

Emerging Approaches in Business Model Innovation Relevant to Sustainability and Low-carbon Transitions in Australian Cities

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Abstract: On the one hand, business and related activities are at the centre of the production–consumption system that is the major cause of our sustainability problems. On the other hand, the dynamism of modern business and its ability to innovate and generate solutions to current and emerging problems, including those related to sustainability, promises to be one of the primary sources of new ideas and strategies to tackle the sustainability challenges we face. The changes required of business will be more than incremental process and product innovations. Over the last two decades this focus of sustainability innovation has certainly brought us cleaner and more efficient products and services. However, we also need to make fundamental changes to our business models – and the systems that support them – if we are to meet our current and future sustainability challenges. In this paper, we provide a review of some emerging approaches that influence the development of new business models that might assist in sustainability and low-carbon transitions in cities. We draw on examples and on the output of three participatory visioning workshops held in Melbourne and Sydney to explore the potential and implications of these emerging business models in assisting low-carbon transitions in Australian cities. Our findings suggest that although these emerging business models can be part of future cities, there are uncertainties associated with technological, social, organisational and governance aspects which make it difficult to reach a clear judgement on their actual potential in assisting low-carbon transitions.

Keywords: Low-carbon, transitions, system innovations, business models, cities

1. Introduction

We are in “the critical decade” (Hughes & Steffen, 2013); i.e. the decade during which our decisions and actions in relation to climate change will determine the success or failure of the necessary decarbonisation of society in the coming 30-35 years if we are to avoid severe implications. This is not solely a technological, social, economic or governance issue; addressing climate change requires fundamentally different practices in all these areas combined. Similarly, action is necessary across all sectors and levels of society and we are all “actors” with a role to play in climate change mitigation and adaptation. While not all actors have equal levels of ability to act and influence change, business is among the most critical of actors in addressing climate change specifically and sustainability issues generally.

Sustainability is recognized as a key driver for innovation in business (Nidumolu, Prahalad & Rangaswami, 2009). The idea that businesses can gain strategic advantage through innovation aiming to address sustainability issues is not new. Michael Porter and Claas van der Linde argued in mid-90s that properly designed stringent environmental regulation would influence and facilitate innovation in companies (Porter & van der Linde, 1995). This argument has been supported by a body of empirical research (e.g., Greenstone, 2003; Taylor, Rubin & Hounshell, 2005). Some of the influences on business to shift towards more sustainable practices include regulation and standards, resource limitations, desire to be a market leader, customer pressure, shareholder and employee pressure, and wider stakeholder pressure such as supply chain actors (e.g. Anton, Deltas, & Khanna, 2004; Brown & Wahlers, 1998; Charter et al., 2008; González-Benito & González-Benito, 2006; Hart, 1995; Henriques & Sadosky; 1996; Orsato 2009; Wheale & Hinton, 2007).

Although business is accepted to be a key actor in addressing sustainability issues and sustainability is a key driver for innovation in business, the relationship between business innovation and addressing climate change in urban contexts has been understudied. As part of thematic exploratory research undertaken for Visions and Pathways 2040, a project for the Cooperative Research Centre for Low Carbon Living, we identified nine emerging approaches used in the development of business models that are referred to in the literature, and currently being implemented in practice, as “promising” approaches for creating more sustainable business practices.

Visions and Pathways 2040 focuses on developing systemic visions, scenarios and pathways for transitioning to low-carbon and resilient futures in Australian cities (Ryan et al, 2015). In 2014 we held three participatory visioning workshops in Melbourne and Sydney which were attended by a total of 103 people from our partner and stakeholder network. In these workshops the participants shared and discussed their desirable visions for low-carbon and resilient Melbourne or Sydney in the year 2040. In these workshops designers were present and treated the table discussions as “design briefs” to later create visualizations depicting technological, social and behavioural changes that were envisioned as part of their desirable low-carbon and resilient futures. These visualisations are referred as ‘glimpses’ of the future. In these glimpses, alongside elements of the built environment and specific social, cultural and economic activities, several business models were manifest. In this paper we present findings of our exploratory research on emerging business models and the ways project partners and stakeholders envisioned them as part of low-carbon and resilient futures in Australian urban settings.

2. Business Models for Low-carbon and Resilient Cities

2.1 Business models using product-service systems

For more than a decade product-service systems (PSS) have been discussed in the literature on design and innovation for sustainability as a promising approach for sustainability. A product-service system is a set of products and services capable of jointly fulfilling a user’s need (Goedkoop et al., 1999; Mont, 2000). PSS can help companies to expand their role in the market to better coordinate and control the mix of products and services to meet needs of people while lowering overall environmental and social impact (Tischner, Ryan & Vezzoli, 2009).

Tukker (2004) identifies eight archetypal PSS categories: 1. Product-related service, 2. Advice and consultancy, 3. Product lease, 4. Product renting or sharing, 5. Product pooling, 6. Activity management/outsourcing, 7. Pay per service unit, 8. Provision of functional results. While all PSS represents a shift from product focus to system focus, only those which are based on delivering functional results to customers are promising in terms of shifting socio-technical systems while the rest generate only marginal sustainability benefits (Tukker, 2004). In functional PSS, the PSS provider promises to deliver a particular ‘outcome’ or meet a ‘function’ as exemplified above. Functional PSS is also referred to as function (or functional) innovation in eco-design terminology (Brezet, 1997; Halila & Hörte, 2006). Functional PSS applications not only challenge existing product concepts and consumption patterns through alternative ways of function fulfilment, but also give way to different models of businesses or stakeholder collaboration (Keskin, Brezet & Diehl, 2009; Van der Zwan & Bhamra, 2003; Williams, 2007). Therefore, development of functional PSS might contribute to a mindset change in companies.

Some current examples of PSS relevant to low-carbon transitions include solar leasing schemes and access-based mobility systems such as car-sharing schemes. In the visions developed by the participants of VP2040 visioning workshops the idea of “AutoRickshaws” (Figure 1) was a good example of a functional innovation type PSS.



Figure 1. Auto Rickshaws (image copyright of Katherine Bissett-Johnson, Trish Cave, VEIL, CRC LCL)

AutoRickshaws are slow moving, quiet electric vehicles which move through the streets and green spaces between transport nodes. These are collectively owned by the public and decorated to represent different neighbourhoods of diverse Melbourne in 2040. AutoRickshaws charge at Melbourne's tram stops which are configured as charging ports using solar PV.

2.2 Business models using open innovation

Open innovation is an innovation paradigm which puts emphasis on using external ideas as well as internal ideas, and internal and external paths to market through collaborative networks involving private and public organisations as well as individuals or groups of people (Chesbrough, 2003; Tapscott & Williams, 2006). A UK-based open innovation agency 100%Open defines open innovation as “innovating in partnership with those outside your company by sharing the risks and rewards of the outcome and process” (100%Open, 2014). The open innovation model is a more dynamic approach through which companies cooperate to source and generate knowledge in order to create new ideas and commercialise them in shorter periods of time (OECD, 2008). It utilizes both technology-push and market-pull mechanisms to generate and diffuse innovation.

While in some cases open innovation takes place through collaboration of partners from private and/or public sectors, in other cases it happens through collaboration of companies and individuals or groups of individuals through online crowdsourcing platforms or hackathons which respond to particular innovation challenges. A recent example of an open innovation challenge relevant to low-carbon transitions is the Dynamic Demand challenge by UK's innovation foundation Nesta (Dynamic Demand, 2014). The challenge has been presented in collaboration with National Grid, UK's grid operator and other partners focusing on demand side response. The challenge was to “create a new product, technology or service that utilises data to significantly improve the ability of households or small businesses to demonstrate measurable reduction in carbon emissions by shifting energy demand to off peak times or towards excess renewable generation”.

2.3 Peer-to-peer innovation models

Peer-to-peer innovation is based on cooperation of loosely connected, widely distributed individuals who share resources and outcomes without relying on market signals or top-down commands in hierarchical firm structures (Benkler, 2006). The early examples of intentional open peer production were observed in software development from early 1980s. More recently, in addition to software, peer production started to be observed in hardware through diffusion of micro-manufacturing methods such as 3-D printing within globally connected micro-communities, the majority of which are currently in North America and Europe (Moilanen, 2012). It is as yet uncertain whether hardware focused peer production will have a significant influence on society similar to open source software or whether it will remain within a technologically savvy and enthusiastic sub-culture. Nevertheless, developments in this space is worth watching.

Centralised systems of provision are vulnerable due to potential infrastructure failures, increasing demand and increasing costs of maintenance and development (Biggs, Ryan & Wiseman, 2010). Yet, increasing resilience of energy, food and water provision is fundamental in transitioning to low-carbon and sustainable futures. In this environment, peer production is increasingly observed within communities who would like to meet their needs without relying on centralised systems of provision. One current example using a peer-to-peer model to address many issues related to dominant food growing and distribution system is Open Food Foundation. This non-profit charity was established in 2012 to develop free and open software to support fair and sustainable food systems (Open Food Foundation, 2014). The Foundation's flagship open source project is the Open Food Network which is an online marketplace and logistics platform to connect local producers with local consumers. It is a disruptive innovation aimed squarely at market concentration in food supply networks. It provides an easy way for enterprises to find and trade with farmers and consumers and to run their operations, reducing barriers to entry for community and ethical enterprises. The core defining feature is transparency: end consumers can see who grew their food and how much they were paid. Open Food Network is currently being trialled with food hubs in a closed beta phase (Open Food Network, 2014).

2.4 Business models based on closed-loop production

The premise of circular models is minimizing or eliminating waste and maximising resource efficiency in production-consumption systems. It is argued that this can be achieved by closing material cycles in manufactured products through design, an idea popularized as “cradle-to-cradle” by McDonough and Braungart (2002) (although it is a term that has been in wide use in eco-design research since the mid 1990's) or by building symbiotic networks of companies within which waste from one company is used as raw material by another. The latter is often referred to as “industrial ecology” (Ayres & Ayres 2002; Frosch & Gallopoulos, 1989) or as “industrial symbiosis” (Chertow & Ehrenfeld, 2012).

Among the scientific community, there is a consensus that industrial ecology will have a significant influence on sustainability. However, the fundamental proof of this is still missing (von Hauff & Wilderer, 2008). In an assessment of eco-parks which were built upon principles of industrial ecology, a study found that top-down public programs could not facilitate the formation of collaborative networks to make eco-parks successful in a business sense (Orsato, 2009). This suggests that institutional changes may be necessary if industrial ecology will play a role in transitions.

In VP2040, some participants in our workshops envisioned a zero-waste future in which waste was a resource and traded as a valuable commodity (Figure 2).



Figure 2. “Waste is gold” (image copyright of Katherine Bissett-Johnson, Trish Cave, VEIL, CRC LCL)

2.5 Business models using crowdfunding as a financing mechanism

Crowdfunding (also known as crowdfinancing and crowdinvesting) can be defined as the process of a party requesting and acquiring financial or other resources from many individuals with the purpose of

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realising a specific project. Investors are offered some kind of return on, or reward for, their investment which may or may not be financial (Mollick, 2014; Vorbraak, 2011). Crowdfunding is generally mediated through online platforms.

This novel form of financing may be particularly useful in supporting the development of niche innovations. The latter are likely to be a fundamental element of low-carbon transitions as they, if successful, can disrupt the mainstream dynamics of business, change the rules of competition and replace incumbent technologies or social practices (Geels, 2005). At present, however, the availability of venture capital and angel investment for niche innovations is limited, especially following the financial crisis of 2008.

Crowdfunding makes it possible for niche innovators to turn their innovation ideas into businesses facilitated by information and communication technologies and online social media. For example, US based company Solar Mosaic Inc. connects individual investors with solar projects needing investment and enables collection of repayments with interest once the project starts to generate profit from renewable energy through an online marketplace (Solar Mosaic, 2014).

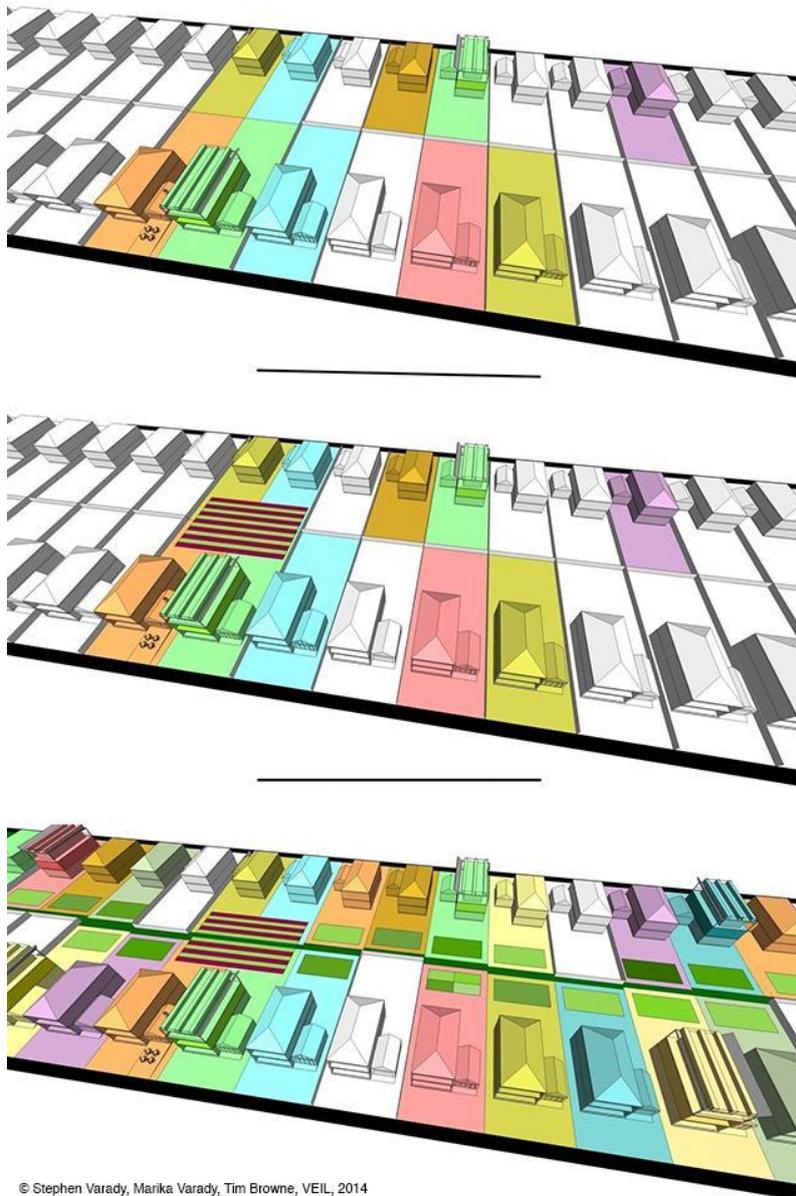
In addition to the potential of crowdfunding as an alternative financing approach for start-up companies, crowdfunding is also becoming popular among communities and local government as a way of financing major public projects when government policy or funding fails to deliver what citizens desire. Some examples of crowdfunded public infrastructure projects include the pedestrian bridge Luchtsingel in Rotterdam, a 66-storey skyscraper in Bogota, and +pool in New York. Currently, there is a crowdfunding campaign for renewal of the Sydney Opera House.

2.6 Sharing economy

Profit-centred traditional business practice operating within classical market economy requires companies to continuously increase the sale of material goods - one of the main drivers of ubiquitous consumption and throw away culture (Mont & Power, 2009). The idea of sharing as an (re)emerging economic model has been recently popularised by Botsman and Rogers (2010). Sharing blurs the boundary of possession and includes voluntary lending, pooling and allocation of resources, and authorised use of public and private property, while not requiring contractual renting, leasing or unauthorised use of property (Belk, 2007). Therefore, it is related to but distinct from access-based consumption (Bardhi & Eckhardt, 2012).

The business models that are emerging from the sharing economy are most interesting in terms of their “offering” for the end-user. Businesses generally offer platforms for people to share collectively or individually owned assets. Some of these models also offer “business opportunities” for the end-user, i.e. they become profit-making opportunities for the individuals or collectives sharing their assets. These models increase utility per asset and thus help to dematerialise consumption. They also introduce and normalise social practices based on values like collaboration, sharing, and connecting with one’s local community.

In addition to currently existing sharing businesses and non-monetary sharing schemes such as platforms enabling peer-to-peer sharing of cars, bikes and rooms, in VP2040 visioning workshops the concept of “shared space” was put forward by some participants (Figure 3). Breaking the public and private space dichotomy, shared space are areas (generally backyards or frontyards) privately owned but voluntarily shared by the members of neighbouring community. Whether this was a for-profit or non-profit sharing was unclear. In the future both options may be viable. Participants also envisioned shared ownership of certain assets (such as 3D printers) within neighbourhoods.



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Figure 3. Evolution of shared space over time between present and 2040 (copyright of Stephen Varady, Marika Varady, Tim Browne, VEIL and CRC LCL)

2.7 Social Enterprises and Benefit Corporations

In recent years, the term 'social enterprise' has been used to describe organizations that trade and operate in business activities with the aim to maximize improvements in human and environmental well-being, rather than maximizing profits for shareholders. The precise meaning of the term is still a contested one, and social enterprises can take many organizational forms including cooperatives, mutual organization, and incorporated companies. However, they should not to be confused with not-for-profit enterprises; distribution of profits or payments to individuals can occur as long as it is consistent with an enterprise's value statement and/or social objectives.

Perhaps the most exciting development within the sphere of social enterprises has been the recent development of certification schemes and legislation in a number of regions around the world that are now formalising the status of social enterprises. For example, in the United States, the B-Corp certification scheme started in 2007, and in the U.K, the Social Enterprise Mark scheme started in 2010. These offer companies an accreditation process that rigorously examines a company's social, environmental and governance practices against global benchmarks and provides an ongoing assessment that ensures the company is steering along the path to sustainability. Unlike other certification schemes it applies to the whole business and not just the products being made. In Australia, a number of small firms have already achieved B-Corp certification status. Some B-corps,

such as those focusing on food security and waste reduction are very relevant to low-carbon transitions in urban context.

In VP2040 visioning workshops, participants envisioned the transformation of consumption-focused iconic shopping malls, such as the Chadstone of Melbourne, into spaces where small and medium sized social businesses and B-corps could create local economic systems based on reuse and remanufacturing of fashion consumables as well as vocational training for the fashion sector (Figure 4).

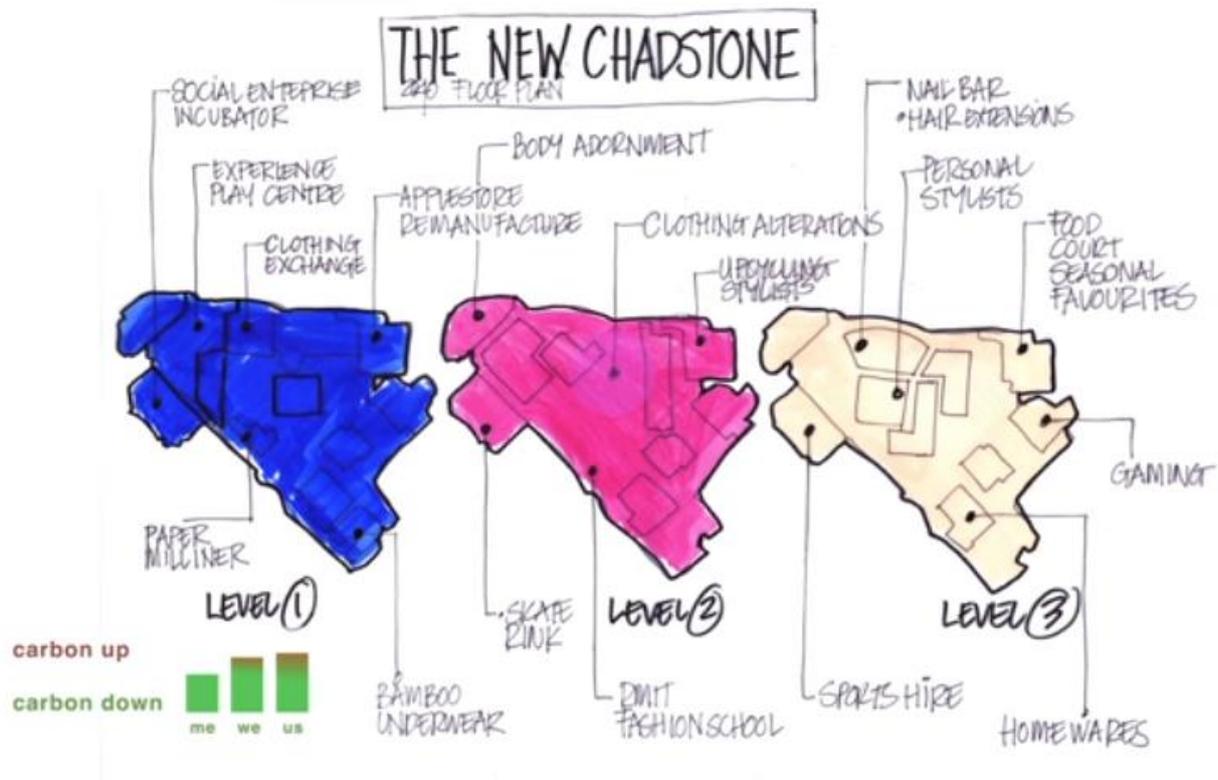


Figure 4. The New Chadstone (image copyright of Katherine Bissett-Johnson, Trish Cave, VEIL, CRC LCL)

2.8 Business Models Driven by a New Manufacturing Paradigm

Additive and digital manufacturing, or as more commonly referred to as 3D printing, has become a new paradigm for manufacturing. Its potential to be disruptive from an economic point of view is already apparent: In 2013 the market size of 3D printing was US\$ 3.1b. Over the next 6 years this size is expected to grow at a rate of 32% per year to reach US\$ 21b by 2020 (Wohlers Associates, 2013). The implications of 3D printing for sustainability and low-carbon transitions may also be substantial; however it is still too early to definitively conclude whether the effects will always be positive.

From an environmental perspective, 3D printing has four main selling points (Kovac, 2013). First, there is the potential to reduce waste, particularly when using metal where the additive approach contrasts with the conventional manufacturing process of cutting away at a solid metal block. Second, the same machine can build many different things, and hence does not require further energy and resources to create or retool specialised machinery for each new object produced. Third, there is the potential for reduced energy and emissions from lower transport costs, as the assumption is that production will be more 'distributed' – closer to points of consumption – and the raw material for printing may be acquired from 'local' sources. Fourth, there are enhanced opportunities to repair products by creating damaged or worn parts (particularly useful if the object is out of mainstream production) and thus help extend the life of products. Against these potential energy and environmental gains, concerns include the potential for rebound effects (increased consumption resulting from lower prices), questions as to the energy efficiency of printers, and end-user waste from failed products or the overproduction of throwaway goods (Sorrell, 2007; Kovac, 2013; Olson, 2013).

3D printing may also cause a major disruption to the traditional distribution chains for manufactured objects, with a movement towards a more distributed model and the likely involvement of a range of

new actors. Such a change to manufacturing systems have been envisaged as an emerging shift in the business models of future sustainable industry (Evans et al., 2009). Currently there are start-ups in the Netherlands focusing on new waste-to-product systems, taking plastic waste 'in' with small 3D products 'out' (e.g. The Perpetual Plastics Project) illustrating another way the current linear production-consumption-waste model might shift towards a circular system.

Perhaps one of the most exciting developments, partly driven by the new possibilities opened by 3D printing, is the rise of the Makers Movement. This is a community of craftspeople, tinkerers, hobbyists, and inventors who are harnessing the internet and the latest manufacturing technologies and, according to some commentators, may provide a renaissance in product design and business start-ups (Deloitte, 2014). Often working in shared community workshops (often referred to as hacker spaces, maker spaces) or for-commercial spaces (e.g. TechShop, Fablabs) and convening in Maker Faires, the Maker Movement along with associated developments such as crowdfunding, points towards a new type of manufacturing economy, one shaped like the web itself: bottom-up, broadly distributed, and highly entrepreneurial (Deloitte, 2014).

In VP2040 visioning workshops, the participants who proposed new manufacturing visions focused more on the opportunities around mobile and micro businesses delivering 3D printed solutions for replacement of appliance parts by recycling the damaged part as material for the new one, or customised 3D printed plumbing solutions demonstrating an emphasis on the potential of waste reduction associated with 3D printing (Figure 5).



Figure 5. Mobile micro-businesses delivering 3D printing services (image copyright of Sarah Jamieson)

3. Discussion

Functional PSS is very relevant to transition of provisional systems (especially of transport and energy) to becoming low-carbon. But functional PSS have broader implications than business model innovation. Development and implementation of functional PSS raises design and policy relevant questions around cultural, behavioural and institutional changes that are necessary for shifting from our current systems which are dominated by individual car ownership, centralised energy infrastructure and an increasing tendency towards privatisation.

It is not also certain how these new systems can be governed. Take, for example, the VP2040 workshop vision which foresaw a publicly owned system of on-demand serving AutoRickshaws as part of a larger urban transport system in the future. Unless there is a fundamental restructuring of our political economy, it would seem to make more sense that systems like these will be run by specialised enterprises than local government or neighbourhood communities. Despite associated uncertainties around governance models, functional PSS innovation is likely to be one of the main mechanisms for how systems of provision will be transformed during low-carbon transitions in urban context.

Both open innovation and peer-to-peer innovation are very relevant to sustainability and low-carbon transitions in urban context because systems of provision and patterns of consumption have complex interdependencies and sectoral or company-based, proprietary and closed innovation approaches are not likely to be fully effective for transitioning to low-carbon futures. Arnold and Barth (2012) argue that tools of open innovation can open up closed and linear urban planning processes to include company

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representatives and citizens in the decision making process which can foster bottom-up energy transformation. Since radical innovations and creation of new markets to achieve sustainability and low-carbon transitions cannot be achieved within a single organisation (de Boer & van Bergen, 2012), willingness to adopt and support open innovation is a fundamental requirement for generation of systemic business models and disruptive innovations to transform existing systems (Maula et al., 2008; Rohrbeck et al., 2013).

Crowdfunding can assist niche innovations to take-off where there is no or limited access to venture capital. The increasing use of crowdfunding in financing major public projects including infrastructure, also signals a potential in facilitating institutional change. Such institutional change implies power to become more distributed, decisions on public spending to become more democratised and participatory and local governments to develop their own “business models” for increased self-reliance than relying on central government funding.

Sharing economy seems to be at cross-roads with corporate, for-profit models like Uber and AirBnB currently seen by many as the iconic examples. However, these businesses have been criticised as co-opting what could be a more fundamental transformative change for society in terms of shifting values towards an emphasis on community building and solidarity and away from the dynamics of the classical market economy. It is likely that these two models of the sharing economy - commercial provision of sharing platforms to connect buyer of a service with service provider, and open-source platforms enabling peer-to-peer exchange of goods and services with or without monetary exchange - will co-exist. Most likely the former will mature towards becoming global and big business disrupting incumbents in their respective sectors (as has already happened in hotels and taxis) and the latter serving more local needs and preferred by a particular segments of society based on political and values perspectives.

B-corps can be seen as a transitional model in low-carbon transitions assisting with increasing the expectations on social and environmental responsibility of business. Whether large publicly listed companies in Australia will attempt to adopt B-Corp or similar social enterprise commitments will likely depend on the success of the experiences of small and medium sized enterprises and whether there are legislative changes that support and encourages B-Corp type companies (Pro Bono Australia, 2013).

The potential impact of 3D printing on production-consumption systems has high economic and environmental relevance. It is an open question as to whether all associated possibilities and developments will be largely limited to niche product areas or whether it will transform whole industries and see competitive advantage of many current incumbent companies shift away from the ability to manufacture in high volumes at low cost and move towards other areas of the value chain, such as design or ownership of customer networks (Dante, 2014).

Multiple of the above discussed approaches are generally used in combination with each other in development of new business models which are innovative and relevant to sustainability and low-carbon transitions in the urban context in following ways: 1. Designing products, services and associated industrial and organisational processes as whole systems thus potentially reducing the overall impact of production-consumption system; 2. Financing niche innovations and start-up companies in ways alternative to venture capitalism thus overcoming financial barriers to development and market entry of those businesses that are addressing issues related to provisional systems; 3. Introducing new models of social, structural and legal organisation across innovation networks thus enabling knowledge sharing and accelerating pace of innovation; 4. Experimenting with new models of economic exchange thus enabling institutional change and societal reflection on the role, purpose and meaning of business, and; 5. Promoting adoption and use of new technologies thus facilitating development and widespread diffusion of new technological and organisational capabilities.

4. Conclusions

The *Visions and Pathways 2040* project aims to contribute towards building knowledge for innovation and policy action towards achieving low-carbon resilient futures in urban contexts. Innovative business models will most likely be a critical element of the needed knowledge base for achieving low-carbon transitions. A premise of the VP2040 project is that business-as-usual supplemented by incremental innovation is not likely to be sufficient in achieving the sustainability changes that are needed in the built environment. Innovation in all aspects of our lifestyles and social structures is required and will be an ongoing and collective endeavour.

The design and development of sustainable business models is still in its infancy and this paper has only provided a taste of the types of new business models for sustainability in the built environment that may emerge and generate disruptive change. Some of the models presented in this paper will not gain further traction and some will fail, yet they are seen as inspirational and so might shape other business development in the future. Experimentation and learning is a central dynamic of the innovation and transition process, and the inevitable failures of some business models will not deter innovative thinking in sustainable business model design.

During our research we realised that these new and emerging business models present challenges for research about business and business models for the very reason that these models were conceived to address environmental and social problems which stem fundamentally from the flaws of the existing economic system. On the one hand, these new models, to be successful, follow the rules and institutions of the existing socio-technical systems. On the other hand, they challenge the rules and institutions of the existing socio-technical systems.

In our research, we also identified that business models can be powerful strategic tools not only for businesses but also for a diversity of traditional and emerging types of organisations aiming to deliver sustainable innovations ranging from governmental bodies to peer-to-peer networks. As a result, we also identified a need to expand the focus of research on new business models applications to cover types of organisations which are not traditionally considered as business but which can benefit from using tools of business in conceiving and delivering low-carbon and sustainable innovations.

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