construction of new developments.

Both passive and punitive strategies can be described as interventionist, and deny the importance of the intrinsic motivational factors of user groups. These models have been criticized by Shove [9] and others within the discipline of Systems Theory. These authors advocate instead for a more complex behaviour change model for sustainable decision making that combines intrinsic and extrinsic motivation and reward. Involving end-users at the start of a design process has been shown to have the dual benefits of:

- a) ensuring that the products and services being designed and created meet user needs; and
- b) helping end users not only understand the way a product or service works, but also to have an active interest in its ongoing success.

End-user involvement has been shown to lead to better economic outcomes for product or service developers by giving them access to the incredibly rich tacit- and learned-knowledge that local residents, stakeholder groups, university researchers and students are often very eager to share.

While current strategies can be said to be focused on post-construction behaviour change, a more complex but effective model would be to engage in pre- and inter-construction behaviour change, for example, seeking to use design as a means to influence behaviours that foster and support better environmental outcomes.

2.4. Co-creation

There are a vast array of labels for end-user involvement in design processes. These include user-centred design, human-centred design, collaborative-design, participatory design, co-design, co-production, and co-creation. Each of these terms has a subtly different focus and can lead to very different processes. User-centred design and human-centred design generally reflect the consideration of a user without necessarily invoking their involvement; collaborative design, participatory design and co-design suggest a moment of collaboration, while co-production and co-creation suggest involvement at multiple stages throughout a design process.

Because the Adelaide Living Laboratory project sits within ENoLL, co-creation has been chosen as the preferred terminology. Co-creation requires ongoing and iterative consultation, rather than the singular or isolated moments of consultation that can be a feature of other terms. This is a key part of ensuring that consultation is viewed as a verb rather than a noun, a process rather than an event.

2.5. Government driven consultation

Consultation is a part of governments' vocabularies around Australia, and on the surface it would appear to support active attempts to apply co-creation at the urban scale. However, consultation is largely conceived of as a momentary event in a larger process, rather than an overarching philosophy of development. While there sometimes

are exceptions during pre-concept design stages, consultation typically relies upon citizens giving feedback on propositions rather than actively participating in a design process. Community consultation often involves notifying citizens of an upcoming decision and giving an opportunity to voice objections or support, or presenting a number of options to express preferences between.

The International Association for Public Participation (IAP2) has defined five levels of consultation:

1. Inform
2. Consult
3. Involve
4. Collaborate
5. Empower.

These levels build upon Arnstein's ladder of citizen participation [10], and reflect varying levels of engagement and consultation from the perspective of governments. Co-creation sits at the upper end of this spectrum and can be applied at the 'Collaborate' level, or 'Empower' level, depending on the level to which the government and / or developers maintain decision making control. Most current large-scale development processes in Australia could be considered to fall within the 'Inform' or 'Consult' categories with select (often government driven) projects achieving an 'Involve' level. The goal of the Adelaide Living Laboratory project is to strive to achieve the 'Collaborate' level of participation.

2.6. Collaborative design

Although the focus of the co-creation methodology is often considered to be the strategies for involving end-users in design and development processes, co-creation also assumes significant interdisciplinary collaboration. To understand the significance of both user-engagement and interdisciplinary collaboration, a very brief history is now presented.

Collaborative design practice has a rich history across the latter half of the twentieth century and within western practice can be separated into two distinct streams: A model of interdisciplinary collaboration, primarily found in the United States; and a model of collaboration between companies and end-users often found in Scandinavian and European practice.

The Massachusetts Institute of Technology (MIT) has been at the centre of collaborative practice in the United States across the twentieth century. The Radiation Laboratory (Rad Lab) is often regarded as being the earliest example of collaborative design practice in the US, developing microwave radar systems in the 1940s with funding from the United States Government Defence Department. In the 1960s, this interdisciplinary was further developed in the Architecture Machine Group and eventually in 1985 resulted in the founding of the highly successful MIT Media Laboratory. Across the range of collaborative practices that have been a feature of MIT, interdisciplinarity remained of high importance, but connection with users was viewed as a marketing issue for product development rather than an issue of concern in pure research.

By contrast, in Scandinavia, the Participatory Design (PD) movement was focussed on enabling factory workers to provide feedback and input into the design of the systems and processes in which they would vocationally participate. The focus on user-centred design has remained in Scandinavian and European practices, and is now most commonly referred to as co-design.

The Living Laboratories approach can be viewed as a way of bridging between the user-centric, and the professional-centric, approaches for collaborative innovation. Living laboratories are defined by the European Commission as being 'open innovation environments in real-life settings, in which user-driven innovation is integrated within the co-creation process of new services, products, and infrastructures' [11]. The user-centred nature of innovation reflects the cultural approach within European practice of designing with- rather than for-users, however, there is also implicit within the Living Laboratory approach, an opportunity to support interdisciplinary collaboration and cooperation.

3. Method

The Adelaide Living Laboratory project is attempting to facilitate low carbon living through a commitment to the use of a co-creative approach whereby end users, industry and research are able to collaborate in an iterative process. It is anticipated that this process will be able to facilitate innovation of existing products, the development of new products, services and systems, and behavior change.

The researchers are documenting a series of case study projects through a blended methodological approach that incorporates both ethnographic research and a Value Network Analysis (VNA). VNA is a branch of social network analysis (SNA) that combines elements of Latour's Actor Network Theory with SNA. Instead of focusing on the relationships between human and non-human nodes within a network, a VNA is focused on the value exchanges that take place in the interactions between these nodes. This means that the value of the co-creation approach is being explored not just in terms of outcomes, but also in terms of the value generated by the collaborative process. The VNA is being undertaken alongside ethnographic observation as a way of quantifying the non-monetary exchanges that take place as a part of a co-creative approach.

3.1. *The Adelaide Living Laboratory*

The Adelaide Living Laboratory has three primary sites, one greenfield, and two brownfield sites:

- Lochiel Park –A small suburban greenfield site with a number of experimental low- or zero-carbon homes;
- Bowden –A low-carbon brownfield urban renewal project on a former industrial site on the edge of the Adelaide CBD; and
- Tonsley –A comparatively large low-carbon brownfield urban renewal project on a former industrial site in the southern suburbs of Adelaide.

Each of these sites has unique challenges and opportunities for low-carbon development; however, the Tonsley site is the largest and most ambitious project, seeking to apply precinct level information modelling (PIM) and to meet GreenStar neighbourhood requirements. This paper discusses a number of projects undertaken at these sites in broad terms. Specific details and analysis of these case studies will be published at the conclusion of the research.

As well as these sites, the project has expanded to include the documentation of a privately funded project in Adelaide. This project is applying co-creation as a way of stimulating organizational behavior change and lowering the overall carbon-impact of their development.

4. Discussion

The following section is not exhaustive, but describes a series of key insights and findings that have come from the project to date. These results are based upon ethnographic observations as the VNA cannot be finalised until the conclusion of the project.

4.1. *Construction processes*

As stated earlier in this paper, co-creation was developed as a methodology for facilitating the design of products and services. Because an urban development is exponentially more complex than the design of a traditional product or service, both public and interdisciplinary collaboration has been restricted by the nature of workflow processes. Until recently, the linear process of concept design, design development, design documentation, and construction was the primary mode of delivering projects at the urban scale. However, recent developments in Building Information Modelling (BIM), and new construction procurement formats (such as Public-Private-Partnerships, and Design & Construct contract forms) are facilitating interdisciplinary collaboration at all stages of urban development. Although not yet being done in any large way, it is anticipated that the technologies that are facilitating enhanced interdisciplinary (professional) collaborations could also be applied to facilitate broader (non-professional) stakeholder engagement.

BIM is challenging the role definitions of almost all stakeholders in urban development, with some, such as the estimating fraternity facing irrelevance as their vocation becomes automated as a part of the design process.

Architects and urban designers too face a significant challenge in defining their value as other disciplines become involved in decision making far earlier in design processes.

There is a general attitude within the co-design and co-creation literature that designers, including architects and urban designers, face a shift from the romanticised notion of being the 'lone creative' to becoming 'process facilitators' [12, 13]. Only one of the case study projects has utilised BIM as a significant part of its process, and even on this project, to date, the co-creation aspect of the process has relied upon traditional paper based discussions and has not utilised the capabilities of the BIM model.

4.2. Defining 'the user' in new development

The concept of the 'user' is complex in any design process because there are often large numbers of unknown user groups. In the case study projects to date, the 'user' has been represented in a number of ways: by an existing group of users, a predicted future user (lead user), by proxy through a representative, and as a hypothetical construct.

'Design' can be broadly categorized as either focusing on an existing need, or on a predicted future need. For design challenges that are focusing on future needs, a lead-user approach is often used to identify those stakeholders that may hold information about future needs because they sit on the boundary between expressing current and future needs. However, a lead-user approach has been shown to be most useful in fast-moving disciplines rather than in the design of slowly evolving products or services [14].

While there is an element of future needs involved in the design of urban environments, the design of habitable spaces is predominantly focused on designing for existing needs. During this process the need for a technological or systemic innovation may be identified, but this is not the core focus. In some urban-scale design processes, user groups may be easy to identify, but in others, at the time of design, users are a hypothetical construct. This significantly complicates user-involvement in processes like co-creation and creates a paradox where it becomes necessary to seek user-input without any users.

This may appear to be a stopping point for the application of co-creation as a methodology in urban development; however, it is possible for users to be involved by proxy representatives, or through a variety of tools that help to explore the anticipated needs and perspectives of a broad cross-section of users with a variety of stakeholder groups.

It is difficult to reconcile user-involvement by proxy with the aforementioned goals of catalysing behaviour change through involvement in co-creative processes. However, if looking beyond the interventionist Attitudes, Behaviour, Choice (ABC) model of behaviour change [9], toward a macro systems theory approach, creating a change in the way processes take place and providing opportunities for user groups to be involved in low-carbon living design processes (whether the users end up being eventual residents or not) is significant and will lead to broader systemic benefits.

From the authors recent experience, there was initially great resistance from the project manager tasked with the development of the brief because it was expected that the process would create unrealistic expectations within the user group, and would slow down the finalisation of the brief. Similarly, there was initial resistance from the Architectural firm who won the design tender. Both however, came to realise that the co-creation process enabled a far deeper exploration of user-needs thus providing the brief with greater nuance at the start of the design process. The co-creation process has identified a number of critical faults in the design prior to construction commencing that may otherwise have not been identified until occupancy.

4.3. Power dynamics between actors

There is little in research or professional discourse that has mapped the complex network of interactions between stakeholders when applying co-creation as a methodology at the urban scale. As defined earlier in this paper, urban-development and particularly low-carbon urban-development are wicked problems that incorporate an immeasurable number and variety of influences.

The brief discussion about the transformational nature of BIM processes highlights the challenge of radical shifts in the roles played by various actors in the Architecture Engineering and Construction (AEC) industry. Co-creation potentially poses further complexity to these established and newer roles, particularly related to the role of the architect or designer, and the role of the client. The relationship of technical engineering disciplines to construction

projects is unlikely to be challenged by this process, but it is anticipated that the shift to involving stakeholder groups beyond the traditional definition of ‘the client’ will add significant complexity to the design process that is currently undertaken. Similarly, for urban planning authorities, the involvement of constituents may raise some interesting questions about democratic processes, particularly with a shift upward on the IAP2 public participation spectrum.

These power dynamics and relationships will be primarily expressed through the VNA; however, interactions to date have shown how the co-creation process can undermine the authority of traditional decision makers in the role of both ‘client’ and ‘designer’. This has been dealt with in various ways, including through the instigation of an extra layer of reporting and sign-off between co-creation activities and fundamental design changes. This layer is a symptom of the immense complexity involved in urban-scale projects, and makes the process less agile than its counterparts in product and service design. Despite this limitation, the co-creation processes appear to be generating positive results for all parties involved.

5. Conclusion

This paper has signalled the opportunity for co-creation as an approach to support broad systemic change in both user-engagement, and citizen literacy and behaviour change towards low carbon living. To achieve this however, there needs to be consideration and appropriate activation of both professional and non-professional stakeholder engagement in delivering a successful co-creation strategy. Although government policies and actions would appear to support a shift toward more collaborative practices, significant challenges are ahead to shift professional cultures and to innovate processes within the realm of urban development. These challenges require further action-based research to explore whether co-creation as an approach can be successfully applied at the urban scale, and whether consultation can shift from being considered a noun to a verb.

Acknowledgements

This project is being conducted with financial support from the Cooperative Centre for Low Carbon Living.

References

- [1] S.C. Sauer, User innovativeness in living laboratories: everyday user improvisations with ICTs as a source of innovation, *Universiteit Twente* 2013.
- [2] A. Ståhlbröst, A living lab as a service: creating value for micro-enterprises through collaboration and innovation, *Technology Innovation Management Review*, 3 (2013).
- [3] R.R. Bond, M. Mulvenna, D. Kane, A. Bolster, D. Finlay, S. Martin, *Pop-up Living Labs: Experiments in Co-creating Service Design with Diverse Stakeholders in Hackerspace Communities*, (2013).
- [4] Concilio, Grazia, Emma Puerari, and Francesca Risso. "LIVING LABS MODELS FOR CO-DESIGNING IN URBAN AND PUBLIC SPACE." *My Neighbourhood | My City*. http://my-neighbourhood.eu/wp-content/uploads/2013/10/MyN_D21_UrbanLivingLabs.pdf (accessed June 16, 2014).
- [5] Gallagher, M. Petrova, S. Raphaely, T. Marinova, D. Collaborative urban planning for low carbon living in Australia, *CRC for Low Carbon Living*, Sydney 2015
- [6] Rittel (1972) in C. Churchman, B. West, *Wicked Problems*, *Management Science*, 14 (1967) 141-142.
- [7] Rittel, H, Webber M *Dilemmas in a General Theory of Planning*, *Policy sciences* 4.2 (1973): 155-169
- [8] Biddle et al., 2006 Biddle, Tony, et al. "The costs of infill versus greenfield development: A review of recent literature." 29th Australian Transport Research Forum, Gold Coast, Queensland, Australia. 2006.
- [9] E. Shove, *Converging conventions of comfort, cleanliness and convenience*, *Journal of Consumer policy*, 26 (2003) 395-418.
- [10] Arnstein, S, *A Ladder of Citizen Participation*, *Journal of the American Institute of Planners* 35.4 (1969) 216-224.
- [11] European Commission, *Design as a driver of user-centred innovation*, European Commission, Brussels, 2009
- [13] E.-N. Sanders, *Generative tools for co-designing*, *Collaborative design*, Springer 2000, pp. 3-12.
- [14] E.B.-N. Sanders, P.J. Stappers, *Co-creation and the new landscapes of design*, *Co-design*, 4 (2008) 5-18.
- [15] E. Von Hippel, *Lead users: a source of novel product concepts*, *Management science*, 32 (1986) 791-805.