

Agile housing for an Ageing Australia

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Abstract: By 2055, Australia's 65+ population will have doubled and, if current strategies are followed, it is likely that the housing available will be inappropriate. Today's housing stock will still be in use yet few developers and designers are capitalising on the potential of agile housing and, more broadly, the creation of age-friendly neighbourhoods. Current changes in design and prefabrication technology, along with government initiatives for ageing at home in preference to institutional care, have the potential to transform the way we consider housing design to support changing demographics. This research considers agile housing for an ageing population from the perspectives of urban planning, design, prefabrication, sustainability, life-cycle costing and social gerontology. We highlight the need for interdisciplinary perspectives in order to consider how entrenched policy, planning, design and construction practices can be encouraged to change through advocacy, design speculation and scenario testing to deliver right-sized housing. A cradle-to-grave perspective requires the exploration of the social and practical benefits of housing in multigenerational communities. This research links to concurrent work on affordable housing solutions and the potential of an industry, government and academic partnership to present an Australian Housing Exposition, that will highlight the possibilities of a more agile housing approach.

Keywords: agile housing; seniors housing; design and prefabrication; rightsizing.

1. Introduction

Australia is facing housing challenges with an increasingly diverse, urbanised and ageing population. The number of people aged 65 and over is expected to double in the next forty years (Commonwealth Treasury, 2015). In the last century life expectancy has increased resulting in a new group of active middle agers alongside a frailer 80+ group (Simpson, 2015). With housing affordability at crisis levels in our largest cities (Kelly and Donegan, 2015) agile housing strategies that allow homes to adapt to the changing needs of occupants will enable more efficient use of housing stock. New housing remains polarised, with inner city precincts oversupplied with small units for individuals and couples, and family dwellings in the peri-urban fringe, frequently located far from jobs, transport and services (Wood *et al.*, 2014; Whitzman *et al.*, 2015; Birrell and McCloskey, 2016).

The research project was funded through a University of Melbourne competitive grant process and addressed three main questions: (1) what alternative housing typologies and construction innovations could better support the needs of Australia's changing demography? (2) how might these respond to a wide range of household compositions, age groups and income ranges? (3) how can we begin to educate and advocate for these changes with developers, government and consumers? Because of the complex nature of this research area, the project brought together experts from the disciplines of urban planning, design, construction innovation, sustainability, life-cycle costing and social gerontology.

Australia has some of the best research on housing in the world through the Australian Housing and Urban Research Institute (AHURI) but some of the worst housing outcomes (Whitzman *et al.*, 2015). Almost nine in ten private renters in the lowest income quintile pay over 30% of their income on housing (Hulse *et al.*, 2015), the percentage considered the threshold level for unaffordable housing. Housing prices in Sydney and Melbourne are amongst the world's most expensive.

New housing in Australian cities does not sufficiently consider design, construction or tenure to accommodate our diverse household types and our ageing population (Olsberg and Winters, 2005). More examples of agile housing design, able to readily adapt and adequately respond to changing household composition and ability, are needed if Australia's conservative housing market is to respond. Worldwide, there is an increase in the number and percentage of lone person households. Concurrently, the number of multi-generational households is also increasing for complex reasons including housing affordability, ageing, adult children yet to leave or returning home and cultural preferences. While the number of single person households was one-quarter of all Australian households in 2011, multigenerational households comprised just less than one-fifth (Liu *et al.*, 2015).

In this paper, we present international best practice and local innovations that demonstrate architecture and construction innovation; typologies and tenures suitable for adaption in Australia; and the notion of age-friendly design facilitating greater social diversity and community cohesion. The data is based on a horizon scan of best international practice, policy documents and workshops, including a literature review. We undertook case study visits and interviews with suppliers in northern Europe, the USA and Japan using a systems approach to better understand the interrelationships between design, policy and outcomes. The first part of this paper identifies key issues from the multiple perspectives of the contributing authors and a suite of strategies for encouraging more agile housing approaches.

2. Defining Agile housing

For the purpose of this research, agility in design and construction has been taken as adaptability over time of individual homes or multi-residential contexts. Agility in terms of tenure goes beyond the traditional options of ownership and rental, and looks at alternative approaches such as co-housing and community land trusts.

In Australia, whether housing is developer-led and speculative or client-driven, designs are typically focused on a single type of housing occupation whether this be an individual, a family, or a couple. Unlike the UK, Australia has few guidelines that are mandated in order for housing to meet diverse needs across the life span. In parts of the UK universal design is mandatory and 'lifetime homes' encouraged (The Foundation for Lifetime Homes and Neighbourhoods nd). Lifetime homes have such characteristics as wider and accessible car parking, potential for entrance level bedrooms, showers and WCs.

2.1. Agility through age-friendly design

Age-friendly design requires a combination of strategies that operate at different scales. The World Health Organisation has developed guidelines for age-friendly cities (World Health Organization, 2007); these principles are broad in scope and include social and civic criteria as well as design of physical space. Neighbourhoods that are age-friendly facilitate ageing in place but only if housing is also age-friendly. Rather than design for the needs of the aged alone, a useful concept is universal design or design that meets the needs of all occupants in terms of being accessible, barrier free and inclusive. Inclusive design is based on seven principles developed by architects, product designers, engineers and environmental design researchers at North Carolina State University in 1997 (Preiser and Ostroff, 2001) including equitable, simple and flexible use, clear information, low physical effort, and appropriate size. Such principles allow individuals to access housing regardless of physical, mental ability or age. Livable Housing Australia (LHA) provides advice, advocacy, guidelines and certification with the aim that all new housing be universally designed by 2020. With all of these aspirations, we should also deliver on ‘design’ so that a quality of experience is supported by quality in design.

There is a strong research case for improving the design of both housing and the associated urban environment as there is a large body of evidence linking well designed physical environments to positive health and social outcomes for older people (Dufty-Jones and Rogers, 2015). Supportive housing environments facilitate provision of home-based care and reduce care costs. Unfortunately, Australia lacks reliable data on the number of houses with positive accessibility features so the magnitude of the task to develop age-friendly housing design is not well understood.

2.2. Agility in planning and construction

The concept of agility can be extended to include planning and construction, enabling dwellings to be rearranged, divided or grouped as needs change. The idea of agile or adaptable housing is not new, yet there is now a convergence between emerging digital design and prefabrication technologies, the design community’s interest in design-led construction innovation and burgeoning societal needs making innovation more viable (Newton *et al.*, 2015).

Paradoxically, Australia has a housing affordability crisis concurrently with a glut of empty bedrooms across the states (Darcy, 2014; Wood *et al.*, 2014; Birrell and McCloskey, 2016). Householders aged over 50 occupy around half the detached housing with few desirable options currently available for them to downsize (Birrell and McCloskey, 2016).

Building upon Brand’s (1995) temporal understanding of buildings as having seven layers, new building prefabrication technologies have the potential for components such as bathroom pods to be added or exchanged according to need. Such prefabrication approaches can play an important role in housing adaptability over time. Designs with moveable walls, pack away components and ‘plug and play’ technology are maximizing both spatial use and longevity, enabling more options within smaller footprints. Smart houses with technology that track use will help the safety of the frail elderly. Technology developed at the Technical University of Munich along with industry partners offers smart wall panels to assist the elderly in their own homes, for example the ability to issue a warning if the apartment’s occupant has not taken the front door key from the key holder when the front door is opened. Australia’s off-site construction industry faces similar transformation with 2016 federal government funding for an Industrial Transformation Training Centre that brings prefabricated housing researchers and industry together to develop new products for market.

2.3. Agility, tenure types and financing options

Home ownership reduces the overall cost of living in later life (Bradbury and Gubhaju, 2010), provides security of tenure, and has psychosocial benefits such as reinforcing independence, autonomy, belonging and achievement (Olsberg and Winters, 2005). Some older home owners are asset rich and cash poor (Wood *et al.*, 2010) and many low income home owners struggle to meet housing costs. By 2046, home ownership for those 65+ is expected to drop from 80% in 2006 to 72% (Yates *et al.*, 2008)

Australian tenures predominantly consist of private ownership and short-term private rental. The Reserve Bank of Australia has suggested that an answer to Australia's housing affordability crisis 'lies in more innovative and flexible use of the land that we have so that the marginal cost of adding more stock of dwellings is lower' (Hutchens and Mason, 2015). Two key innovative approaches, more common in northern Europe and America, are co-housing and community land trusts. Both have potential in Australia to provide greater housing agility.

Co-housing emerged in Denmark as families sought to create intentional communities with shared facilities, a level of communal living and a sense of neighbourhood (Durrett and McCamant, 2011). The strategy is for individuals to co-purchase land and develop both housing and amenities for shared use. The concept has been successfully translated to the United States, the UK and more recently to Australia. In Australia, examples include friends grouping to help with the costs of a first home, intergenerational families, and downsizers seeking to live close to family and friends while having access to shared amenities and support of their own choosing.

Community Land Trusts provide a tenure approach that involves trust entities maintaining ownership over the land then renting or selling dwellings through ground leases. It is an approach that is particularly suitable when public housing is considered for redevelopment by community housing organisations, as has been the case in the UK (Moore and McKee, 2012). The ground leases include affordability formulae that balance limited equity gain while maintaining perpetual affordability (Whitzman *et al.*, 2015). When an owner-occupied dwelling is sold, the equity is shared between the Trust and the seller due to limitations placed on resale prices as set by the Trust. What makes them unique is their focus on community involvement in or ownership of the organisation, and their focus on balancing the rights of the household with the rights of the broader community or society (Crabtree *et al.*, 2013).

Service integrated housing by community and private sectors represents just 5.9% of dwellings for households aged 65+ (ABS 2006 Census). Retirement village or seniors' housing formats range from resort-style or townhouse-style options, to inexpensive transportable options. Leasehold arrangements often help buyers avoid home purchase stamp duty taxes (Jones *et al.*, 2010).

2.4. Agile housing case studies

The authors considered case studies exploring a range of agile housing principles summarised in Table 1. These principles spanned co-housing, the different layers of a building's construction, a home's ability to be adapted, use of prefabrication, potential for reconfiguration or relocation of buildings or elements, and the typology of housing.

Three case studies then illustrate distinct approaches to the provision of agile housing, from the perspectives of design and construction, innovative tenure and urban planning and policy.

Table 1: Matrix of case studies

| co-housing | building layers | adaptable housing | prefabrication | relocatable | multi-residential | |
|------------|-----------------|-------------------|----------------|-------------|-------------------|-----------------------------------|
| ■ | | | | | ■ | Swans' Market Co-housing |
| ■ | | | | | | Trudeslund Co-housing Community |
| ■ | | | | | ■ | Bo90 Urban Co-housing Community |
| | | | | | ■ | Westwyck Eco-Village |
| | ■ | ■ | ■ | ■ | ■ | Heydeborg Cognitive and Aged Care |
| | | ■ | ■ | | ■ | Next 21 Experimental Housing |
| | ■ | ■ | ■ | | ■ | Adaptable Futures |
| | ■ | ■ | | | ■ | Kangaroo Tower |
| | | | | ■ | ■ | Spacebox Student Housing |
| | | ■ | | | | Laneway Houses Vancouver |
| | | ■ | ■ | ■ | ■ | The L41 House |
| | | ■ | ■ | | ■ | BoKlok (Live Smart) by IKEA |
| | | ■ | ■ | | ■ | Adaptable Kit Homes |
| | | ■ | ■ | | ■ | DASH Housing Typology |
| | | ■ | ■ | | ■ | Adaptable Eco-Housing |

(Source: Agile Housing Research)

Hydeborg Care Facility, The Netherlands – The Use of Prefabrication

As part of an upgrade of the Hydeborg Care Facility, provision of a high quality decant facility was an urgent yet temporary need. HDVN Architecten (now Studio Nine Dots) described how the temporary facility (Figure 1) was designed, prefabricated and installed in less than a year to provide the decant space. As a facility for individuals with cognitive impairments, the quality of the building was critical even though it was only temporary. The choice of prefabricated modules was central to the overall strategy as the modules were pre-designed to be dismantled and reconfigured elsewhere in the local community as permanent community housing at some later stage.



Figure 1: Hydeborg Care Facility, The Netherlands HVDN, 2010. (Source: HVDN, 2012)

Swan's Marketplace Co-housing, California USA – Creating a Village Ambience

Swan's Market Co-housing in San Francisco was established in 2000 as an intentionally multi-generational community (Figure 2). It integrates a 20-unit cohousing community within an eclectic mixed use facility including affordable apartments, retail units, office space for local businesses, together with public spaces, creating the sense of being in a small village contained within a city block.



Figure 2: Swan's Marketplace Cohousing (Source: <http://ebaldc.org/home/swans-marketplace-apartments-and-co-housing>)

Laneway Housing, Vancouver, Canada – Diversified Housing Stock

The City of Vancouver changed planning regulations to allow small laneway houses and increased urban density (Figure 3). In addition, the laneway houses brought agility through providing housing for a variety of users from ageing family members to adult children and carers. Within a community they provide more opportunities for people to live near their work and provide a larger variety of housing types within a neighbourhood.

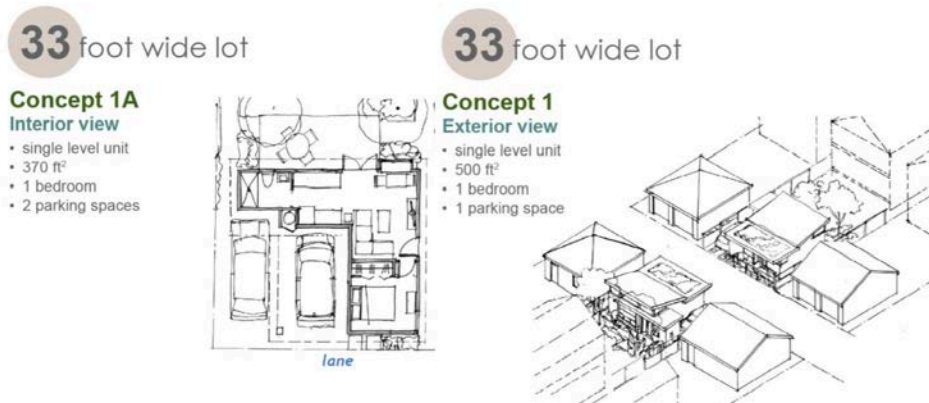


Figure 3: Laneway housing Vancouver, (Source: <http://vancouver.ca/home-property-development/building-your-laneway-house.aspx>)

3. Strategies for future proofing Australia's housing

3.1. Encouraging agile house designs

Incorporating agility in design is not difficult if the market is encouraged and educated to consider design for tomorrow's needs. Three strategies should be encouraged through legislation, design standards and/or education: (1) housing pre-designed to be subdivided would enable older people to downsize in place; (2) enabling policy such as Vancouver's Laneway Housing would encourage more diversity and density within our middle ring suburbs which are dominated by detached housing; and (3) tangible examples such as demonstration projects that provide useful 'proof of concept'. The regulatory framework is a critical catalyst. For example Victoria, unlike NSW, does not have secondary housing policies which permit small units to be built adjacent to housing without planning permit.

While the design and construction of new housing can easily be adapted to consider an agile housing approach, additions to the housing stock represent no more than 2% per annum (ABS, 2015). An equally important challenge is in addressing accessibility and adaptability of existing housing. Strategies for retrofitting such agility will be unique and more difficult without incentives, through policy or otherwise.

3.2. Encouraging agile house construction

Until recently, Australia lagged Japan, Germany and northern Europe in prefabrication innovation. The gap is closing with new products and designs that take advantage of off-site construction manufacturing. Products such as bathroom pods are one area of growth, and although many of these are destined for the healthcare sector there are significant possibilities for the retrofitting of homes. Two strategies that would assist in changing buyers' mind-sets are: (1) developing prefabrication display centres such as the Fertighaus display villages in Germany and the HIVE display village in New Zealand to showcase innovation and dispel myths around prefabricated homes being of lower quality; and (2) providing open house examples of the many new prefabrication providers.

3.3. Encouraging agile house tenure

Cohousing has potential to make buying or renting a home cheaper but also enables sharing of bills, cars and household goods, as well as trading of services such as babysitting and care for the elderly. With over 30% of households in Australia being lone occupants by 2026, cohousing provides a balance between community and privacy. Australia has fewer urban innovations than North America and northern Europe but this is gradually changing with the WestWyck Eco Village in Melbourne <<http://www.westwyck.com/>> and the Illabunda Village near Sydney <www.illabundavillage.com.au>.

Community Land Trusts are common in the US and the UK, but there are none yet established in Australia due to our residential tenancies legislation (Crabtree *et al.*, 2013). However in Tasmania, NSW and Victoria it is possible to get an exemption, so there are now a number of organisations planning to establish trusts in Victoria and Tasmania (Whitzman *et al.*, 2015).

Co-housing and Community Land Trusts options have potential to provide greater agility and self-determination using strategies that support all life stages from first home buyers, families and people in later stages of life. Strategies to be considered include: (1) encouraging research through post-occupancy evaluations of new cohousing and community land trust developments; and (2) housing options on leased land as long term rental propositions which take into account life-cycle costings.

3.4. Considering life-cycle costs

The concept of agility in design and construction also extends to life-cycle costs of housing, which typically include heating, cooling, and maintenance but should also include the cost of alterations and modifications to a home over its lifetime. Agile approaches that include flexibility for change often entail a higher capital outlay however the ability to adapt a home over time to suit changing needs could be considered a worthwhile investment enabling future-proofing by allowing for economical change. The emphasis of agile thinking must shift from initial cost of construction to life cycle cost, and from housing affordability to life cycle housing affordability.

In the current practice, finance for home ownership is often based on the initial capital cost of the house, as well as the cost of finance and repayments. These are often assessed on the basis of current income and outgoings of the prospective home owner. The future changes in expenditure profile as a result of changes in circumstances such as family structure and running cost or cost-in-use of the house, and so the life cycle expenditure profiles are often ignored. Agile housing initiatives need to incorporate lifecycle affordability into the design. In that regards, agile design needs to adopt an integrated life cycle design approach which focuses on life cycle quality and life cycle performance of the house. Housing design must be optimised to achieve a low capital cost and low operating and maintenance cost by considering functionality in use, alternative materials, convenience, safety, health, building traditions, business culture, architectural styles and trends, aesthetics, initial capital costs, running costs, end of life costs, energy costs, environmental burden costs (if any), and waste cost (Sarja, 2002) amongst other things. Whole life costing method should be applied during design to assess and evaluate all cost that could arise from owning, operating, maintaining, and ultimately disposing the house. Design process must search for a building that minimises life cycle ownership cost to achieve a financially viable investment in the long term.

3.5. Encouraging downsizing and rightsizing

Judd *et al.* (2014) have outlined the complex reasons behind housing choices and the need for downsizing.

- Encouraging an adequate supply of options for the current as well as the future aged by incorporating downsizing and upsizing potential into new homes and apartments.
- Considering a 'last-home buyers' grant such as stamp duty exemptions to encourage rightsizing.
- Develop a secondary housing to supply diverse housing types within established suburbs.
- Develop awareness of options for those entering or in retirement.
- Shifting public debate away from the idea of the aged occupying valuable real estate more suitable for family housing by presenting better options for the elderly.

The term 'rightsizing' as an alternative to downsizing is explored in 'Generation Stuck' (Beach, 2016) in which Beach argues that emphasising alignment between housing and the aspirations of occupants at any age is a more useful concept than the expectation of downsizing in order to free up housing needed by younger families.

3.6. Educating through demonstration projects

Tangible demonstration projects that illustrate the impact and possibilities of agile design are required. Members of the author team are currently working on a multi-university/multi-sector project with government to make an evidence based business case for a Melbourne Housing Exposition. The

Exposition would promote new housing typologies and innovative construction as well as alternative tenure and financial approaches that include life-cycle costing in addition to capital costs, creating a permanent legacy of quality, future-proofed housing. The aim is to fundamentally challenge the current market offering, while also leveraging the research opportunity by developing the brief of the Exposition as a best-practice evidence-based document, monitoring during construction, followed by post occupancy evaluation, all through multiple disciplinary lenses.

4. Conclusion

There is a tension between Australian policies that support ageing-in-place and the lack of appropriate and affordable housing in our rapidly growing urban centres. This paper argues that more agile housing solutions that enable a better fit between housing needs and aspirations across the life of the building in alignment with the changing needs of occupants would better accommodate Australia's changing demographics. We identify that the concept of 'rightsizing' rather than 'downsizing' is useful, understanding that with good design rightsizing could occur without relocation. Alternatively rightsizing into age-friendly communities could be encouraged by 'last home buyer' incentives alongside 'first home buyer' schemes.

The variety of elderly housing options is increasing. Building prefabrication, together with its endless potential for embedded technology and plug'n'play building elements, has potential to transform the housing sector and offer greater agility across the whole life course. Regulatory frameworks require review and advocacy so that more agility is mandated, whether in individual house design or urban planning contexts. Innovative tenure models, common in northern Europe and America, have potential in Australia. This paper argues that cross-sector conversations on housing futures are needed. Learning from the Housing Exposition precedents in Scotland and Finland, members of the authorship team with other academics and industry stakeholders are currently developing a business case for an Australian Housing Exposition to test and demonstrate new housing models and influence Australia's conservative housing market. This agile housing research is feeding into that work.

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